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Master Thesis

Identification and processing of quality ideas: A case of idea management in the front-end of project management in Projektron BCS

by

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II. Abstract

This study explores idea management in the front-end of project management from a systems configuration standpoint. It is based on the case of Projektron BCS – a web-based project management software – and the organizations using it. Configurations of an idea management system enable the processing and identification of quality project-related ideas in different environments and for different organizational requirements. This study explores them in an abductive approach built on a grounded theory literature review and semi-structured interviews with experts in Projektron GmbH and user organizations. The study first outlines a framework of the idea in an idea management system. Based on the processing of an evolving idea, this study expands the framework to include the stages taking place during idea processing and identification of quality ideas and the related concepts to the stages: the gates and activities conducted by different roles. The findings show that the stages are components of an idea management system and they are orchestrated in possible configurations based on the value configuration model of a chain, shop, and network. Chains are a sequential long linked idea management system that excels at efficiently processing refined ideas. Shops rely on intensive cyclical processing of ideas and can increase idea quality to meet a standard. Networks consist of a mediating platform that links users to simultaneously conduct the stages and co-create value during capture, improvement, and evaluation in the form of user ideas. The organizational context and the characteristics of processed ideas relate to each configuration: This enables organizations to choose a configuration based on their organizational context and idea types to configure a suitable idea management system in the front-end of project management. Based on these insights, this study develops a conceptual prototype of an idea management solution inside Projektron BCS in the front-end of project management and outlines design guidelines for both future design science research application and product development in Projektron BCS. On the academic side, this study addresses the research gap regarding idea management in the front-end of project management. The development of a framework of an idea management system and its configurations suitable to the different organizational contexts enlarges the corpus of knowledge regarding idea- and project management and information systems for these topics and introduces a new theory about the front-end of project management.

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1. Introduction

1.1 General Background

It is not only doing projects right that leads to success but doing the right projects (Lerch and Spieth, 2013). Only firms who accurately select the best projects succeed (De Oliveira, Rozenfeld, Phaal, & Probert, 2015). In reality – as was found in a study by the US Army – only 2% of their IT projects concluded were used as delivered (Williams & Samset, 2010). They found that the source of the problem is often not in the execution but in the selection of the right project idea. The front-end of project management (PM) is therefore "the perhaps most important stage in the overall project cycle in securing the success […], or avoiding failure" (Flyvbjerg 2013, p. 760). Only when an organization selects the right idea from a pool of innovative ideas, can the subsequently initiated project contribute to its long-term objective (Lerch & Spieth, 2013). This shows that there is pressure on the front-end of PM to generate, identify and select quality ideas from which innovative projects can emerge (Aagaard, 2013; Kock, Heising, & Gmünden, 2015; van den Ende, Frederiksen, & Prencipe, 2015). The key tool that can manage an efficient and effective generation, evaluation and selection of ideas is idea management (Gerlach & Brem, 2017).

Whereas traditional suggestion systems focus on the generation of incremental innovations, the modern idea management (IM) enables the generation, processing, and evaluation of innovative ideas (Gerlach & Brem, 2017). In addition, the emergence of web-enabled ideation systems in the past decades enables new open approaches which leverage creative potential, knowledge, and networks of internal and external entities to generate innovative ideas (Gilson & Lichtfield, 2017; Walsh, Lee & Nagoaka, 2016; West & Bogers, 2014). In 2007, Dell for example was faced with the challenge to select promising ideas from over 6200 ideas posted in their online forum within the first five months after its launch (Di Gangi & Waskio, 2009). After initial failed attempts at adopting ideas, Dell changed the selection of ideas to an iterative process with the focus on bridging the knowledge gap between idea source and the organization and succeeded in implementing product innovation projects based on the submitted ideas. This shows that an idea management system (IMS) must handle large quantities of ideas from many geographically dispersed users and select promising ones (Di Gangi & Wasko, 2009; Van Dijk & van den Ende, 2002). This poses an additional problem because the front-end – the stage preceding the initiation of a project – is characterized by high uncertainty due to lack of information, misleading signs as well as difficulties with forecasting future scenarios (Constantino, di Gravio, & Nonino, 2015; Froehlich, Hoegel & Gibbert 2016).

In this phase financial-, knowledge-, and human resources are constrained, and the generation, improvement, evaluation, and selection of ideas are major challenges for organizations (Eling, Langerak & Griffin, 2015; Foehlich et al., 2016; Kock et al., 2015; Kornish & Ulrich, 2014; Spieth & Lerch, 2014). Especially in web-enabled ideation systems that utilize user's creativity, decision makers do not have the resources to consider every idea in detail (Van Dijk & van den Ende, 2002). Organizations require an information system (IS) which enables the efficient and effective selection of promising project ideas and supports processing and decision making of these ideas (Eling et al., 2015; Lerch & Spieth, 2013).

In the past, these IMS were often based on the value chain logic(e.g. Hansen & Birkinshaw, 2007; Westerski, Iglesias, & Nagle, 2011; van Dijk & van den Ende, 2002) but recent approaches call into question the underlying static viewpoint of the idea and propose a dynamic perspective in which ideas the idea is developed to maturity (Gochermann & Nee, 2019) or co-created by a network of actors (Beretta, 2019, Perks, Kowalkowski, Witell, & Gustafsson, 2017). Therefore, cyclical approaches focused on idea development (e.g., Neagoe & Klein, 2009; Vandenbosch, Saatcioglu, & Fay, 2006) or open network-based approaches (e.g., Di Gangi & Wasko, 2008; Walsh et al., 2014) emerged. This raises the question, based on which approach an IMS should be configured to process ideas and work as a catalyst for innovation (Van Dijk & van den Ende, 2002).

1.2 Case Background

These problems IMSs face are underlined by the case of Projektron BCS – a web-enabled PM and business coordination software used by over 850 organizations across Europe to manage projects (Projektron, 2021). Projektron BCS enables them to manage projects from preparation to completion and aims to support organizations in the front-end of PM through IM functionalities interlinked with the powerful tools built around Scrum, PRINCE2 and IPMA.

This is supported by Projektron's recent push to enable organizations to open their innovation activities in the font-end of PM by providing free-of-charge guest licenses. These enable additional employees to be added to the system and submit ideas and therefore offer companies an easily scalable solution for their IM. But as outlined in theory, such an open system must be able to process large quantities of ideas and improve, evaluate, and select them efficiently and effectively. This is where the current functionalities based on a chain approach reach their limits. Therefore, many companies who want to organize the IM either use the ticket system in or custom configurations of Projektron BCS or decide to organize it outside of the system. Stiftung Warentest for example uses a custom-made configuration of the software to

collect ideas from employees and manage the front-end of their Product-testing project. Similarly, Hörmann Antriebstechnik uses Projektron BCS to collect a variety of ideas including product ideas and turn them into project proposals.

Projektron GmbH itself is also an example for this: ideas from internal and external sources are collected in the ticket system. Its customers and employees are a valuable source of ideas in the current suggestion system where mainly product-related ideas are submitted. The current system inside its internal as well as customer support ticket systems enables customers and employees to propose suggestions in text form, which are screened and are an input for the project and product management. But recent developments put pressure on the current system: Firstly, the company considers opening the portal to additional users beyond the system administrators on the customer's side. Secondly, the current system is focused on product-related suggestions. But a broad range of other ideas can benefit the organization and the submission of service, organizational, process, or innovation ideas in Projektron BCS from which project can emerge is a goal. Thus, it is the challenge to develop an IM tool inside Projektron BCS which supports processing, evaluation, and selection of product, service, organizational, process, and service ideas in the front-end of the PM.

But each of these cases underlines different requirements for an IMS. As discussions with customer consultants inside Projektron GmbH who have frequent contact to a variety of its customers have shown each IMS implementation differs in the user groups, processes, idea types processed, evaluation methods, integration with their PM and more. An IMS can therefore not be a standard system but it must fit the organizational context and the ideas processed. But organizations require a cost-effective and well-integrated solution that works well with the other systems such as PM, CRM, communication and more. Therefore, a configurable standard software for PM such as Projektron BCS offers a promising base for a configurable IMS.

An IMS must therefore enable companies to capture all relevant information regarding an idea, process it accordingly, and identify and select the quality ideas. But to do so, it must be suitable for the organizational context and the ideas being processed. This system would fill the observed gap between the generation of ideas and the initiation of the project preparation. Discussions with Projektron's Consultants have further shown that ff such a system was available many organizations would decide to facilitate the IM in the front-end of their PM with an IMS. This would result in better and more innovative projects and higher project success rate because companies can choose to do the right projects based on quality ideas from employees, customers, and other stakeholders.

1.3 Research Gap

Past research has focused on creativity and the generation of ideas (Girotra, Terwiesch, & Ulrich, 2010) as well as the initiation and implementation of projects based on ideas (e.g. the PMBOK guide starts with the initiation of the project). But an under researched gap exists between the generation of project ideas and implementation and the front-end of PM. Pinto & Winch (2016) called this the black box of project shaping and assert it should be opened using case research.

This study aims at opening this black box grounded in an increased focus on the idea itself (Froehlich et al., 2016). This is necessary, because past research often considered ideas as a static construct, whereas ideas are dynamic and evolving (Gochermann & Nee, 2019). Ideas can only be processed effectively if in addition to the reflective measures such as quality, also the idea profile and the source of the idea which form the idea are taken into consideration and research attention should be given to these factors (Gilson & Lichtfield, 2017). Looking at formative as well as reflective measures in the context of the idea in an IMS is a novel approach promising new insights into idea processing and improvement.

