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IMPLEMENTATION OF IDEA PROCESSES IN THE SPECIFIC CONTEXT OF BUSINESS PRACTICE

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Keywords: implementation of processes, adaptation of processes, idea process, idea management

1. Introduction

In view of the large number of processes, methods and tools that have been developed in recent years within the context of design methodology, design engineers should be supported in most activities relating to product development. However, the development of these methods and tools is "accompanied by an on-going debate concerning their applicability in practice" [Gericke et al. 2013, p. 1]. This fact can be observed in the context of idea processes, for example. Many proposals for idea processes and methods for idea generation and evaluation can be found in literature (e.g. [Drachsler 2007], [Cooper 2011], [Stevanović et al. 2012]). However, in business practice a number of problems exist connected to this topic [Messerle et al. 2012].

Thus, the question of possible reasons arises. One reason for this problem is that methods are often described in an abstract way in scientific publications. This complicates their implementation in business practice [Gausemeier et al. 2000]. Another fact that complicates usage of methods is that they cannot be used for every specific problem in every situation [Gausemeier et al. 2000]. Instead, an adaptation to the specific circumstances is necessary in order to achieve the goal of ensuring suitable and individual support for relevant activities in companies [VDI 1993], [Gausemeier et al. 2000].

However, this adaptation is not supported sufficiently. At the same time, employees of companies are often unable to adapt the methods themselves due to their limited time. Especially for small and medium sized enterprises, efficient adaptation is difficult to achieve [Gausemeier et al. 2000].

As a result, it is necessary to develop processes to support the adaptation of methods and processes to suit the specific context and the circumstances of the company [Gericke et al. 2013].

2. Problem statement and goals

A large number of methods and tools can also be found in literature for idea processes and associated methods. Nevertheless, the described problems also exist in connection with these processes and associated methods. For example, Messerle et al. [2012] examined problems relating to idea evaluations and found several. For instance, idea evaluations are often carried out in a superficial, quick and isolated way so that the evaluation results are incomprehensible to others [Piippo et al. 1999], [Stern and Jaberg 2010]. Additionally, it is often the case that the evaluation criteria are incomplete or overlapping and that a different or incomplete understanding of product ideas and evaluation criteria exists. Often, the evaluation methods used do not fit the specific situation [Messerle et al. 2012].

In order to overcome these exemplary problems for idea processes, an implementation process and associated methods are necessary. Thus, the main research question that shall be answered within this

contribution has been defined as follows: What implementation procedure and what associated methods allow successful implementation of an idea process in a company?
In order to answer this question in a comprehensible way and to define the focus of this contribution several definitions and classifications must be provided. In this context, it must first be explained what is meant by the term 'idea process'. The idea process is seen as a process that begins with the generation of product ideas and ends with the selection of one ore more at the end of the planning stage according to the product development process of Pahl et al. [2007] before a detailed design specification is developed. The detailed idea process according to Messerle et al. [2013] can be mentioned as an example (see Figure 1). The example idea process consists of different phases for idea detailing and evaluation.

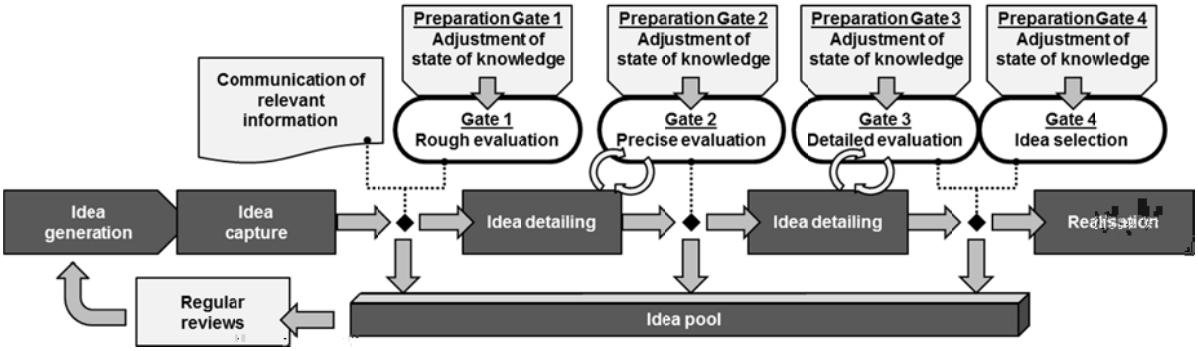

Figure 1. Idea process according to Messerle et al. [2013]

