THE FIRST STEPS TOWARDS INNOVATION: A REFERENCE PROCESS FOR DEVELOPING PRODUCT PROFILES

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ABSTRACT

Successful companies spend many of their resources in the initiation and realisation of innovation projects, which might be successful at the market. Especially in the early phase of these projects, there is a high degree of uncertainty and therefore, product profiles established themselves as methodological support for product developers. However, it is not possible to give developers a straight and always equal process to follow for developing these product profiles. Based on this problem, this contribution investigates context-independent process steps to develop promising product profiles. Thus, this work provides a possible reference process to develop product profiles to support product developers in the early stage of innovation projects. Therefore, 631 process steps of 16 innovation projects were analysed and 100 process steps were derived from literature. Based on an expert workshop, 48 of these process steps were identified as relevant to consider in a context-independent reference process model. In a further empirical Live-Lab study, process patterns were investigated and the usability and relevance of the process steps were evaluated as positive.

Keywords: Design process, Innovation, Process modelling, Product Profile, Early design phases

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1 INTRODUCTION

Industrial trends as shorter product lifecycles, emerging technologies and saturated markets toughen the innovation pressure of mechatronic product engineering companies. Hence, many large companies try to strengthen the early phase of product engineering projects through introducing methodological approaches as e.g. design thinking, lean start-up (Schmidt and Paetzold, 2016), as well as implementing new organizational structures as e.g. an innovation newstream to increase the innovative capabilities of the company (Lawson and Samson, 2001). Nevertheless, large companies need a systematic support to identify the most promising ideas in a very early phase of the product engineering process to reduce uncertainties and to evaluate the economic and technical risk (Gassmann and Bader, 2017). Therefore, a methodological support is necessary to improve the initiation and discovery of new product engineering projects. As stated before, there are already different approaches available to support this, but in many cases, these approaches are very generic and not tangible enough for product developers.

In the past, product profiles were able to establish themselves in order to support product developers in the initiation and discovery of new product development projects at an early stage. A product profile considers the intended customer, user and provider benefits, specifies the technical solution space of the new product generation and makes these aspects accessible for an early validation (Albers *et al.*, 2018). The development of these product profiles differs from project to project, because every engineering project is individual and unique (Albers, 2010; Smith and Morrow, 1999). Thus, it is not possible to follow a strict process to develop promising product profiles in practice. In contrast, it is important to provide developers a methodological framework to combine their practical experiences with theoretical background to enable them to develop promising product profiles. Thus, the objective of this contribution is, to provide product developers a possible reference process, which consists of different process steps to develop promising product profiles. The developers can use these process steps to plan their own process considering their project context and their specific boundary conditions.

2 STATE OF THE ART

2.1 Design processes

Although each product development process is unique, recurring elements exist across different projects (e.g. content recurring elements or time recurring elements) (Smith and Morrow, 1999). In order to support product development processes appropriately, to avoid development risks or to make processes robust, a large number of process models were developed that represent product development processes from different perspectives and with different purposes. These models can be distinguished, for example, by their degree of abstraction from activities or the supported project level (Wynn and Clarkson, 2018).

In addition to the pursued purpose with a process model, the handling of iterations also influences the design and use of process models (Wynn and Eckert, 2017). In the field of mechatronic system development, companies are increasingly implementing agile development processes in their organisation (Schmidt and Paetzold, 2016), which are replacing the established, plan-driven approach (Boehm and Turner, 2003). For example, flexible approaches such as Scrum (Schwaber and Sutherland, 2017) or Design Thinking (Ge and Leifer, 2017) promise companies improved handling of uncertainties arising in the process (Schmidt and Paetzold, 2016). However, uncertainties in development processes have existed for a long time (Thomke and Reinertsen, 1998), and the established agile approaches quickly reach their limits due to their lack of technical orientation (Heimicke *et al.*, 2018) which means that a process model has to be able to represent both iterations and classical sequences of activities. The approach of the ASD - Agile Systems Design (Albers *et al.*, 2018) allows engineering teams to pursue a flexible or sequential approach depending on the respective development situation. This approach continuously integrates the way of thinking of the PGE - Product Generation Engineering (Albers *et al.*, 2016a) and thus the necessary technical knowledge. As a process model, the ASD approach uses the iPeM - integrated product development model, which is shown in Figure 1 in its two-dimensional view (Albers *et al.*, 2016b). The iPeM is based on the idea of the Ropohl system triple (1975) and contains all necessary elements to derive a situation- and demand-dependent, individual product development process.