Such an approach would answer calls by Gochermann & Nee (2019) and Westerski et al. (2011) for research into methods and processes of idea improvement, evaluation, and selection while simultaneously offering a novel approach with increased focus on the dynamic idea. This is supported by Martinsuo & Poskela (2011) who outline that the improvement, evaluation, and selection of ideas for creating future business potential remains unexplored. Therefore, this study explores this gap by taking a systems perspective on IM in the front-end and exploring the dynamic idea in the context of idea processing stages and decision making.

But the requirement for IM to be a complete and repeatable process clashes with IMSs becoming more complex and more interconnected with the organization (Westerski et al., 2011). Furthermore, IMSs differ from organization to organization depending on the context and a more nuanced approach than the static frameworks outlined by researchers in recent years is necessary (Walsh et al., 2016). Especially since the emergence of platform models (Beretta, 2019) more research into different approaches is needed. This study takes the viewpoint that distinct approaches are not contradictory but are different configurations of an IMS. How an organization orchestrated an IMS to increase the value of the ideas processed depends on the configuration of the system. Because this is a novel approach to the field of IM interconnecting it with the value configuration theory (Stabell & Fjeldstad, 1998) offers promise to explore differences in IMSs and improve these systems.

1.4 Aim of the Research & Research Question

This study investigates how project ideas can be captured, processed, and selected using a web enabled IMS such as Projektron BCS. It intends to combine insights from theory with the cases of organizations using Projektron BCS to develop a conceptual framework of an IMS in the front-end of PM and its interplay with the dynamic idea and its characteristics. Because an IMS processes project idea through different stages, these are investigated in this study in comparison with the dynamic idea and how the idea is developed throughout the stages.

In addition, this framework should include how organizations in different environments orchestrate IMSs. Therefore, the approach takes a configurational view on IMSs and explores what configuration is suitable to process and identify quality ideas. This study achieves this by developing a framework of the idea and interconnecting it with an IMS framework and exploring possible configurations of this system. Lastly, it will outline a IMS inside Projektron BCS based on the framework and showcase its applicability to the case. The goal of this study is therefore to explore what configuration of IMSs in the front-end of PM enables the processing and identification of quality ideas. This leads to the following research question:

What configuration of an idea management system enables organizations to process and identify quality project-related ideas?

This study question is broken down into the following sub questions: An IMS is suitable for the ideas it develops. Therefore, a focus on the idea should be the base of an IMS. Therefore, this study clarifies a conceptual framework of the idea taking into consideration what forms the idea and what reflects the ideas characteristics and idea quality.

1. What is an idea in the front-end of project management and what are its characteristics?

The processing and identification of quality ideas can be broken down into distinct stages which integrate operations and gates and are conducted by different roles. These stages are orchestrated according to the organizational requirements in a configuration.

2. What are the stages of processing quality project-related ideas?
3. What framework represents a configurable idea management system?
4. What are configurations of an idea management system that enable the processing and identification of quality project related ideas?

This study showcases how the framework can be applied by conceptually developing a configurable IMS tool inside Projektron BCS based on its data structure, interface, and processes.

5. What does a configurable IMS inside Projektron BCS look like?

1.5 Thesis structure

This thesis is divided into five parts. After the introduction which this chapter concludes the next chapter outlines the methodology. For the purpose of this thesis, it is beneficial to first outline the methodology before outlining the theoretical framework and findings, because this study follows an abductive approach that includes a grounded theory literature review. The methodology of the literature review as well as the rest of the paper is therefore outlined in the next chapter before the theoretical findings and the theoretical framework are presented in the subsequent chapter. The theoretical findings outline a framework of the idea in an IMS and the stages through which an idea is processed. It concludes with insights into possible configurations which are further developed in the results of the case study in the third part. This part presents the findings from the semi-structured interviews describing the cases. It does so in a cross-case analysis and combines them with the theoretical findings to form a framework of the idea and an IMS and its configurations. In the last part, the author discusses the findings and the limitations and outline possible future research and the implications for theory and practice.

2. Methodology

2.1 Research Setting & Case

The focus of the case study is the IMS module inside the software Projektron BCS: A web-based PM software for preparation, planning, execution, and evaluation of projects which is supported by various functions such as customer and internal management functions which is developed by Projektron GmbH. At the time of this study, the IM functionalities in Projektron BCS are limited in two ways: In the standard of Projektron BCS, only a rudimentary IMS is included which enables the capture of ideas but is limited for idea processing and evaluation. Secondly, on the customer side, a set organization use a custom-made IMSs build on top of the standard-functionalities in Projektron BCS. These are not available for use by other organizations and are specific to the organizational context of those companies. Furthermore, Projektron GmbH itself utilizes IM and aims to develop its internal IMS. Projektron BCS's user-organizations are an appropriate focus for this study and for the development of a IMS inside Projektron BCS because they are organizations which collect project-related ideas with the aim to process and identify quality ideas from which project emerge. Each of the user configuration differs and the types of ideas collected, and the organization context differs from organization to organization.

Projektron BCS provides the ideal base for the research into a development of an IMS:

- Projektron BCS is a web-enabled modular standard software which allows configurations by user-organizations and is suitable to include a configurable IMS.
- Projektron BCS offers tools for process-design and -management (Workflows, BPMN processes) and therefore enables IM from a process perspective.
- It has a granular permission system which enables the definition of role-based permissions which enable the definition of distinct roles in an IMS.
- It has teamwork functionalities for the daily work organization of employees which supplement an IMS and serve as an interface with the users.
- It enables PM including project preparation, planning, execution, and controlling which can be supplemented with an integrated IMS in the front-end of its PM functionalities.
- It is a business coordination software and serving as a platform for employees, customers, and stakeholders. It is therefore suitable as an idea platform for the collection of ideas from all parts within and outside of the organization.

Additionally, Projektron GmbH enabled me to spend 2 years with the to get to know Projektron BCS, its organizational context and its customers, thus contributing to a deeper understanding of the cases, the participants, and the context of the research (Perecman & Curran, 2006).

2.2 Research Design

The research problem first appeared in the case of Projektron GmbH. However, in the initial observations, the case continuously evolved to incorporate a broader focus including the capture, evaluation, and selection of ideas in the front-end of PM and the configuration of an IMS in different organizations. Further redirection emerged from the re-evaluation of theory resulting in a back-and-forth movement between the conceptual and the empirical world (Dubois & Gadde, 2002). Thus, the present study is an evolving, exploratory study consistently reevaluating theory and empirical findings while developing a theoretical framework through matching, direction & redirection (Fig. 1). Therefore, the study moved from an inductive approach towards what Dubois & Gadde (2002) term an abductive approach termed "systematic combining". Through "continuous movement between [the] empirical world and [the] model world" (Dubois & Gadde, 2002, p. 554) it enables the reorientation of an inductive approach with a stronger reliance on theory (Dubois & Gadde, 2002). An abductive approach can improve the case against the criticism of Yin (2009) regarding limited foundations for theoretical generalizations by improving the case study's explanatory ability (Dubois & Gadde, 2002). Because the configurations and therefore the framework depends strongly on the local context and local truths, this study is also in line with the critical realism approach for which Järvensivu & Törnroos (2010) recommend an abductive research focused on theory generation and testing. Lastly, the abductive reasoning applied here is "an essential part of theorizing for design" (Lee, Pries-Heje, & Baskerville, 2011) which supports the IMS design related sub question. But, opposed to design science research approaches, the focus of this study is the theorizing of a theoretical framework based on empirical observations and case analysis (Dubois & Gadde, 2002) instead of the creation of a design artifact. Therefore, this study focuses on the abstract domain and on the case whereas the artifact itself is not the subject of the research.

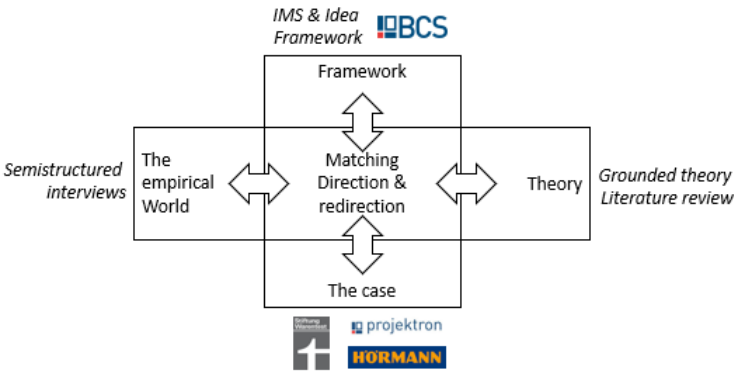

Figure 1: Four ingredients of systematic combining (Dubois & Gadde, 2002)

Based on these insights and the 4 “ingredients ” (Dubois & Gadde, 2002, p. 555) (fig. 1) the following research approach underlies this study(cf. figure 2):

- At first, a preliminary understanding of the case is achieved and articulated preconceptions of the framework are developed through data collection in the case environment Projektron BCS in Projektron GmbH. This was done through unstructured interviews, discussions with employees and primary data collection in the suggestion ticket system.
- Simultaneously, the author searched the theoretical environment in a grounded theory systematic literature review (Wolfswinkel et al., 2013). The goal was to identify building blocks of the framework. The literature review and search in the primary case environment iteratively influenced each other with the theory guiding the observations and the data collected leading the search terms and relevance criteria. The insights from literature formed a preliminary theoretical model of the idea in the IMS and its related concepts.
- The studyexpands the understanding of the empirical world based on previous insights through semi-structured interviews following a 7-step process by Kvale (2008). This method is suitable in this qualitative research context where deduction and induction phases alternate cyclically (Babbie, 2016). Emerging patterns in semi-structured interviews enable new insights and can challenge initial assumptions (Diefenbach, 2009).
- These sources of information coalesce in the framework building in which, through systematic combining, the theory, and data sources as well as analysis are matched (Dubois & Gadde, 2002). Also, in this stage, discoveries about the theory lead to redirection and additional searches in empirical data collection and the theory.