Furthermore, it has to be discussed what is meant by the term 'implementation'. In order to ensure a clear focus for this contribution, only the procedure for the implementation of an idea process is considered. In other words, the relevant process, the process steps and (in part) the methods used during this implementation are analysed and developed.
It must also be mentioned that several important aspects of companies that could play a role in the changes (see for example [Stolzenberg and Heberle 2009]), such as the culture of the company or the organisational structure, are considered within this contribution as elements that cannot be changed. As a result, only the process structure – in this contribution the structure of the idea process – is to be changed by means of the implementation process. However, the other aspects mentioned naturally have to be respected during the development of the implementation process because they influence the configuration of the structure of the idea process.

3. Method

In order to structure this contribution, the following stages of the Design Research Methodology (DRM) according to Blessing and Chakrabarti [2009] have been used: Research Clarification, Descriptive Study 1, Prescriptive Study and Descriptive Study 2.
In the first stage of DRM (Research Clarification), the existing problems are analysed and described in order to clarify the research approach. Literature and results of empirical research are analysed in the second stage so that understanding of the phenomena examined can be increased (Descriptive Study 1). In the next stage (Prescriptive Study), approaches are developed for improving the current situation. In the fourth stage (Descriptive Study 2), the support developed is assessed and implications for improvement are developed [Blessing and Chakrabarti 2009].
In this paper, the results of the Research Clarification are analysed and described in Section 2. The results of literature research can be found in Section 4, where the state of the art is discussed (Descriptive Study 1). For this purpose, literature that examines the question of which procedures allow successful implementation of methods and processes in a company has been analysed. Based on the results of this literature research, an example procedure for the implementation of idea processes is elaborated within the Prescriptive Study (see Section 5).
The final stage of the DRM (Descriptive Study 2) has been carried out by evaluating the procedure for implementation of idea processes in business practice (see Section 6). It has been evaluated by means

of expert discussions. Specifically, structured interviews have been conducted with three experts from a medium sized company of the German mechanical engineering industry. These experts included managers from the development and product management department who all deal with the evaluation of product ideas in their everyday work. In collaboration with these experts, an idea process has been implemented in their company. They have not conducted the implementation process themselves, but have participated and witnessed the process directly. In addition to this, the implementation process was shown explicitly to the experts and they were asked several questions concerning completeness and applicability.

4. State of the art

For the analysis of the state of the art regarding implementation processes, the goal was to find literature connected to the areas of idea and innovation management, as these fields correspond to the main focus of this contribution. Due to the fact that hardly any studies exists proposing detailed process models in these areas, the search area has been expanded. Thus in this section, literature from different areas is considered. Some of these studies are closely linked to the topic examined within this contribution because they relate to similar areas such as knowledge management and technology management [Heisig 2005], [VDI 2009], [Laube 2009], [Kratzer et al. 2013]. Others deal with the implementation of processes and methods in a more general way connected to the areas of design methodology, process management, management of IT systems or change management [Guha et al. 1993], [Hinderer 2005], [Stolzenberg and Heberle 2009], [Becker et al. 2012], [Gericke et al. 2013]. One study is taken from an area that is thematically less linked to idea management. It deals with the implementation of methods in the health care sector [Guldbrandsson 2008].

Before the process models are presented, several important requirements for such implementation processes shall be discussed. Heisig [2005] proposes several aspects that should be kept in mind for the development of such processes:

- The process or method to be implemented should be modelled in such a way that any person involved can gain the same understanding and an orientation framework is provided.
- The employees who are involved in the business process to be changed should also be involved in the implementation of the new process.
- It should be verified that the implementation process is suitable for use in business practice.

Several of the studies examined subdivide their process models into different phases (see Figure 2) [Guha et al. 1993], [Heisig 2005], [Hinderer 2005], [Stolzenberg and Heberle 2009], [VDI 2009], [Becker et al. 2012]. Each of these phases can be characterised by different goals, a different focus and different challenges [VDI 2009]. In Figure 2, only the phases that are relevant for this contribution have been respected due to the limitations described in Section 2.