The transfer of a system of objectives into a system of objects by an operation system is described by the combination of product engineering activities with problem solving activities. The system of

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objectives contains all objectives, their reasons, interactions, derived requirements and boundary conditions for a solution. The system of objects contains all objects generated in the product creation process (partial solutions, sketches, models, prototypes and finally the product). The operation system is formed by all resources (employees, infrastructure, capital, etc.), knowledge, methods, processes and tools necessary for the transformation of the system of objectives into the system of objects. The product engineering activities consist of the basic activities (project management, validation and verification, knowledge management and change management) and the specific activities that cover the complete product life cycle. Each of these activities is modeled as a problem solving process in the product development process. The problem solving methodology SPALTEN is used, which consists of the steps situation analysis (S), problem containment (P), detection of alternative solutions (A), selection of solutions (L), analysis of consequences (T), deciding and implementing (E) and recapitulation and learning (N). This results in 84 generic situations (activity matrix), which are supported by different methods. (Albers *et al.*, 2016b)

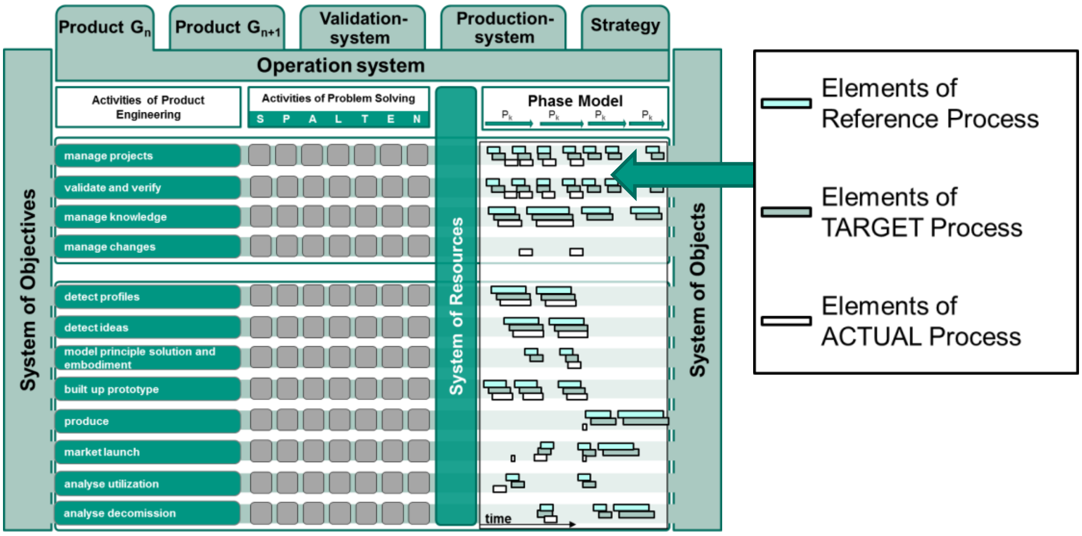

Figure 1. 2D representation: integrated product engineering model (Albers et al., 2016b)

The chronological sequence of activities in the product development process is depicted in the phase model of the iPeM (Figure 1 right part). Parallelization, iterations as well as sequences of activities can be displayed here. The phase model can also be used to document, further develop and use process knowledge and experience from various projects. Thus, it maps up to three models. The model of the reference process describes a company-specific, generic process that describes the usual sequences of activities, methods and processes for developing different products. It is derived on the basis of various experiences from different projects. The reference process is used during the initiation of a new development project to derive a TARGET process (a type of project plan) from the reference process based on the empirical knowledge. The reference process is adapted to the specific requirements and boundary conditions of the respective development project when deriving the TARGET process. The TARGET process serves the development team as a time and content orientation in the development project. The actual course of the project is documented in the ACTUAL process in the iPeM. This usually rejects the TARGET process due to unforeseeable circumstances in the development process. The delta resulting from the ACTUAL and TARGET processes can therefore be used, for example after a development project, to adapt the reference process if necessary. In this way, process knowledge can be used, reused and further developed over generations of developed products, enabling the development of mechatronic systems to be continuously made more robust and efficient. (Albers *et al.*, 2016b)