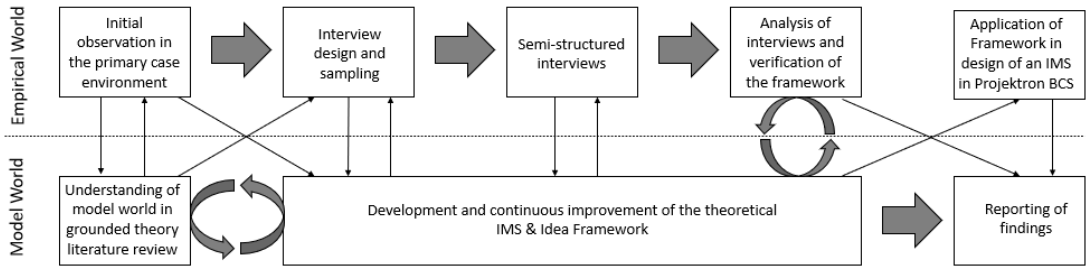

Figure 2: Research design based on the abductive approach by Duboise & Gadde (2002)

2.3 Data collection & Analysis

2.3.1 Initial Case research

Before the empirical material is collected in the case, it is useful for the researcher to be familiar with case and participants (Dubois & Gadde, 2002). Therefore, the author observed the primary case environment through iterative discussion in the form of unstructured interviews with Projektron's CEO, two technical consultants, and two customer consultants and recorded key insights based on notes. All discussions were conducted face-to-face to ensure quality interactions (Babbie, 2016). This was complemented with an analysis of 43 customer and 8 internal ideas in the current suggestion system.

2.3.2 Data collection and analysis (Literature review)

A grounded theory approach is suitable here because it enables the observation of "well-rooted and fruitful new links between variables" and draws new insights from theory (Wolfswinkel et al., 2013, p. 51. The literature review consisted of 5 stages conducted iteratively (Wolfswinkel et al., 2013). Moreover, it combines "inductive and deductive thinking" and is thus in line with the abductive approach and uncovers concepts and develops theories (Wolfswinkel et al., 2013, p. 51). Such an approach increases the transparency and thus also follows Webster & Watsons (2002) call for clarity about focus in systematic literature reviews in the IS field.

The author defined criteria for inclusion and exclusion and refined them in a discussion with an experienced supervisor (Thesis supervisor Dr. A.B.J.M. Wijnhoven) (Appendix A). Search terms were defined based on the research question and relevant fields of research in a building block approach. Based on the initial case research and the research question synonyms, related-, and broader terms were defined and combined into search terms. Search terms that did not yield any results or results that did not fit the topic were excluded. Databases employed for the literature search are primarily Scopus and as a secondary source Google Scholar.

In the next step the search was conducted iteratively between August 2019 to December 2020. The author added additional papers based on discussions with Dr. A.B.J.M. Wijnhoven and a snowballing approach andexported all relevant results into a single list which served as the base for the selection of relevant papers. The authorthen refined the sample by filtering out doubles and screening titles and abstractsconducted a full text screening of the remaining papers and excluded irrelevant ones. Additional papers were added based on forward and backward citations from the previously selected papers. This stage was iteratively repeated until exhaustion of the data is achieved (Wolfswinkel et al., 2013) (Appendix B).

In the analysis stage the study utilized a grounded theory approach (Wolfswinkel et al., 2013). The author built a database of relevant excerpts from the papers (754 entries from 88 scientific papers). Based on this data set open-, axial-, and selective coding were conducted (Wolfswinkel et al., 2013). During the iterative open coding, The author defined related concepts for each excerpt and created groups of concepts as categories (Wolfswinkel et al., 2013). This resulted in 361 concepts grouped in a hierarchical structure of eight levels. The simultaneously conducted axial coding explored interrelations between the subcategories and categories (Wolfswinkel et al., 2013). Through the continuous relating, comparing, and linking of categories during the selective coding, categories,concepts, and conceptualized relations between the main categories in the developing theoretical framework were refined (Wolfswinkel et al., 2013) (See Appendix C. for progression of theoretical framework).

2.3.3 Data collection & analysis (case study)

The focus of the study is an IMS (potentially, but not necessarily implemented in Projektron BCS) which is also the unit of analysis. Because the software is used and configured for the front-end of PM in the context of a single organizations, the unit of observation relevant for data collection is the organization using the IMS.

Using multiple organizations and a multitude of data sources enables deep probing in the case study (Dubois & Gadde, 2002). Therefore, this study used additional data sources: Firstly, tickets regarding the IMS configurations of the respective organization. Secondly, a discussion with the customer consultant of the respective company. Lastly, six semi-structured interviews with members from three organizations following Kvale´s (2008) 7 stage interview process.

2.3.3.1 Interview design

Following Kvale´s (2008) 7 stage interview process, the author conducted the thematizing during the initial case research. During the designing phase, the author built the interview guide including six questions for two themes and six additional questions that depend on the interview partners viewpoint on an IMS (see Appendix D). All questions are non-leading to ensure later interpretive validity (Ayres, 2008) and were pretested in a pilot survey with two non-participants (Rowley, 2012) and improved based on the insights.

The author conducted the interviews via phone (2) in a video call (3) and in person (1). During the interview there was no strict order of questions the author adjusted the interview depending on the interviewee's response and used neutral probes (Ayres, 2008). The author recorded the interviews with permission of the interviewee and prepared word-by-word

transcriptions (Babbie, 2016) and acquired a permission for the usage of name and direct quotes (One remains anonymous).

2.3.3.2 Sampling & Sample size

The sample consists of companies which collect internal or external ideas during the front-end of PM and who use standard or customized Projektron BCS functionalities for IM. In consultation with a customer consultant (Carsten Friedrich - CF) and the Head of Sales/CEO MD the researcher created a list of five organizations fitting these criteria and contacted representatives of the organizations via E-Mail outlining the topic and the background. Members of two organizations were available for interviews. In addition, the author contacted employees of Projektron GmbH directly of which four agreed to interviews.

Table 1: List of Organizations in the sample and their characteristics

Organization	Employees	Field	IMS
Stiftung Warentest (SW)	359 (2018)	Non-profit Consumer organization	Used in the front-end of product test projects.
Hörmann Antriebs-technik (HA)	6000 (2020)	Industry	Used for project ideas relating to organization and product development
Projektron GmbH (PROJ)	105 (2020)	Software	Used for organizational and product related ideas

For Projektron GmbH the interviews include multiple stakeholders of an IMS to enable insights into different perspectives. Firstly, an employee who has a record submitting multiple realized ideas over the course of the last 2 years (RF) and secondly the CEO MD who has an insight into controlling and strategy in the context of an IMS. Additionally, CF and an anonymous technical consultant were suitable for the interview due to their role as customer/technical consultant for SW and HA and their involvement in the configuration process of the respective Projektron BCS system. This enables a validation and a second perspective on the two organization's configurations (HA, SW). Table 2 summarize the interviews:

Table 2: List of Interview Partners and Interview Details

#	Interviewee	Title	Company	Duration
1	RF	Employee	PROJ	23:33
2	MD	CEO	PROJ	31:31 + 63:28
3	CF	Consultant	PROJ	32:00 + 40:30
4	AN	Technical Consultant	PROJ	13:42
5	EU	Head of Division Assistant	HA	38:12
6	EG	Quality control & process optimization	SW	48:24

2.3.3.3 Data analysis

The data analysis of the interviews is both inductive and deductive (Dubois & Gadde, 2002). The deductive directed content analysis is suitable for a topic for which prior research exists (Hsieh & Shannon, 2005) and the author used a structured based on initial coding categories and their operational definitions from the grounded theory literature review (Potter & Levine-Donnerstein, 1999). The author coded the transcripts of the interviews and present the evidence including the codes (concepts), examples and descriptive evidence and additionally screened the interviews for emerging concepts and relationships between the concepts in an open coding and derived additional codes from the data (Hsieh & Shannon, 2005).