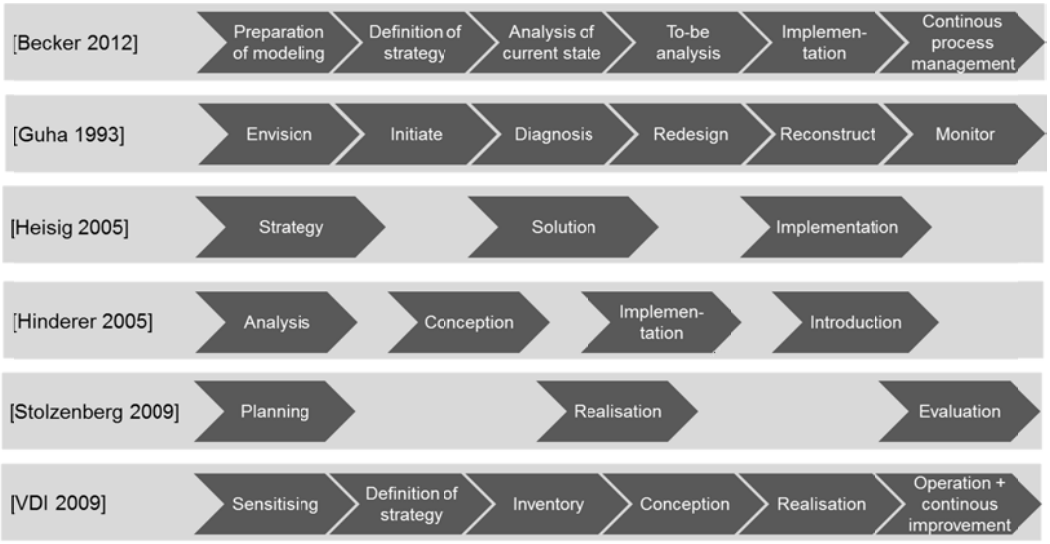

Figure 2. Different phases for the implementation of processes and methods

It is notable that a different number of phases is proposed and that different aspects are covered by the proposed phases. Regarding the main aspects, however, the different phase models are very similar. Most of them begin with stages where preparatory steps are carried out, e.g. for the planning of the implementation. After a realisation or implementation phase, most of the models also have a phase for the evaluation or monitoring of the implementation results.
The same can be observed for the more detailed process models in literature, where the phases are subdivided into several detailed process steps. Although the literature analysed comes from different research areas, many steps of the implementation process are very similar. However, some differences exist in terms of the extent and the sequence of the different process steps. In the following section, the detailed steps from different studies are described and summarised.
In order to prepare for the implementation of a process, the need to change the current process first has to be recognised [Guldbrandsson 2008]. It is also necessary for higher management levels to develop the intention to change this process [Guha et al. 1993]. They then have to convey this information to the employees involved [Guha et al. 1993], [Laube 2009] so that everyone involved is informed, the necessary awareness can be achieved and a common vision for the future process can be developed [VDI 2009]. For the next step, several studies propose the definition of goals that are to be achieved by means of the implementation of the new process [Heisig 2005], [Hinderer 2005], [Laube 2009], [VDI 2009]. In contrast, Guha et al. [1993] carry out this step later in the implementation process, just before the analysis of the current state is performed.
In order to define the extent of the intended changes, the process that is to be improved has to be identified and determined [Guha et al. 1993], [Heisig 2005], [VDI 2009], [Becker et al. 2012]. Additionally, Becker et al. [2012] propose that the technical terms used should be defined exactly, so that an easy communication between the employees involved is possible.
Following this, a project schedule and the responsibilities are to be defined [VDI 2009]. Examination of the question of whether the change of the identified process fits the company's strategy is followed by the creation of the implementation team [Guha et al. 1993], [Laube 2009], [Becker et al. 2012].
Subsequently, several authors [Guha et al. 1993], [Heisig 2005], [Hinderer 2005], [Laube 2009], [VDI 2009], [Becker et al. 2012] propose a detailed analysis of the starting situation, the framework conditions and the process that is to be improved. According to Guha et al. [1993] and Heisig [2005], a possible means of doing this is consultation with the employees involved in the current process. The goal of this analysis is to identify existing problems, weak points, obstacles and potential for improvement [Guha et al. 1993], [VDI 2009], [Becker et al. 2012]. In this context, the studies of Kratzer et al. [2013] and Gericke et al. [2013] have to be mentioned. In both contributions, different sets of criteria have been developed to support the analysis of the existing process and the existing framework, in order to decide if the implementation of a new process is useful and which parts of a process should be adapted.
In order to be able to do a control of success after the implementation of the process, in VDI 5610 [VDI 2009] the definition of evaluation criteria is seen as a useful step to this point of time. After that, the search for new and reasonable processes as well as the development and modelling of the new process has to be carried out according to different authors [Guha et al. 1993], [Hinderer 2005], [VDI 2009], [Becker et al. 2012]. The associated methods and tools can also be described at this point [VDI 2009]. For the next step, Guldbrandsson [2008], Heisig [2005] and the VDI 5610 [VDI 2009] propose the presentation and examination of the developed process so that the decision can be taken as to whether or not the new process is to be implemented. In this context, Guha et al. [1993] additionally mention the development and examination of a prototype. Based on the results of this examination, the process steps and the methods have to be elaborated in detail [Heisig 2005], [VDI 2009].
With this elaboration, the development of the new process is finished and the implementation of the new process as well as the change of actual activities can start [Hinderer 2005], [Guldbrandsson 2008], [VDI 2009], [Becker et al. 2012] accompanied by initial training sessions for the employees involved [Heisig 2005], [Hinderer 2005], [VDI 2009].
Finally, the new process can be used in business practice [Heisig 2005], [VDI 2009]. Based on an evaluation and the feedback from employees involved, continuous improvement can be achieved