2.2 Product profiles and the identifying potentials phase to detect market needs

Wynn und Eckert (2017) describe a large number of different iterations in the product development process, including exploration as “Iterating around problem and solution while elaborating them concurrently”. In the understanding that the product development process is a problem solving process (a problem is characterized by: undesirable initial state, desired final state and barrier, that prevents the transformation from initial to final state at the moment (Dörner, 1979)), the final product then represents

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the solution in the sense of exploration. Since products always satisfy a demand situation on the market, this demand situation represents the problem in the product development process (Albers *et al.*, 2018). Although the probability of later product success is very high if the product satisfies a real demand on the market (Cooper and Kleinschmidt, 1987), the identification and anticipation of a really relevant demand situation on the market is not trivial and a project in the process of product development characterized by uncertainties. Moreover, the respective demand situation usually lies in the future and is difficult to anticipate from the present (Chong and Chen, 2010). In order to support product developers in the process of product development in identifying relevant demand situations, there is a multitude of practices and methodologies. For example, developers use the persona method to put themselves in the perspective of potential customers with the associated requirements (Schäfer and Keppler, 2013). Another established procedure for the continuous validation of the customer value represented by a product is the creation and validation of a Minimum Viable Product (MVP) (Münch *et al*., 2013). In ASD - Agile Systems Design, the product profile represents “a model of a number of benefits that makes the intended provider, customer and user benefits accessible for validation and explicitly specifies the solution space for the design of a product generation” (Albers *et al.*, 2018). An example for a product profile is given in Figure 2. The product profile is generated in the meta-process of the ASD during the Identifying Potentials Phase and in the subsequent phases is expanded and adapted with regard to new findings in addition to the continuous development and advancement of prototypes. During this phase, development teams follow an iterative approach. The focus lies on the continuous development and safeguarding of demand situations from the customer, user and provider perspective. In addition, existing technical systems are examined with regard to their potentials and potential entry points into the markets are identified, considering competitors. The existing information in the product profile indicates the further search direction for the developers to complete the profile. It contains a large number of information clusters with consistent content for the complete description of a future potential demand situation on the market. This enables developers to align continuously the generated technical solutions with the product profile (Albers *et al.*, 2018). These solutions are validated in the process against the product profile, whereby problem and solution are iteratively worked out and concretized in terms of exploration (Wynn and Eckert, 2017).

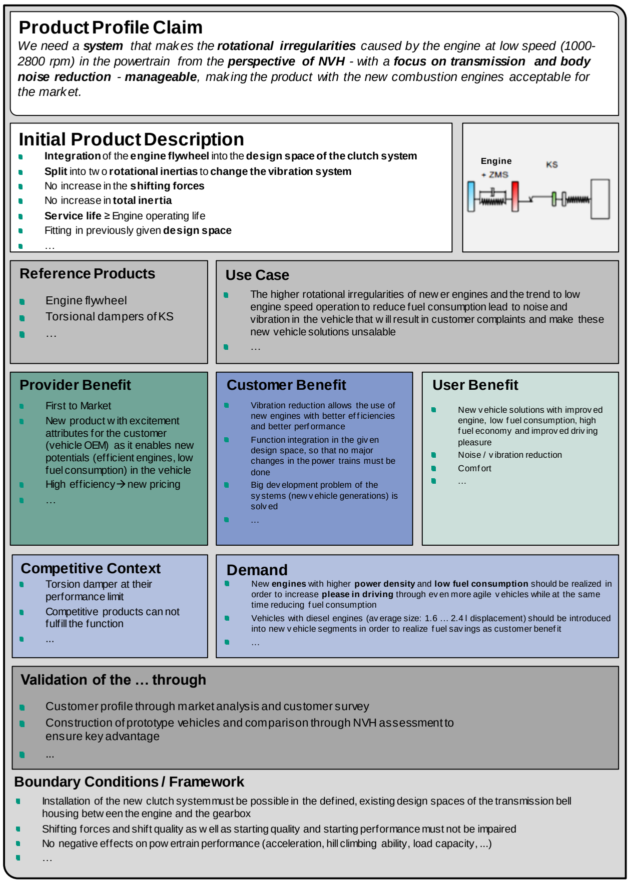

Figure 2. Example for product profile (Albers et al., 2018)