2.3.4 Framework building

Based on the findings from literature and interview analysis the author iteratively develops a framework of an IMS in an IS such as Projektron BCS. Guarino (1998) recommend the use of ontologies for the designing, developing, and using in information systems. An ontology is an explicit specification of a conceptualization and thus encodes the structure and implicit rules constraining this structure of a piece of reality (Gailly & Poels, 2007). Furthermore, ontologies describe knowledge structures and give overview over the concepts in a domain therefore enabling the understanding, reuse, and analysis of this knowledge (Noy & McGuinness, 2001). Gailly and Poels (2007) further summarize that there is wide acceptance of the use of ontologies for the purpose of semantic integration and making IS interoperable which is important in Projektron BCS – a modular system spanning multiple business functions. Weber et al. (2007) outline a strategy which enables the combination, adjustment, and reuse in different technical infrastructures with the help of ontologies. This leads to the higher flexibility, better compliance, lower costs, and quicker change management (Weber et al., 2007) required by the organizations. To achieve this, an ontology must capture potential states of the domain (Weber et al., 2007) which is done in this case by looking at the idea in different stages. Based on this, this study outlines entities and their relationships and presents them in a descriptive lightweight application ontology (Gailly & Poels, 2007) which is transformed into conceptual "application program fragments with business functionality" (Weber et al., 2007, p. 57) based on Projektron BCS. The framework serves as a roadmap for the configuration of different fragments. The author conducts this by linking concepts and attributes in the framework to Projektron BCS and developing a conceptual artifact based on the Projektron BCS data structure and interface.

2.3.5 Validity and reliability

Shenton (2004) proposes 4 criterions to increase a qualitative research trustworthiness which this study follows: Firstly, it uses well recognized research methods in an abductive approach overlappingly and described the approach in this chapter. These increase credibility, dependability, and confirmability by ensuring the study can be repeated or scrutinized (Shenton, 2004). Using specifically a grounded theory literature review additionally increased credibility with a strong reliance on previous research (Shenton, 2004).

Secondly, it ensures credibility and transferability by creating early familiarity with participating organizations and their culture over the course of 2 years. This enables the tailoring of questions during interviews and the collection of background data (Shenton, 2004).

Thirdly, it increases depth of the study and ensure credibility and confirmability with a triangulation approach (Shenton, 2004; Yin, 2012) which includes crosschecking of data from multiple information sources (Suggestion tickets, initial case interviews, interviews) as well as different types of informants (3 different companies and 6 interviewees with different profiles). Shanton (2004) considers member checks of data collected and theories formed as the most important provision. Both during and after data collection the author ensures the accuracy of the data through verification of statements and discusses the framework with two of the informants (MD, CF) in follow-up discussions (Shanton, 2004).

Nevertheless, this study does not fulfill some of the provisions made by Shenton (2004). The author could not ensure honesty of informants through face-to-face interviews due to the current Covid-19 contact restrictions but interviews in a video chat were conducted when possible. The researcher's status as employee in Projektron GmbH may also impair the honesty of informants, but the encouragement to be frank, the building of rapport and the right to withdraw at any point without disclosure of explanation increased credibility (Shenton, 2004). The sample of informants was not random (Shenton, 2004) but the reliance on informants recommended by the CEO (MD) and a consultant (CF) familiar with user organizations ensured a relevant sample and decreased the researcher bias. One issue specific to this study concerns language: the study's operating language is English, while the data collection took place in German. Issues are mitigated due to the bilingual background of the researcher (Full Bachelor and Master studies in English and two years of working experience in an English-speaking environment) and the crosschecking of questionable translations with a second person. Lastly, more debriefing sessions between the researcher and supervisor as well as peer scrutiny are lacking in this study but are conducted during the submission process (Shanton, 2004).

3. Theoretical Background and Literature Review

3.1 Definition of the Project-related Idea

Amabile, Conti, Coon, Lazenby, & Herron (1996, p. 1154) state that "all innovation begins with creative ideas". They further elaborate that ideas are the base of new programs, new products, and new services. Björk and Magnusson (2009) expand on this and assert that today, innovation ideas also include new business models and processes. In comparison, Innovation projects are "projects aiming at developing or improving products, processes, business models, and services" (Lerch & Spieth, 2013, p. XX). They further explain that such projects have the aim to convert ideas into innovations (Lerch & Spieth, 2013). Therefore, a project-related idea is a creative idea aiming at the development or improvement of products, services, processes, or business models through a project. Williams & Samset (2010) the specify that a creative project-related idea is a mental construct that satisfies a need or can help to solve a problem with different alternative possible solutions. These constructs are a new way of combining related concepts which often already existed before (Goldenberg, Mazurski, & Solomon, 1999; Hargadon, 2002). The need or problem on the other hand is solved by executing innovation projects (Lerch & Spieth, 2013). The goal for an organization is the identification of quality ideas (Williams & Samset, 2010) and the transfer of employee creativity into such ideas through a thinking process (Boeddrich, 2004; Van Dijk & van den Ende, 2002). A quality idea is therefore an implementable solution which applies to the problem at hand (Dean, Hender, Rodger & Santanen, 2006). Additionally, the requirement for an idea to be novel and useful is added to describe quality, creative ideas (Bassiti & Ajhoun, 2013; Dean et al., 2006) and a requirement for an idea to have value which is evaluated through criteria is often added (Zhu, Kock, Wentker, & Leker, 2019). The following definition is therefore the base of this study:

A project-related idea is defined as a context-specific novel, and valuable combination of concepts which change the status quo by solving a problem or satisfying a need through implementation in a project.

3.2 Idea-related constructs relevant to an IMS

Building on the definition above, this study explores what forms and reflects an idea by investigating its source, its characteristics, which idea types can be identified and what are indicators of its quality. Based on this it introduces and proposes a framework of a project-related idea in an IMS.

3.2.1 The source and the context of an idea

The first phase of an idea is its conception when it is created within an organizational context. This is the formative context of the idea where the "institutional arrangements as well as cognitive imageries informing the sources reasoning and routines" are the "actual situation of action" in which the idea was formed (Ciborra & Lanzara, 1994, p. 61, p. 64). As the formative context "comprises both an organizational and a cognitive dimension" (Ciborra & Lanyara, 1994, p. 70) it also includes the idea's source's cognitive context and characteristics. These characteristics of the source affect the value of the idea (Appelman & Sundar, 2016).

Research has found that ideas can come from a variety of sources (Di Gangi & Wasko, 2009, Gilson & Lichtfield, 2017). In this study, when referring to the source of an idea, the focus is on an individual or a group who conceived of the idea. Overall, the starting point of new ideas is the creativity of internal sources such as employees (Van Dijk & van den Ende, 2002) and external sources such as customers, collaborators, partners, and private inventors (Björk & Magnusson, 2009; Boeddrich, 2004; Cooper & Edgett, 2007; Flynn, Dooley, O´Sullivan, & Cormican, 2003). The source reacts to a situation: a problem which then compels a solution, or a new opportunity which can be exploited (Flynn et al., 2003). Individuals develop creative concepts in their mind either based on intuition and experience or systematic analysis of needs, requirements, or problems (Christensen, 2012). But not only individuals are possible sources: Koen and Kohli (1998) found that interactions between customers and engineers/scientists create radical innovations. Furthermore, specific qualities such as flexibility openness, and cognitive complexity are required of the source (Howell & Boies, 2004). Thus, the identity and characteristics of the source have a formative effect on the idea. From this follows the propositions regarding a project-related idea in an IMS:

A. The Source is a formative construct of the idea.

While earlier models explaining innovation have focused on the internal, the recent years have seen a growing support of open innovation models which focus on innovation and idea generation in networks spanning inside and outside of organizations (Du Preez & Louw, 2008; Björk and Magnusson, 2009; Di Gangi and Wasko, 2009). Especially stakeholders outside of the innovation process of the company can conceive of ideas which would not have been generated inside the process because they can play an expert role while simultaneously playing a user role that comes with the understanding of the context and usage of products and services (Froehlich et al., 2016). While the integration of heterogenous sources makes the implementation of ideas more difficult (Lee, Walsh, & Wang, 2015), the combination of knowledge from different sources with functional distinctiveness and expertise can create new

combinations and produce higher quality inventions especially during the generation stage (Walsh et al., 2016). Ideas from internal as well as external sources are similarly feasible, novel, and creative and both sources are important (Kornish & Hutchison-Krupat, 2016, Poetz & Schreier, 2012). Ideas from either of these environments can be generated to be an incremental solution to a known problem or can outline an unknown problem and a potentially radical solution (Kornish & Hutchison-Krupat, 2016). Thus, it is beneficial for an organization to foster all creative talent of its members (Flynn et al., 2003) and involve external sources (Di Gangi & Wasko, 2009) and combine both in a varied pool and use them as a starting point for innovation through projects (Gilson & Litchfield, 2017). In addition to the network position of the source Appelman and Sundar (2016) recommend that the source's trustworthiness and expertise affect the idea. Thedimensions of the source are therefore the position of the source in the network, trustworthiness, and expertise.