[Hinderer 2005], [Heisig 2005], [Guldbrandsson 2008], [Laube 2009], [VDI 2009], [Becker et al. 2012]. Additionally, the process can be transferred to similar areas if necessary [Heisig 2005].

5. Implementation of idea processes in companies

Based on the process models relating to other disciplines described in the last section, a specific procedure for the implementation of idea processes shall be developed and described in this section. After the definition of several phases that divide the implementation process into four main parts, the detailed steps of each phase as well as some tools to be used within these steps will be presented.
The different phase models for the implementation of processes and methods presented in Figure 2 are similar to each other in principle. However, some differences exist in terms of the extent and level of detail. Following the principle of the phase models presented, four phases for the implementation of idea processes have been defined within this contribution: 'Preparation', 'Diagnosis', 'Realisation' and 'Evaluation and Improvement'. In the following subsections, each phase will be described in more detail. In order to maintain a clear focus, it is assumed that the implementation of the idea process is carried out by external persons who do not belong to the company or the participating department. This is not an unusual practice, as employees of companies often do not have the time to deal with processes and methods in detail [Gausemeier et al. 2000], so external persons, for example consultants, often support such implementations. Therefore, the steps that are important for the external participants of the implementation are discussed in more detail.

5.1 Preparation

An important limitation that has to be considered within this process model is the fact that the object of the implementation, namely the idea process, is already defined in principle. Of course, this process can be adapted to a certain extent. However, this fact has to be kept in mind for each step of the implementation process because the variety of possible solutions for problems relating to the handling of product ideas in business practice is limited. The first step where this can be observed is the recognition of a need and the development of an intention to change the existing procedure relating to the handling of product ideas. Both steps have been presented in Section 4, but have to be adapted to the present case. With these steps, also the task of identifying a business process that is to be changed (see Section 4) is already complete. As soon as any problems relating to the existing handling of ideas are recognised, the problems and the identified needs have to be confronted with the potential of an idea process. In this context, it is useful to present the process model of the idea process and a detailed description of each process step to the employees who know the problems of the existing procedure. Therefore, background knowledge concerning the details and the potential of such an idea process is necessary. External experts often take on this role. As a result, it is possible to estimate whether the problems identified can be solved by the new process. In this context, it should be noted that the terms 'idea' and 'product idea' are often used in business practice in different situations. Therefore, it has to be considered whether the idea process in the sense of this contribution can really be used for the 'product ideas' in the particular situation. Afterwards, it has to be checked if the intended changes are suited to the strategy of the company. Only if the needs, potential, examined business process and strategy of the company fit together with the general idea process according to Figure 1, an implementation will be promising. Therefore, these comparisons are important steps before the decision for or against the implementation is made. After this decision is taken, other steps set out in Section 4 can be used for this case. First, the decision has to be communicated to employees involved in the idea process and an implementation team can be put together. Secondly, the vision and goals relating to the implementation can be defined. As proposed by Becker et al. [2012], the technical terms should be defined in such a way that a common understanding can be achieved. In this step, not only do the terms relating to the new idea process have to be defined, but the technical terms and abbreviations relating to the company's products and procedures also have to be explained, in particular, in the case of an external (consultant) team that supports the implementation.
In summary, it can be stated that all the early steps of the process implementation from Section 4 have been respected in this particular case. However, the sequence has been changed several times. Furthermore, some of the steps are not as important because these cases are only relevant where the