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3 NEED FOR RESEARCH, RESEARCH QUESTIONS AND RESEARCH METHODOLOGY

In literature and practice, there are several approaches to support the initiation and discovery of new product engineering projects in an early phase. However, these approaches are most often too generic and need a specific adaptation to the respective development project. This leads to a bigger hurdle that prevents developers from using a methodological approach to initiate and to discover new product development projects in an early stage. To overcome this hurdle, this contribution aims to provide a possible reference process for engineers to develop promising product profiles, while considering specific boundary conditions. Therefore, this contribution will give an answer to the following research questions:

- How do engineers develop product profiles in practice?
- Which process steps are at least relevant to consider for developing product profiles?
- Which process patterns can be identified through an analysis of actual processes for developing product profiles?

As shown in Figure 3, the research methodology is based on DRM - design research methodology (Blessing and Chakrabarti, 2009) and consists of several empirical studies. For answering the first research question, empirical process data from 16 engineering projects with four different innovation challenges was analysed to identify overall 631 process steps which were executed by the different engineering teams. Although the majority of these process steps overlapped, there were also very different and context-specific process steps. Through a literature review of theoretical process models, which have similarities to the development of product profiles, a list of around 100 process steps resulted. To identify the at least relevant process steps, the 631 empirical process steps of the different teams were compared with each other and clustered to reduce the total number of process steps. Furthermore, these empirical process steps were linked to the process steps, which were derived from theoretical process models out of literature. As it was possible to link nearly every process step based on the empirical data, with a theory-based process step, these 100 process steps were considered as plausible regarding the development of product profiles. Through an expert workshop with six design researchers, who have a broad experience with developing product profiles, the most important, context-independent 48 process steps were identified. Finally, all 48 process steps were described in detail and were linked to possible methods to build a possible reference process for developing product profiles.

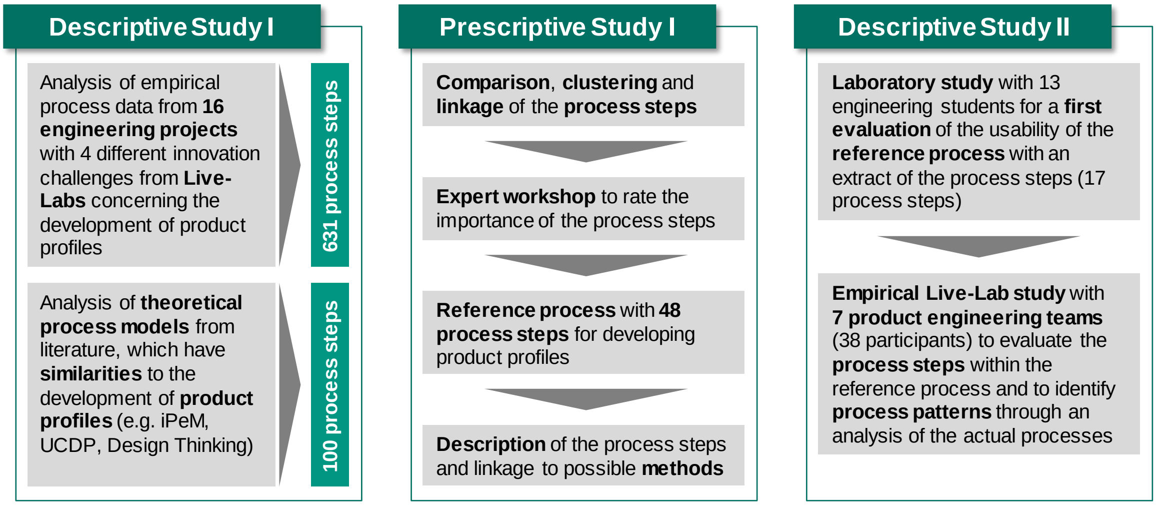

Figure 3. Research methodology based on DRM - design research methodology

For answering the last research question regarding the relations between the process steps, two empirical studies were conducted. Furthermore, these studies were also used to evaluate the usability of the provided reference process, as well as the importance of the 48 process steps. Firstly, a laboratory study with 13 engineering students was executed for a first evaluation of the reference process. The participants were split into four teams and had to develop a promising product profile within 60 minutes. They were allowed to use the provided 17 process steps to make a small project plan and to document their ACTUAL process. As the results of the first study were positive, a second,