3.2.2 Idea Knowledge Structure

After the source encounters a problem or opportunity but before the idea's articulation it represents a tacit knowledge in the sources mind. Only by making it explicit can it be transmitted and become part of the organization's knowledge network (Herschel, Nemati & Steiger, 2001). To achieve this, its characteristics must be made explicit (Herschel et al., 2001) thus generating explicit knowledge about the idea which can be shared with and implemented by other members of the organization (Björk and Magnusson, 2009). An explicit idea has a knowledge structure that organizes knowledge at a level of abstraction and enables the making of assumptions about its characteristics under a condition of incomplete information (Martins, Rindova, & Greenbaum 2015). Froehlich et al. (2016) argue that this is "transported by the presentation of the idea within the suggestion system" (pp. 890) and point out that a link to the insight which led to the idea leads to better results. Therefore, an idea is framed in a scenario. For quality ideas, this knowledge structure should include a new way of combining related concepts which often already existed before (Goldenberg et al., 1999; Hargadon, 2002). For ideas, a concept in the form of a mental construct helps to solve a specific problem or satisfy an observed need (Williams & Samset, 2010). Froehlich et al. (2016) sum this up in the dimension idea character, which they describe as "the way different concepts were combined to generate it" and is included in the idea profile. Therefore, this study proposes the following construct with the dimensions idea character and idea presentation:

B. The knowledge structure is a formative construct of the idea.

3.2.3 Idea Quality

The success or failure of an idea is related to its quality which in turn is formed by its characteristics (Constantino et al., 2015, Froehlich et al., 2016). Reflective indicators that describe idea quality have been a focus in research and there is a variety of criteria used for evaluation depending on company, industry, project types and strategies (Kaiser, Arbi, Ahlemann, 2015; Constantino et al., 2015). A reflective indicator is criterion "by which anything can be judged" (Lim and Mohamed, 1999, pp. 243). For ideas there is a wide range of methodologies used employing either single criteria or a combination of multiple criteria and ranking methods reflecting the idea quality (Constantino et al., 2015). Thus, a standardization of criteria across organizations is seen as impractical (Kaiser et al., 2015).

Literature summarizes that because the monetary value of ideas can hardly be judged, the use of other dimensions such as novelty, workability, relevance, and specificity are necessary (Blohm, Riedl, Leimeister, & Krcmar, 2011; Dean et al., 2006). Dziallas (2020) on the other hand proposes the use of customer relevance, strategic fit, communication potential and vision potential as indicators. Though which measures are used and how they are weighted differs in different contexts (Martinsuo & Poskela, 2011) and thus a customizable approach according to the classification of ideas is useful. Overall, researchers recommend the usage of technical, market and strategic criteria combined with idea complexity and novelty (Martinsuo & Poskela, 2011). But even for these well-defined criteria questions are open. For example, concerning novelty, there is the question for whom the product is new: to the world, to the industry, to the firm or even only to the customer (Spieth & Schneider, 2016). This also relates to the classification of ideas because Hart, Hultink, Tzokas, & Commandeur (2003) suggest using different types of evaluation criteria for different projects. Furthermore, also across different markets and organizations different criteria are relevant (Carbonell-Foulquie, Munuera-Aleman, Rodriguez-Escudero, 2004). Overall, it is clear, that evaluation systems are needed that balance different competing interests (Martinsuo & Poskela, 2011). Narrowing the quality evaluation down to a single goal is conflicting with the complexity and ambiguity (Williams & Samset, 2010). Therefore, the dimensions of this construct are dependent on the context and must be observed further in the case, but the proposition poses that:

C. Quality is a construct reflecting the idea's characteristics.

3.2.4 Information Quality

Decisions about ideas require reliable information (Williams & Samset, 2010). If an idea is thorough and worked out it detail it provides reliable information (MacCrimmon & Wagner,

1994). MacCrimmon & Wagner name exact, concise, clear, and full as specifications of a thorough idea. Dean et al. (2006) researched this as well and name three dimensions as part of their specificity construct: implicational explicitness, completeness, and clarity. Because in this study, ideas are dealt with specifically in the context of an IS and are represented through information, the construct referred to here is information quality. Batini & Scannapieco (2016) characterize information quality with the four dimensions accuracy, completeness, consistency, and currency. Accuracy is that the information adheres to the reality of interest. Complete information represents all relevant aspects of the reality. Consistency means that there are no contradictions to other properties of the reality. Currency refers to temporal dimension of how up to date the information is. This results in the following proposition:

D. Information quality reflects the idea's characteristics.

3.2.5 Idea Types

Processing decisions decide on the development path of an idea and some result in "quickwins" while others result in the development into significant projects (Flynn et al., 2003). But not only processing decisions depend on the characteristics of the idea. Also, the evaluation criteria used may depend on the characteristics of idea (Martinsuo & Poskela, 2011). Ideally, every idea would follow its unique development path, but because groups of ideas share common characteristics, they can be grouped into categories referred to as types. This is necessary, because limited resources and high numbers of ideas require a partially standardized processing (Eling et al., 2015; Van Dijk & van den Ende, 2002). Therefore, the construct of the idea type is suitable to reflect a set of characteristics of an idea and make decisions based on the limited information available in the front-end (Constantino et al., 2015, Froehlich et al., 2016).

The idea type has gathered only limited attention in research and no universal typology exists. Because ideas in this study are project-related ideas which include innovation-, and product-related ideas, previous research from these fields can help outline possible idea types. Ideas can be classified by their origin (as is practiced in Projektron GmbH). Other authors propose a classification by the nature of change the idea brings (Flynn et al., 2003; Kornish & Hutchison-Krupat, 2016). This is the degree of novelty which is represented by either a continuous scale from incremental to radical (Gilson & Lichtfield, 2017; Sternberg, 1999), split in classes such as incremental, radical, and architectural (Burgelman, Christensen, & Wheelwright, 2009) or focused on the effect it has on the customer (Darroch & McNaughton, 2002). The classification by novelty is the most common in literature and is argued to be relevant because it impacts evaluation and selection. Instead of focusing on the novelty of an

idea, Martinsuo & Poskela (2011) propose a classification by complexity of the idea. Another approach to classification of ideas is the business function they relate to (Oesterle, 2000): products, services, processes, organizational structure, or strategies (Rowley, Baregheh & Sambrook, 2011; Spieth & Schneider, 2016; Van den Ende et al., 2015). Additional classifications can be drawn from the classification of projects which they later evolve into (Yim, Castaneda, Doolen, Tumer, & Malak, 2013) or the innovation they evolve into (Damanpour, Szabat, & Evan, 1989). (cf. Appendix E – Literature review of categorizations) For each company different categorizations are relevant. From this follows the proposition:

E. An idea has a type which reflects the idea's characteristics.

3.2.6 Concepts related to an Idea

Based on the concepts and categories in 3.2.1 to 3.2.5 the framework of an idea in an IMS consists of seven core concepts. The relationship with the idea is proposed based on the logic of reflective and formative constructs (Petter, Straub & Rai, 2007). The constructs with a formative relationship are formative measures which "cause change in the underlying construct" (Petter et al., 2007, pp. 624). Two of the constructs have a formative relationship with the idea. For an IMS these constructs are important for operations changing the idea's attributes because they form, change, and refine the idea in the IMS. For the constructs with reflective relationship, a change in the construct (the idea) causes a change in the reflective measures (Petter et al., 2007). There are three constructs which reflect the idea in the information system: firstly, the quality of the idea, secondly the quality of information and lastly the type. These constructs take an important role during decision making because they

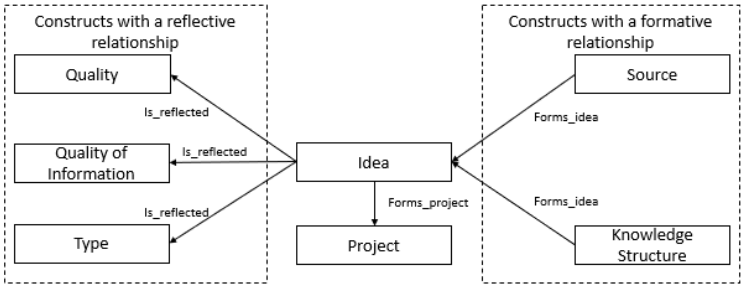

Figure 3: Framework of the Idea in an IMS

Table 3: Idea constructs and dimensions

Construct	Definition	Dimension	Relationship	Literature
Source	An individual or a group who conceived of the idea	Position in Network	Formative	Du Preez & Louw, 2008; Björk and Magnusson, 2009; Di Gangi and Wasko, 2009
		Trustworthiness	Formative	Appelman & Sundar (2016)
		Expertise	Formative	Appelman & Sundar (2016)
Knowledge structure	An organization of knowledge at a level of abstraction which enables the making of assumptions about its characteristics under a condition of incomplete information	Idea Character	Formative	Froehlich et al. (2016)
		Idea Presentation	Formative	Froehlich et al. (2016)
Quality of Information	Current information adheres to the reality of interest and respects all aspects of it with no contradictions	accuracy	Reflective	Batini & Scannapieco (2016)
		completeness	Reflective	Batini & Scannapieco (2016)
		consistency	Reflective	Batini & Scannapieco (2016)
		currency	Reflective	Batini & Scannapieco (2016)
Quality	Implementable solution which applies to the problem at hand		Reflective	Dean et al. (2006)
Type	A group of ideas which shares common characteristics		Reflective	Martinsuo & Poskela, 2011

indicate the quality of the idea and enable comparison. For a list of the constructs and their dimensions refer to Table 3.

3.3 The Idea Management System

At the core of this study is the aim of outlining the configuration of an IMS. An IMS is a "structured support of the ideation phase" and facilitates continuous improvement through IT tools (Sandström & Björk, 2010, p. 311). Furthermore, an IMS serves as a tool for the collection and processing of "ideas for innovation from larger communities" (Westerski et al., 2013, p. 1317). Processing refers to stages such as screening, improvement, evaluation, and selection with the result of approval, shelfing, or termination of the ideas (Flynn et al., 2003; Edkins, Geraldi, Morris, & Smith, 2013). Regarding the order of these stages, theory differs but for example Martinsuo & Poskela (2011) state that screenings and evaluations take place before decisions. Before the capture stage that initiates the processing, the idea generation takes place during which the idea is created in the mind of an individual (Samset & Volden, 2015). The idea generation stage is important to IM overall, but for the purpose of this paper with the focus on the IMS it is outside of the scope and the capture stage serves as the interface between generation and IMS and the idea serves as a boundary object.