idea process (see Figure 1) can be used in principle. This reduces the diversity of solutions and, as a result, the extent of some of the steps presented. Other steps of Section 4 have been adapted to this case and described in more detail.

5.2 Diagnosis

In the second phase of the implementation process, a detailed analysis of the starting situation and the process (framework conditions, problems etc.) that is to be improved first has to be performed. For this, the relevant employees have to be interviewed. In order to maintain the focus, these interviews should be explained and classified using examples of the idea process. This helps the employees involved to understand the reasons for and background of the questions and to explain the relevant topics. Within the research project to which this contribution belongs, a detailed set of questions for the analysis of the current state has been developed. Due to the length restrictions of this contribution, this set of questions cannot be presented in detail here. In the following, only the approach for development and a few examples of this set of questions are described briefly. Based on the approach according to Kratzer et al. [2013], the design engineering transformation system by Hubka and Eder [1996] is used in order to develop a set of questions that is as complete as possible, covering all parts of this system and therefore of all related aspects of the company. The operators (engineering design knowledge, technical system, design engineer, management of design processes) of the transformation system are used as topics which are covered in detail by several questions so that no important aspects are neglected. A brief example of the analysis of aspects relating to the product ideas (= technical system) and the persons involved (= design engineer) is provided in Figure 3.

Analysis: product ideas - technical system
What kind of ideas are developed and evaluated within this process? (ideas for tangible products, PSS, service ideas)
Answer:
What level of novelty do the product ideas have?
Answer:
What level of detail do the product ideas have?
Answer:
Do the product ideas involve complete products or single assemblies?
Answer:
…

Analysis: involved persons - design engineer
Which persons are involved in the existing procedure?
Answer:
Which background do the employees involved have?
Answer:
Which position do the employees involved have?
Answer:
What are the (perhaps hidden) goals of the employees involved?
Answer:
…

Figure 3. Example questions for the analysis of the current state

Based on the identified problems and framework conditions, an initial rough concept of the future idea process can be developed. This concept serves as a basis for the development of specific requirements of the new process (= the operand of the design engineering transformation system) and its process steps so that the employees involved are able to understand the reasons for and background of the requirements. Therefore, another checklist has been developed so that all relevant aspects of the idea process can be collected. In Figure 4, an example part of this checklist is shown. The requirements shall serve as a basis for the development of the new engineering design process, comparable with the definition of requirements during a product development process (see for example [Pahl et al. 2007]).
It is then necessary to analyse how the standard idea process has to be adapted. In this context, for example, the following questions are to be answered:

- Which methods for the detailing or the evaluation of ideas are to be used?
- Which tools are necessary to support the user of the idea process?
- Which process steps and sub-steps are necessary and useful?

In summary, it can be stated that the existing steps from Section 4 are used, but put in more detail and operationalised. The step of requirement definition has been added.

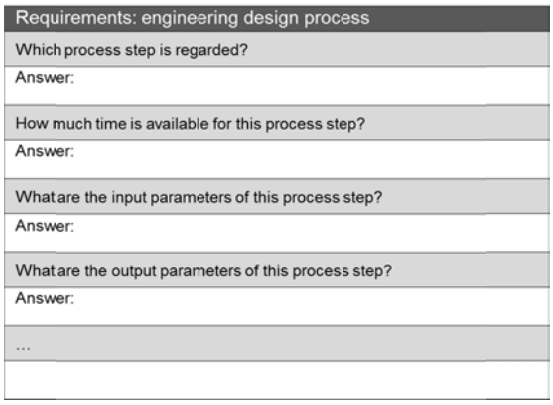

Figure 4. Part of the checklist for requirements definition

5.3 Realisation

In the realisation phase, the developed concept has to be specified. The associated methods and tools have to be elaborated. In this context, for example, the following questions have to be answered:

- Which evaluation criteria are to be used for the idea evaluation?
- How should the evaluation criteria be formulated so that everyone is able to understand the content?
- How should an idea profile look like so that everyone is able to understand the content?
- How are the employees to be involved in the idea process? (for example individual or team work)
- Who takes part in the different idea evaluations?
- Who makes the final decision about which ideas are selected?
- How should the evaluation results be presented so that a well-founded decision can be made?
- What level of detail should be used at what point in time during the idea process?
- How should the forms and checklists look like?

Based on these example questions, an adaptation of the standard idea process is necessary. For example, obvious aspects such as the level of detail of evaluation criteria have to be adapted. However, some details that do not seem that important at first glance, such as the terms used to define the evaluation criteria, can also play a decisive role in the successful implementation of an idea process and therefore have to be adapted.

Furthermore, some additional support, such as legends for evaluation criteria, has to be developed. Based on the assumption that the implementation is supported by external persons, it has to be emphasised that during this phase, all steps have to be carried out by means of very close cooperation between the internal experts of the company and the external supporters. This has to be seen as a decisive success factor so that the goal of a suitable, useful and applicable idea process can be achieved and the imposing of prefabricated models can be prevented.

Also within this phase, a first prototype and initial evaluations of the new process have to be made so that obstacles can be identified and the process can be improved.

5.4 Evaluation and Improvement

For this phase, the findings concerning the evaluation and improvement from Section 4 can be used as a basis. Thus, in a first step the process has to be integrated in the company's procedures and accompanied by initial training sessions for the employees involved. Based on periodic evaluations, continuous improvements of the implemented process can be realised. If other similar processes exist, for example in other departments of the company, the adapted process can be transferred to these as required.

5.5 Summary of the process model

In the previous sections, the process phases and steps from literature (see Section 4) have been used in order to develop an implementation process for idea processes. Therefore, several of the different phases and steps from the state of the art have been put in a different sequence or described in more detail. Some have been omitted, others have been used without adaptation, and certain process steps have been added. The developed process model does not have to be used strictly in the presented order. Instead, iterations or changes of the order may occur. By means of the structured implementation process, the external supporters shall be able to recognise all relevant aspects of the particular situation so that an applicable idea process can be achieved. In Figure 5, the phases and steps that are developed in this section are summarised.

The implementation process should be based on close cooperation between the external supporters and the employees of the company. The better the external supporters understand the circumstances, the (partly unexpressed) needs and requirements of the company, the better the implementation can be performed and the idea process can be adapted.