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Live-Lab study was conducted. A Live-Lab study offers design researchers a validation environment for design methods, processes and tools, which is close to the real-world application in contrast to a laboratory study and allows the control of some boundary conditions (Albers *et al.*, 2017). In this case, the Live-Lab IP - Integrated Product Development was chosen for the evaluation of the reference process. In IP 18/19, 38 engineering students are working in seven teams to develop innovative solutions for a mechatronic problem within four months in cooperation with an industrial partner (Albers *et al.*, 2017). According to the overall process of IP, each team has to develop 3-5 promising product profiles within the second phase "identifying potentials" and had to present these to the project partner at the milestone. Hence, the reference process to support the development of product profiles was implemented into the agile project management tool Jira and thus each team was able to derive their individual project plan for the three sprints which were executed within the identifying potentials phase. After completing this phase successfully, it was possible to export all the empirical process data from Jira and the relations between the process steps were evaluated. Additionally, a short survey was carried out after the Live-Lab study.

4 RELEVANT PROCESS STEPS TO DEVELOP PRODUCT PROFILES

As every engineering process is unique and individual, there are many different ways to develop promising product profiles. Through the analysis of the empirical data from former innovation projects from e.g. the Live-Lab IP - Integrated Product Development 2017/18 (Albers *et al.*, 2017), it was possible to analyse different ACTUAL process models and to visualize these according to the meta-model iPeM - integrated Product engineering Model. An extract of these different ACTUAL process models are shown in Figure 4. This visualization shows the number of process steps (tasks) per matrix field of the iPeM, which have been used by a team to develop promising product profiles. Each team did use a different number of process steps during the Identifying Potentials Phase, thus the granularity of the respective process steps differs from team to team.

Live-Lab IP 17/18	Team 1							Team 4							Team 5							Team 7						
	Activities of problem solving							Activities of problem solving							Activities of problem solving							Activities of problem solving						
Activities of product engineering	S	P	A	L	T	E	N	S	P	A	L	T	E	N	S	P	A	L	T	E	N	S	P	A	L	T	E	N
Manage projects						1		1					3							1		2					3	
Validate and verify								1	4			1							12			2	1			3		
Manage knowledge	2							2	1													4	2					
Manage changes																								1			2	
Detect profiles	2	3	2	2	2	1	1	4	5	22	8	1	1	1	4	3	3	7		1	1	23	5	13	5		1	1
Detect ideas																								1				
Model principle solution & embodiment																						1		1				
Built up prototype																												
Produce																												
Market launch																												
Analyse utilization																												
Analyse decommission																												

Figure 4. Different ACTUAL process models from four teams of the Live-Lab IP 17/18 to develop promising product profiles (located in the meta-model iPeM)

The visualized process steps focus mainly on the product engineering activity "detect profiles", what can be explained through the reference of the process steps to the objective "promising product profiles". Hence, there are additional process steps concerning the remaining product engineering activities within the Identifying Potentials Phase, which are not considered within this research. An example for this is the development of videos for presenting the product profiles to the decision makers at the milestone. These process steps are not visualized in the figure, because these process steps pay for another objective "enabling the committee to make a decision". Thus there are much more process steps executed within the Identifying Potentials Phase, but only the mentioned above pay directly for the objective "promising product profiles" and are in the focus of this research.
Regarding the execution of the problem solving activities S - situation analysis and P - problem containment, some teams have invested more capacities and others have done only the compulsory process steps. This can be related to the previous phase of the innovation project, which focuses on a broad research and deep analysis of all relevant topics and problems. Thus, some of the teams already conducted the necessary research and others wanted to investigate more, because they identified a lack of information during the project. Some of the teams did focus very strong on the problem solving activity A - alternative solutions, what means that they used several creativity methods and research-

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based methods to generate product profiles. In addition, they also invested more time in revising these product profiles to increase their maturity. For example, team 5 executed several process steps to validate and to verify the developed product profiles, through e.g. expert interviews to evaluate the customer and the provider benefits. At the end of the identifying potentials phase, there was a milestone (E - deciding and implementing) with the project partner to decide, which product profile will be processed within the next phase. After the milestone, there was a meeting for recapitulation and learning (N) with all teams. To summarise the analysed ACTUAL processes, not every team followed the complete SPALTEN problem solving process for developing product profiles. The reason for this might be the documentation of the ACTUAL processes by the teams, as they have executed the complete SPALTEN process but did some steps implicitly, without documenting them and that they summarized different problem solving steps within one process step. However, it depends on the specific project objectives and the team itself, how the ACTUAL process is executed and documented.