An IMS serves five purposes which are reflected in the stages: Firstly, an IMS captures ideas and initiates them into the corporate PM and innovation processes by making them explicit (Van Dijk & van den Ende, 2002). Secondly, it develops ideas effectively and efficiently along individual development paths (Gilson & Litchfield, 2017; Williams & Samset, 2010). Thirdly, it improves the ideas quality and increases the knowledge about the idea (Williams & Samset, 2010). Additionally, it evaluates the idea and outlines justifications for decision making (Clegg et al., 2018). Lastly, it results in an implementation decision about the idea which is either terminated, shelved, or approved (Edkins et al., 2013). In the following chapters outline the stages of an IMS which fulfil this purpose based on the literature review.

3.3.1 Capture Stage

The capture stage is where quality ideas are captured and initiated into the process through an interface (Van Dijk & van den Ende, 2002). This stage closes the knowledge gap between the organization and the source through communication and the idea is absorbed (Di Gangi & Wasko, 2009). This means that tacit knowledge about an idea is translated to explicit knowledge to ensure it is processable in the IMS (Du Plessis, 2007). The explicit knowledge about the idea also enables sharing and recombination (Du Plessis, 2007). This is also the

earliest point for the recognition and correction of errors in the information (Chen et al., 2012). This early stage can therefore impact the success strongly and is also a bottleneck because organizations require a sustainable flow of ideas (Björk & Magnusson, 2009).

Building on the framework of the idea (cf. Chapter 3.2) any idea in an IMS should be presented as a knowledge structure that organizes knowledge at a level of abstraction. This enables decisionmakers to make assumptions about the idea's characteristics under a condition of incomplete information (Martins et al. 2015). For organizations this means that they make a choice about the type of information they require. Research outlines, that qualitative information in the form of a concept is a reliable input into the front-end phase (Williams & Samset, 2010) while quantitative information is more affected by time and more prone to errors (Samset & Volden, 2016). Martins et al. (2015) further outline, that schemas including attributes and relationships are good for presenting complex and novel information and unfamiliar experiences (Martins et al., 2015) and therefore also ideas.

Organizations should also decide for which information is required based on the requirements of the evaluation: Froehlich et al. (2016) state that decision makers can understand concepts and relevance of ideas framed in a thematic perspective more easily. Flynn et al. (2003) outline the that the evaluation requires an idea definition, core concepts, the initial stimulus which initiated the idea, and the relation of the idea to organizational goals, contexts, and environment. What information is required furthermore depends on the type of the idea. For example, the evaluation of incremental product improvement ideas requires technical aspects to judge feasibility and user benefits of the idea.

Table 4: Core Concepts of the Capture Stage

Capture Stage	Idea Capture	Capture is the bridging of the knowledge gap between the organization and the source through absorption of the idea (Di Gangi & Wasko, 2009)
	Source	A source is the person or group who conceives of the idea (Van Dijk & van den Ende, 2002)
	Interface	At the interface information is transferred between source and the organization (Di Gangi & Wasko, 2009)
	Tacit idea	A tacit idea is the knowledge about an idea in the sources mind (Du Plessis, 2007).
	Knowledge structure	A knowledge structure organizes knowledge at a level of abstraction and enables the making of assumptions about the idea's characteristics under a condition of incomplete information (Martins et al. 2015)

3.3.2 Screening Stage

After an idea is captured, the submitted idea may pass through the preselection stage (Froehlich et al., 2016). Froehlich et al. (2016) and Martinsuo & Poskela (2011) argue for the application

of the screening stage because scarce resources can be used for the best ideas if the screener makes effective early processing decisions for each idea including the termination of unfit ideas. Unfit ideas can have value but are for example screened out if it is a discontinuous innovation which does not fit the business model (Gerlach & Brem, 2017). This stage is important because a web-based system often creates large collection of ideas which require pruning (Gilson & Lichtfield, 2017). Furthermore, some ideas result in "quickwins" which do not need to proceed through all stages but are implemented immediately (Flynn et al., 2003). This indicates that ideas are terminated early on or require unique development paths depending on their type or characteristics (Gilson & Lichtfield, 2017).

The screener can decide this only if they have knowledge about the idea's is reliability and usefulness (Williams & Samset, 2010). To achieve this, the IMS includes standards for quality-at-entry according to which the screener performs the screening (Froehlich et al., 2016). They can assess the reliability by assessing of the information quality (Batini & Scannapieco, 2016) (cf. chapter 3.2.4). But other formative characteristics such as the source can help to make such early processing decisions as well (McAdam & McClelland, 2002). Screeners can also assess the usefulness of the idea by comparing it with the company objectives (McAdam & McClelland, 2002) or applying market, technical or financial criteria at the screening gate (Martinsuo & Poskela, 2011). Nevertheless, organizations should keep this process informal and limit the resource usage (Martinsuo & Poskela, 2011).

Table 5: Core Concepts related to the Screening Stage

Screening Stage	Screening	The screening is a preselection of ideas according to standards of quality at entry (Froehlich et al., 2016)
	Screening gate	The screening gate is a gate at which a processing decision is made (Froehlich et al., 2016)
	Screener	The screener conducts the screening of the idea and makes a processing decision (Martinsuo & Poskela, 2011)
	Development path	A development path is the order of processing with the aim to develop an idea (Gilson & Lichtfield, 2017).
	Information Quality	Cf. 3.2.4 Information Quality
	Quality	Cf. 3.2.3 Idea Quality
	Type	Cf. 3.2.5 Idea Type

3.3.3 Improvement Stage

Before the decision making and subsequent lock in, the responsible person can consider different solution designs and it is still easy to make changes to the overall design (Samset & Volden, 2015). The design refers here to the knowledge structure of the idea (cf. 3.2.2). Therefore, the potential for improving the idea is the highest in the front-end, when the addition

of information and development of the idea is the easiest (Samset & Volden, 2015). The aim of this stage is to increase the probability of success of the idea (Flynn et al., 2003). Drawing from evolutionary learning, this study outlines an approach in which idea processing includes an improvement stage in which the improver refines the idea and modifies it to avoide a wholesale overhaul (Martins et al., 2015). Therefore, the improvement stage is an ongoing process during which the information is enriched (Brem & Voigt, 2009).

A prerequisite for the improvement stage is that the source provides information about the idea during the capture stage. Based on this, the IMS collects and approximates additional data which is iteratively improved (Equitz & Cover, 1991). This study identifies two general approaches to the improvement of ideas: firstly, the quality improvement of the information describing the idea (Batini & Scannapieco, 2016). And secondly, the quality improvement of idea through modification of the underlying concepts and models (Samset & Volden, 2015).

Research on methods for the improvement of ideas in IMSs is limited but Gerlach & Brem (2017) mention experimentation or discussion whereas Samset & Volden (2015) outline that the improver consults with stakeholders or extracts and uses previous experience by applying simple analysis. But to enable a choice of improvement approach in the IMS configuration, this study outlines a classification of these approaches based on Batini & Scannapieco's (2016) work in the field of data quality. They name the methods information acquisition, object identification, and integrity constraints as methods for improvers to improve the information.

1. Information acquisition is the acquisition of information about or the measurement of the object of the information (Batini & Scannapieco, 2016). In this study this is the idea and the underlying concepts. The improver also may consult with stakeholders (Samset & Volden, 2015), conduct discussions, or collect additional information through market studies or experiments (Gerlach & Brem, 2017).
2. Object identification is the process of comparing the information to other sources which are known to be good (Batini & Scannapieco, 2016). The combination of concepts can result in the emergence of novel attributes and has been important in creativity research (Estes & Ward, 2002). The improver conducts this by identifying a source concept which is comparable to the target idea that is to be improved. Then he compares the structure of both schemas including their attributes, relations, and subschema. In the next step elements from the source concept are integrated and are modified to fit the target idea (Martins et al., 2015). By doing so, the improver is extracting and using previous experience and applying it to modify the idea (Samset & Volden, 2015).

3. Integrity constraints is the setting of criteria against which the information is checked and when inconsistencies are discovered they are corrected through error localization and correction activities (Batini & Scannapieco, 2016). The evaluator conducts this by
4. applying simple analysis which indicates errors and improvement paths enabling the
5. corrections (Samset & Volden, 2015).

Table 6: Core Concepts related to the Evaluation Stage

Improvement Stage	Improvement	Improvement is the incremental idea refinement and modification to fix flaws, improve the design and enrich the information (Brem & Voigt, 2009, Martins et al., 2015, Samset & Volden, 2015)
	Information Acquisition	Information acquisition is the acquisition of information about or the measurement of the object of the information (Batini & Scannapieco, 2016)
	Object Identification	Object identification is the process of comparing the information to other sources which are known to be good (Batini & Scannapieco, 2016)
	Integrity Constraint	Integrity constraints is the setting of criteria against which the information is checked and the correction of through error localization and correction activities (Batini & Scannapieco, 2016)
	Information Quality	Cf. 3.2.4 Information Quality
	Quality	Cf. 3.2.3 Idea Quality
	Knowledge Structure	Cf. 3.2.2 Idea Knowledge Structure

5.3.4 Evaluation Stage

In the evaluation stage, an evaluator assesses the information and processes it into an input for the selection stage in the form of a presentation of "carefully selected sample of relevant facts and judgmental information" (Williams & Samset 2010, pp. 45). The evaluation method applied depends on the overall process model choice, the goals for the evaluation process, the resource availability, the accuracy needed, and the types of ideas being processed. Methods for the evaluation range from financial to non-financial and include single criteria, cost-benefit analysis and multi-criteria and ranking methods and further may also be conducted by more subjective individual or committee evaluation methods (Constantino et al., 2015).