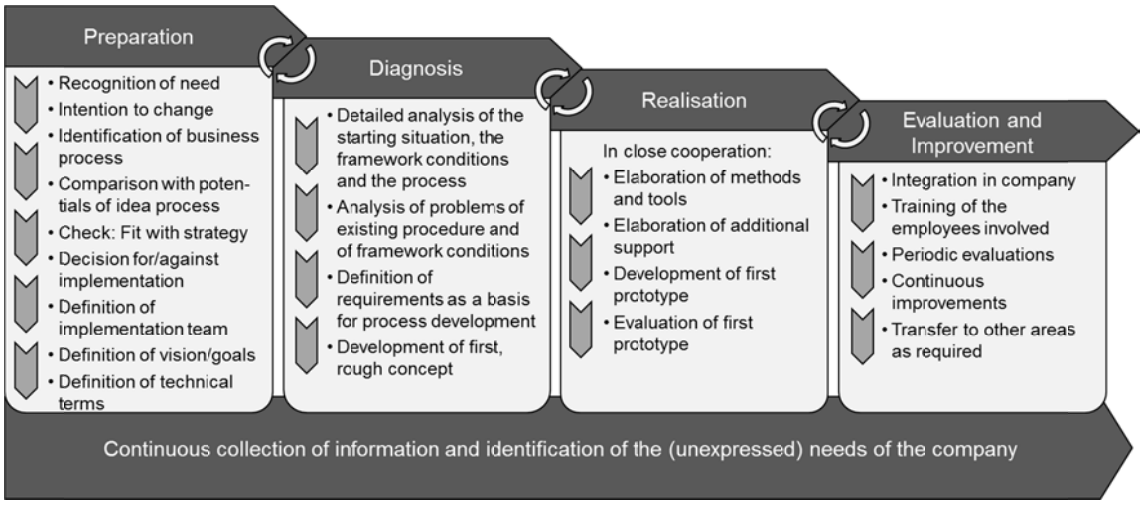

Figure 5. Process for the implementation of idea processes

6. Evaluation in business practice

In Section 3, it has already been mentioned how the implementation process has been evaluated in business practice. In this section, the results of this initial evaluation as well as the criticism and the comments made by the experts are summarised.

At the time of the evaluation of the implementation process, not all four phases have yet been performed. In close cooperation between the organisation of the authors and the company, the implementation process has been applied up to the step involving elaboration of methods and tools. The phase for evaluation and improvement has not yet been performed.

For the evaluation of the implementation process, the experts have been asked the following questions:

- Are the steps of the implementation process compatible with each other?
- Is it possible to apply the implementation process in a useful way?
- Are all necessary steps included in the implementation process?

In connection with these questions, no problems, obstacles or potential for improvement have been mentioned. However, the experts made several detailed statements concerning different aspects of the implementation process:

- The implementation process has produced a useful result in a short time.
- By taking part at the implementation process, the experts have been “forced” to think about their existing procedure. This helps the experts to analyse their procedures in the relevant and in other business processes and to think about their goals and the potential of existing procedures.

- Due to their participation in the implementation process, ongoing projects can already be analysed, specific problems can be identified and existing procedures can be improved to a certain extent.
- The training of the employees involved is seen as an important success factor for the implementation of the idea process.

7. Discussion

In this section, the developed results will be critically discussed. Therefore, the requirements of implementation processes according to Heisig [2005] (see Section 4) can be used as a basis.
The first requirement specifies that the process to be implemented has to be modelled in such a way that any employee involved can gain the same understanding and an orientation framework is provided. This aspect has been respected several times in the developed implementation process. Firstly, in the preparation phase, modelling of the idea process and detailed presentation of each step and gate is proposed. Another aspect that supports the adjustment of knowledge is the definition of technical terms and abbreviations at the end of the preparation phase.
As a second requirement it has been mentioned that the employees involved in the current business process should also be involved in the implementation of the new one. This aspect has been respected by emphasising the importance of close cooperation between external supporters and the employees of the company. This is an important success factor during the realisation phase in particular.
Finally, Heisig [2005] states the need to verify that the implementation process can be used in business practice. In order to fulfil this requirement, an initial evaluation in business practice has been performed. The results show that the developed support works in principle and, therefore, the initial research question could be answered. However, additional evaluations are obviously necessary to ensure that the implementation process can be used in business practice without any problems. Therefore, evaluations covering all four phases of the implementation process should be carried out at other companies from other industries, for example. Additionally, the evaluation partners should carry out the implementation process themselves without cooperation with the authors' organisation so that the complete application of the implementation process can be evaluated.
In addition to the fulfilment of the requirements, another critical aspect should be mentioned. Several important aspects of the developed implementation process should be discussed in much more detail so that all the relevant aspects can be discussed in a comprehensive way. Due to length restrictions, this is unfortunately not possible within this contribution.

8. Conclusion and outlook

In this contribution, a procedure for the implementation of an idea process in companies has been developed. The goal was to help to solve the common problem that a large number of issues exist relating to idea processes in business practice, despite the fact that many proposals for idea processes and methods for idea generation and evaluation can be found in literature. Therefore, the state of the art in terms of implementation processes in general has been analysed. The results have been used to develop an implementation process especially for idea processes. This implementation process has been assessed by means of an initial evaluation in a company of the German mechanical engineering industry. The results show that the implementation process works in principle.
In future work, the implementation process needs to be elaborated in more detail. Additionally, the applicability, completeness and usefulness have to be verified by means of further evaluations. On the basis of the experience gained during the evaluations, future applications of the implementation process can be supported according to the problem solving cycle of case-based reasoning with its four characteristic steps retrieve, reuse, revise and retain (see for example [Mantaras et al. 2006]) so that a faster implementation of idea processes is possible.

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