In Figure 5, there is a list of the 48 process steps, which are part of the reference process for developing product profiles. The column "Total" lists the total of the execution of the respective process step over the analysed 23 teams. The column "% of Teams" shows the relative number of teams, which executed the process step during their project. For identifying the most important or most used process steps, the ten process steps with a relatively high number of executions, as well as a high usage rate over the teams are highlighted in dark grey. Although every product engineering process is unique, these results show that there might be some process steps, which are relevant for a larger amount of projects. During the evaluation of the ACTUAL processes of the teams, it was ascertained, that the process steps concerning the problem solving activity T - analysis of consequences were described very fuzzy, hence it was not possible to clearly assign them to the listed process steps. This might be a reason for the lower usability rate of these process steps. For example, all of the 23 analysed teams executed the process step "developing product profiles creativity-based" and overall, this process step was used 58 times. This means, that in average each team executed this process step at least twice.

ID	PS	Process steps	All 23 Teams	
			Total	% of Teams
1	S	**Analysing customer / user groups**	43	96%
2	S	**Analysing future scenarios**	18	78%
3	S	**Analysing system in development**	38	61%
4	S	Analysing provider	21	57%
5	S	Analysing relevant patents	12	48%
6	S	Analysing reference systems	18	48%
7	P	**Deriving customer and user benefits**	32	65%
8	P	Deriving provider benefits	7	30%
9	P	Deriving user requirements	7	30%
10	P	Identifying use cases	16	52%
11	A	**Developing product profiles creativity-based**	58	100%
12	A	Developing product profiles research-based	18	57%
13	L	Defining evaluation method & criteria	16	61%
14	L	**Evaluating product profiles**	27	91%
15	L	Ranking the product profiles	9	35%
16	L	Comparing different product profiles	17	52%
17	L	Combining similar product profiles	11	43%
18	L	**Selecting TOP [xy] product profiles**	21	83%
19	L	Selecting TOP 3 product profiles for final decision	17	70%
20	L	Selecting favourite product profile for final decision	6	26%
21	T	Ensuring technical feasibility	8	30%
22	T	Ensuring customer / user benefits	9	35%
23	T	Ensuring provider benefits	6	22%
24	T	Defining relevant product properties for validation	5	22%
25	T	Defining validation objectives	3	13%
26	T	Ensuring basic assumptions of business model	5	22%
27	T	Determining payment readiness of customers	6	26%
28	T	Testing the usability of the future product	2	9%
29	T	Accomplishing proof of concept	3	13%
30	P	Deriving requirements to production system	2	9%
31	A	Identify recycling or reuse possibilities	4	17%
32	A	Describing product profile claims	16	65%
33	A	Describing different benefits	12	52%
34	A	Adjusting maturity of different product profiles	12	43%
35	A	Visualizing product profiles	6	26%
36	A	**Filling in the product profile scheme**	42	57%
37	A	Setting up a rough business model	11	43%
38	A	Detailing the business model	2	9%
39	A	Calculating the business case	1	4%
40	A	Identifying technical solutions	3	9%
41	A	Defining functions of product profile	8	26%
42	A	Determining necessary system architecture	4	17%
43	A	Creating a sketch of the future product	2	9%
44	A	Creating CAD model of the product	1	4%
45	A	Creating low-fi demonstrator of the product	2	9%
46	A	Creating functional prototype	1	4%
47	E	**Making final decision on the TOP 1 product profile**	23	100%
48	N	**Evaluating the decision on the finial product profile**	23	100%

Figure 5. List of 48 process steps to develop product profiles with assignment to problem solving activities (PS), total amount of usage and usability rate overall the 23 teams (TOP 10 process steps are highlighted)

Figure 6 shows the representation of a process step with all necessary information the developer needs to configure his individual TARGET process. A process step contains some predefined content and contents that must be filled in by the assigned person during the process. In addition to a general and short description of the process step, the entry "Objectives" clarifies the target by addressing some short questions. A process step also enables a scalable execution, which offers different possibilities for execution depending on various factors. These factors include, for example, the type of collaboration (single work vs. team work), the number of participants, the time required and the digitalization rate of the method. To make this possible, the entry "Scalable Implementation" contains