The most common methods are the checklist (e.g., Stufflebeam, 2000), cost-benefit analysis (e.g., Flyvbjerg, 2013), viability analysis (e.g.,Samset & Volden, 2016), impact assessment (e.g., Flyvbjerg, 2013), Scenario Analysis (e.g., Samset & Volden, 2016), intuitive rating and ranking (e.g., Eling et al., 2015), discussion (e.g., Lerch & Spieth, 2013), opportunity & risk analysis (e.g., Samset & Volden, 2016), multi-criteria approaches (e.g., Martinsuo & Poskela, 2011), portfolio analysis (e.g. Martinsuo & Poskela, 2011), and comparative analysis

(e.g. Flyvbjerg, 2013) (cf. Appendix F. for analysis of methods). Of these approaches, the multi-criteria approach has gained the most attention by researchers and an idea can be assessed according to quality criteria (cf. Appendix G for a literature review of quality criteria).

When companies want to identify high quality ideas either of these methods can be effective depending on the selection process (de Oliveira et al., 2015). In many cases combinations of the methods are used and combinations of quantitative and qualitative methods are beneficial (Martinsuo & Poskela, 2011). De Oliveira et al. (2015) outline that ideally the method and its criteria correspond with the decision criteria of the selection. Additionally, companies should consider the maximization of the utility/cost-ratio of processing additional information and methods due to scarce ressources (Samset & Volden, 2016).

Organizations also need to choose evaluators. Three approaches emerge from literature:

Firstly, utilizing experts in individual or group settings benefits from the innate tacit knowledge they possess which enables them to conduct accurate evaluations (Uusitalo et al., 2015; Williams & Samset, 2010). (Technology-) experts excel especially when dealing with radical ideas (Van Dijk & van den Ende, 2002). The high acceptance by management and lower resource usage compared to decision makers conducting their own evaluations is a benefit and thus many organizations decide for this approach (Williams & Samset, 2010).

Secondly, an evaluation conducted by management profits from easy transfer of knowledge and high acceptance because the identity of the evaluator and decision maker is identical (Williams & Samset, 2010). Nevertheless, this is rarely a viable option due to scarce resources and is true especially for IMS that process high quantities of ideas (Froehlich et al., 2016). Whereas the quality of the evaluation profits from inside strategic knowledge, research has shown that the accuracy of identifying ideas correctly is low (Gilson and Litchfield, 2017).

Lastly, in recent years more organizations utilize open approaches and communities (Di Gangi & Wasko 2009; Walsh et al., 2016). This means that users, employees, or communities conduct the evaluation. Organizations profit from external expertise and capabilities, require less resources and have a higher absorptive capacity (Di Gangi & Wasko 2009; Walsh et al., 2016). Furthermore, this increases the alignment with the business environment and results in a quicker adjustment to changes and trends (Di Gangi & Wasko, 2009).

Organizations should consider how the evaluation is presented to the decision maker of the selection stage. The presentation of the idea functions as a boundary object which enables the communication in the process across departments and hierarchy levels (Clegg et al., 2018). Research shows that the way ideas are presented has an impact on how they are evaluated and the overall decision quality (Caniels & Bakens, 2012; Froehlich et al., 2016). De Oliveira et al.

(2015) found that “better decisions are made when there is good knowledge of project information” (p. 164). The presentation should also support the managers information search and negotiant process (Martinsuo & Poskela, 2011). Due to resource constraints and time limitations in the selection process, the presentation should give a concise but complete overview of the idea while answering core questions asked by decision makers: the idea’s strategic alignment, resource fit and usage, and how it supports value creation and maximization (Lerch and Spieth, 2013). Oliveira et al. (2015) sum up, that simple visual approaches are appropriate. Examples for this are roadmaps (Phaal et al., 2004), scoring models (Davis et al., 2001) or portfolio matrices (Cooper et al., 2001a). This is supported by Clegg et al. (2018) who suggest the use of indicators or graphical representations to assists communication and discussions in decision making. Lerch and Spieth (2013) see portfolio maps, bubble diagrams, scoring models and checklists being used while Clegg et al. (2018) recommend portfolio maps, stop light reports, or dashboards.

Organizations can make this decision by answering whether the decision maker decides for each idea individually or uses comparative (portfolio-) approaches. Firstly, when looking at single ideas the context and information about the idea are important. To give a context about the idea and support understanding Flynn et al. (2003) recommend the presentation of the core message, the initial stimulus from which the idea originated and the organization’s goals this idea relates to. Key indicators, stoplight reports, and evaluation results can supplement this (Clegg et al., 2018). But for many organizations, multiple ideas are subject to decision making simultaneously because they compete for similar resources or and it is often combinations of ideas that help organizations achieve their objectives (Meredith et al., 2017). The organization can build a collection based on the evaluation and rank and prioritize ideas (Constantino et al., 2015) but the comparability of ideas needs to be ensured. A right class of comparatives are ideas regarding similar technologies or with similar levels of novelty (Flyvbjerg, 2013) or with the same type. The building of a collection is a continuous process including re-sampling and revisiting older ideas (Gilson & Litchfield, 2017). Circumstances can change (McAdam & McClelland, 2002) or new problems may arise (Gilson & Litchfield, 2017) for which older ideas in the collections prove useful. Nevertheless, due to potentially high quantities of ideas in a pruning of the collections and a discarding of inappropriate ideas is necessary to enable the decision makers to focus on the relevant ideas when selecting (Gilson & Litchfield, 2017).

5.3.5 Selection Stage

The idea can take one of four states as the results of the selection stage: approval, termination, shelving, or improvement (Edkins et al., 2013). Ideally, decision making should follow a "logical and chronological sequence that will eventually lead to the selection and go-ahead of the preferred project" (Williams & Samset, 2010, pp. 42). A rational analysis enables the identification of and decision for the best idea. But irrational human behavior, thinking biases, poor information and politically motivated decision making often lead to bad decisions (Samset & Volden, 2016; Caniels & Bakens, 2012).

An IMS requires a systematic approach to the selection of ideas which minimizes those risks and enables the accurate and efficient identification of quality ideas. In creativity research, two relevant categories of approaches are outlined which may apply to the selection: Firstly, a normative approach and secondly an exploratory approach.

In an exploratory approach the underlying assumption is that submitted ideas can concern unknown problems (Flynn et al., 2003). The opportunities are revealed through the selection process (Flynn et al., 2003). In this case the evaluation stage serves as a quality gate that ensures specificity (Dean et al., 2006) and as a knowledge gathering stage. In the selection stage the decision maker chooses the idea based the fit with corporate strategy and context (Martinsuo & Poskela 2011) and novelty and workability (Dean et al., 2006). Because decision makers search for solutions to unknown problems the resampling of old ideas is important (Gilson & Litchfield, 2017). The advantage of this approach is the uncovering of a wider range of options, imaginative freedom and, openness to radical ideas (Flynn et al., 2003).

In a normative approach a solution to specific need, objective or problem is created (Flynn et al., 2003). Therefore, the decision maker needs to define the problem. The evaluation procedures and criteria should reflect the requirements of a solution. This problem can also be communicated to the sources who can conceive of solutions to known problems. This approach is seen as more efficient and effective at creating implementable results but simultaneously may restrict creativity and radical ideas (Flynn et al., 2003)

Organizations can also apply hybrid approaches in which a balance between goal orientation and freedom is achieved (Flynn et al., 2003). Eling et al. (2015) illustrate such an approach where decision makers analyze decision options based on the decision problem definition. Either this can take a flexible approach through discussion and conversation or a more formal approach such as a decision tree or decision criteria (Eling et al., 2015). Eventually, the decision is made and an idea or set of ideas is chosen (Eling et al., 2015).

The selection stage should be supported by a decision support system (DS) through which the decision method is conducted. A DS minimizes uncertainty by supporting the decision maker in the evaluation of various alternatives (Uusitalo, Lehikoinen, Helle, & Myrberg, 2015; Di Gangi & Wasko, 2009). IMS can serve this purpose by reducing uncertainty through easy to understand and free of complexity presentations of accurate and suitable knowledge while at the same time monitoring the process (Caniels & Bakens, 2012). Research concerning decision making in the front-end and DS has largely taken the approach of utilizing procedures, methods, and criteria to improve such decisions (de Oliveira et al., 2015). But in practice, formal decision processes are not always applicable, and the practices greatly differ from decision making theory (Clegg et al., 2018). Organizations should weight formality and flexibility against each other when they decide for an approach (Martinsuo & Poskela, 2011). (cf. Appendix H for a comparison of decision methods)

5.4 Configuration of an IMS

An IMS is a funnel through which ideas are processed and this funnel includes decisions or gates (Boeddrich, 2004). For the design of a tool that enables the identification and selection of quality ideas this study should outline A) which information must be conveyed in an idea, and B) the methods and operations being applied (Riedl et al., 2009). I group these operations in stages that are "driven by interactions of different actors and communities with the system and the changes in data" (Westerski et al., 2011, pp. 494).