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various methods and their different execution options. As an example, in the process step "Developing product profiles creativity-based" the methods "Brainstorming" and "Co-Creation Workshop" are provided. Depending on the factors mentioned, the chosen method can be carried out as a person alone, in a group paper-based or in a group with the help of supporting collaboration platforms. If a process step is now selected for implementation in the individual TARGET process, the process step can be assigned to a predefined phase goal and one or more responsible persons. Additional entries allow the assignment of the process step to the product engineering and problem solving activities as well as to the layers of iPeM. This representation of a process step can be easily implemented in current IT tools for project management, which are mainly used in industry, as e.g. Jira. Therefore, it is easier to implement this reference process within companies and to support product developers without a large additional effort.

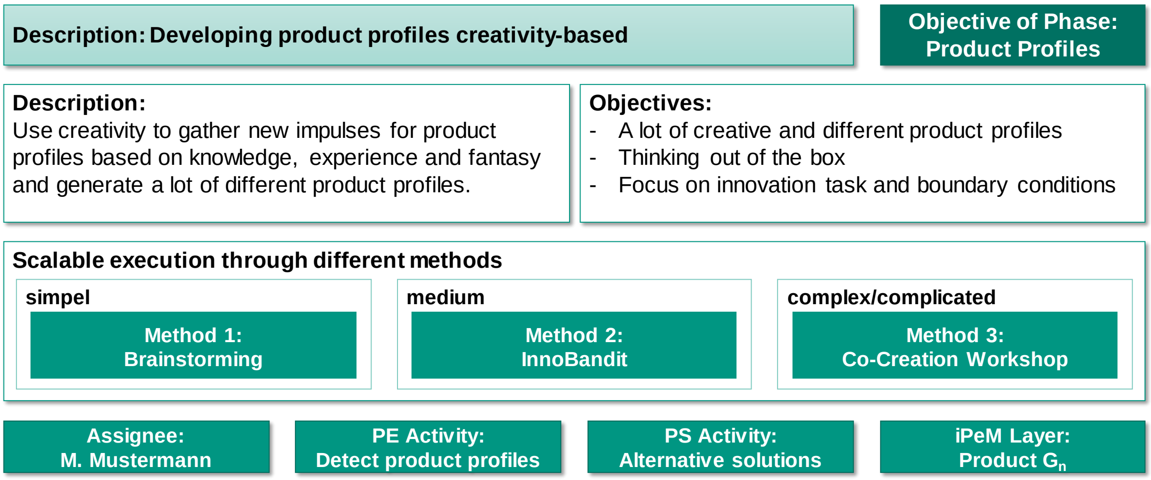

Figure 6. Example for the representation of a process step

5 PROCESS PATTERNS FOR REFERENCE PROCESSES FOR DEVELOPING PRODUCT PROFILES

Reference processes include beside the process steps itself also the relation of the process steps to each other, which are called process patterns. Hence, the empirical Live-Lab study in IP 18/19 was used to identify these process patterns. Through the evaluation of the ACTUAL processes of the seven teams, it could be measured, in how many cases a specific process step was executed before a respective other process step. Figure 7 shows an extract of these results.

ID	Process steps	11 Developing product profiles creativity-based	1 Analysing customer / user groups	47 Making final decision on the TOP 1 product profile	48 Evaluating the decision on the finial product profile	14 Evaluating product profiles	7 Deriving customer and user benefits	3 Analysing system in development	18 Selecting TOP [xy] product profiles	36 Filling in the product profile scheme	2 Analysing future scenarios
11	Developing product profiles creativity-based		67%	100%	100%	100%	100%	57%	100%	100%	71%
1	Analysing customer / user groups	33%		100%	100%	67%	75%	17%	67%	100%	33%
47	Making final decision on the TOP 1 product profile				100%						
48	Evaluating the decision on the finial product profile										
14	Evaluating product profiles			100%	100%		25%		14%	50%	
7	Deriving customer and user benefits			100%	100%	25%			25%	33%	
3	Analysing system in development	29%	33%	100%	100%	43%	50%		57%	67%	29%
18	Selecting TOP [xy] product profiles			100%	100%	43%	50%	14%		83%	14%
36	Filling in the product profile scheme			100%	100%						
2	Analysing future scenarios	29%	17%	100%	100%	43%	50%	14%	43%	67%	

Figure 7. Extract of the matrix to identify process patterns for reference processes through analysing ACTUAL processes within the Live-Lab study in IP 18/19

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As shown in Figure 7, it was measured, that for example in 67% of the cases when the process step "11 - Developing product profiles creativity-based" (row) was used, it was executed before the process step "1 - Analysing customer / user groups" (column). Through this visualisation, it can be shown, that the process steps "11 - Developing product profiles creativity-based", "1 - Analysing customer / user groups", "3 - Analysing system in development" or "2 - Analysing future scenarios" tend to be executed earlier in the process. In contrast, the process steps "47 - Making final decision on the TOP 1 product profile" and "48 - Evaluating the decision on the final product profile" are process steps, which are clearly positioned at the end of this process phase. This can be explained through the boundary conditions of the project, which provides a fixed milestone and a meeting for recapitulation and learning. These identified process patterns can help project managers to plan their project based on the reference process. Through the empirical data, it will be possible to derive a process plan automatically based on the reference process and the boundary conditions of the project.
In Figure 8 are the evaluation results of a short survey with 38 participants of the Live-Lab IP 18/19 visualized. Overall, the participants were mostly satisfied with the reference process steps. The participants rated the description of the process steps as well as the suitability for the project as positive. The participants were less satisfied concerning the usage of the process steps for their project planning, what might be dependant of the given project management tool, which was a boundary condition. Additionally, the participants were also less satisfied with the method recommendations, which can be reasoned through a missing linkage of the process steps to the method database and more information concerning the specific method selection and adaptation. Overall, the reference process and the respective process steps show mostly positive results and much potential to support project managers during the development of product profiles.

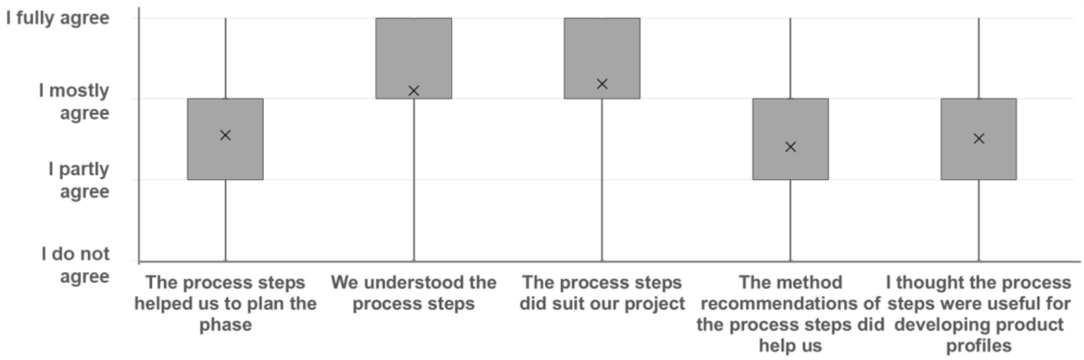

Figure 8. Evaluation of the reference process steps in the Live-Lab IP 18/19 (N=38)

6 DISCUSSION AND OUTLOOK

The empirical base for this research are tasks, which were created by the teams themselves and were documented in an IT tool. All the process steps were categorized based on the available information. Thus, it is possible, that a few of the 631 process steps were not classified correctly. In addition to that, it was not possible to use all of these process steps for the reference process, because some of them were either described too generic or they were too context-specific or they are not stated clear enough. As this research is based on several empirical Live-Lab studies in a similar context, it will be necessary to investigate more ACTUAL processes in different contexts as well as directly in industry. However, the described results are a first base to support product developers in a very early stage of their project to develop product profiles. Besides a broad analysis of industrial processes within the early phase, it will be also a next step to identify the relevant context factors, which affect the reference process itself and the specific TARGET process. Furthermore, it will be relevant to consider the design of an appropriate user interface for project managers to build a TARGET process based on the identified process steps and process patterns, to plan and to execute their process. In addition to that, the iPeM - integrated Product engineering Model (shown in Figure 1) could be extended through the process steps. The identified process steps can be located within the fields of the activity matrix on the left side, as part of the process elements, i.e. process steps, methods and tools. Furthermore, the process patterns give an implication for the relations between the single process steps. Additionally it will be relevant to investigate the relations between all process elements, as well as the influence of the context-factors.

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