Ideas represent opportunities for value creation, but for an organization to capitalize, these ideas require processing and improvement until they can be transformed into projects and innovations inside the organization which enables value capture (Van Dijk & van den Ende, 2002). Ideas evolve over time through different stages (Björk & Magnusson, 2009). During this funnel, the idea may undergo screening, improvement, evaluation, and selection with the result of selection, shelfing, or termination of the ideas (Flynn et al., 2003; Geralid et al., 2013). It is important for this process to be fine-tuned to the context of the organization to be successful (Martinsuo & Poskela, 2011). It should also process different ideas accordingly, in a non-standardized manner (Flynn et al., 2003). This means, that for every idea the stages and operations differ not only in their order, but also their configurations (Flynn et al., 2003). How the IMS is configured, and the implicit order of stages depends, on the types of ideas processed and the organizational context. However, resent research outlines that valuable ideas are not created solely by individuals. Actors in- and outside of the organization can leverage their knowledge in a network and cocreate value (Beretta, 2019; Nambisan, 2002; Perks et al., 2017).

Stabell & Fjeldstad (1998) outline three value configuration logics on a firm level which help describe the configurations of value on an IMS-level. These configurations can indicate which components (stages, roles) and their interactions with the idea. Stabell & Fjeldstad introduce eight dimensions which explain the configuration. The adaption for the IMS means that the focus should be on stages instead of activities.

Table 7: IMS Configuation Characteristics

Value configuration characteristics	IMS configuration characteristic	Description
Value creation logic	Idea processing logic	The logic by which ideas are processed.
Primary technology	IMS technology	The logic by which the stages are combined.
Primary activity categories	Primary stages	The primary stages of the configuration and their associated operations, gates, and roles.
Main interactivity relationship logic	Main stages interactivity logic	The interaction between the stages conducted to process the idea.
Primary activity interdependence	Primary stage interdependence	The extent to which the stages depend on each other.
Key cost drivers	Key cost/resource drivers	The drivers of cost and resource usage in an IMS
Key value drivers	Key value drivers	The drivers of IMS value creation.

3.4.1 IMS as a Chain Configuration

Researchers outline an IMS approach in which initial ideas are a resource which is captured and transformed into a project in a one directional flow (Van Dijk & van den Ende, 2002). This system is a standardized process (Froehlich at al., 2016) following a process model of a value chain (Hansen & Birkinshaw, 2007). These approaches therefore represent a value creation logic of Stabell & Fjeldstad's (1998) chain configuration. The IMS stages and operations are limited to a fixed set of activities through which every idea is processed according to standardized methods in sequential steps (Stabell & Fjeldstad, 1998). These activities are the extraction of ideas during the capture (inbound logistics), the evaluation (operations), and outbound logistics (selection) (Van Dijk & van den Ende, 2002). The result of the process is a binary decision: whether the idea will be implemented or not. This process is scalable and ensures the efficient, standardized processing of a high quantity of ideas but is concerned with capacity and scale to deal with large numbers of ideas (Van Dijk & van den Ende, 2002).

3.4.2 IMS as a Shop Configuration

The value shop creates value by mobilizing resources and conducting activities to resolve a problem (Stabell & Fjeldstad, 1998). For an IMS this is the problem which is the base of the

idea and the idea itself represents the potential solution (Williams & Samset, 2010). Customers or employees who have the reputation to be experts conceive of and develop the value of the idea (Froehlich et al., 2016). After standard information acquisition procedure (capture) the system initiates a customized, internal, non-linear, iterative process (Nambsian, 2002; Stabell & Fjeldstad, 1998). This process furthermore incorporates gates, at which the process can be interrupted and where appropriate activities are decided upon (Stabell & Fjeldstad, 1998). In an IMS shop the stages screening, evaluation and selection can integrate gates (Eling et al., 2015; Samset & Volden, 2015).

The IMS follows a cycling approach and ideas are evaluated or improved iteratively (Martinsuo & Poskela, 2011). Such an approach can deal with potentially unique and novel solutions which require specialized knowledge for understanding and evaluating (Stabell & Fjeldstad, 1998). In the context of the IMS a portfolio/gate approach is suitable during which ideas are evaluated according to criteria by specialists with knowledge about the domain of the idea (Kock et al., 2015, Martinsuo & Poskela, 2011, Blohm et al., 2011, Eling et al., 2016). This also includes intuition-based approaches which propose that specialists can conduct idea screening based on intuition if they are familiar with the domain the idea is related to (Ferioli et al., 2010, Hammedi et al., 2011; Magnusson et al., 2014).

3.4.3 IMS as a Network

An IMS can leverage the creative potential and knowledge of networks to generate and process innovative ideas (Gilson & Lichtfield, 2017; Walsh et al., 2016; West & Bogers, 2014). A wide variety of actors may take part in it and offer insights and feedback (Stabell & Fjeldstad, 1998). Such a system interlinks individuals from the crowd as resource (creating the idea), co-creators (improving the idea) and users (offering insights and feedback) (Nambisan, 2002). Here, the IMS takes the role of a mediating technology (Di Gangi & Wasko, 2009) and facilitates the collaboration between co-creators in improvement and evaluation (Stabell & Fjeldstad, 1998; Walsh et al., 2016). Such a system is suited to develop products or services ideas about which the userbase has extensive knowledge and an interest in improving (Di Gangi & Wasko, 2009). An organization therefore facilitates the crowdsourcing of ideas, idea development, and evaluation. Such an approach is also outlined by Beretta (2019) who states that an intuition-based approach based on multiple opinions results in accurate evaluation. Crowds can thus act as a resource for development and evaluation (Poetz & Schreier, 2012).

4. Results

4.1 The Idea in the Context of the IMS

Based on the literature this study proposed five constructs which are defined by a total of nine dimensions (cf. 3.2.6 Concepts related to an Idea). It presents the results based on the directed content analysis of the interviews in Table 8. It does not include the interviewee AN in the analysis of the idea framework because in his role as technical consultant the interview's topic was the configuration of an IMS and no relevant insights for the idea framework emerged.

The other Interviewees are indicated by their abbreviations. The table shows mentions of dimension of the respective constructs (dark grey). The sum of the mentions indicates the importance of a dimension. In addition, the author investigates relationships of each dimension with the idea and indicates whether it is a reflective (R) or formative (F) relationship and indicates the relevant relationship in column F/R. The study also investigated the concept 'Project' as results of the idea to ensure that the framework only takes into consideration project-related ideas.

Table 8: Results of the Data Analysis for the Idea Framework

Construct	Interviewee / Organization / Dimension	EG SW	EU HA	RF Projektron	MD Projektron	CF Consultant	Sum (out of 5)	F /R
Source	Position in Network	F	F/R	F	F/R	F	5	F/R
	Trustworthiness		F/R	F	F/R		3	F/R
	Expertise	F	F/R		F/R		3	F/R
Knowledge structure	Idea Character	F	F	F	F	F	5	F
	Idea Presentation	F/R	F	F	F/R	F/R	5	F/R
Quality of Information	Accuracy	R	R	F/R	R		4	R
	Completeness	R	R	F/R	R	R	5	R
	Consistency	R	R	F/R	R		4	R
	Currency				R		1	R
Quality		R	R	R	R	R	5	R
Type		R	R	R	R	R	5	R
Project							5	-
Emergin concepts								
Communication Log		R	R	R		R	4	R
Feedback		R	R	R	R		4	R

Legende

F	*Dimension has a formative relationship with idea*
R	*Dimension has a reflective relationship with Idea*
	Dimension was not observed in the interview

Based on the results the framework outlined in 3.2.6 is valid and the propositions A-E are confirmed. The additional reflective relationship of the idea presentation (EG, MD, CF) as well as the emerging constructs, Communication log (EG, EU, RF, CF) and Feedback (EG, EU, RF, MD) each appear in multiple interviews and are included in the framework (Figure 4). In addition, there is a formative as well as reflective relationship of the source that future research should explore (MD, EU). The discussion of results for of each construct and its relationship with idea and IMS are part of the following chapters.

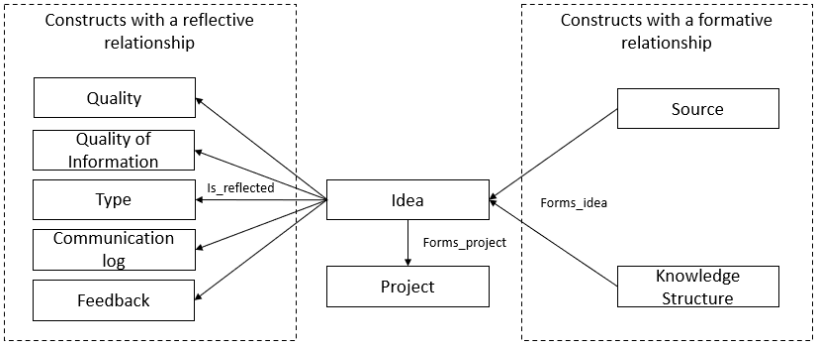

Figure 4: Framework of the Idea in an IMS

4.2 IMS Configurations in the Cases

The next subchapters describe the cases based on the interviews and showcase the configurations of each IMS described. These will be analyzed further in the next chapters.

4.2.1 Stiftung Warentest – Capturing ideas for product testing projects

Stiftung Warentest (SW) is a non-profit consumer organization conducting product and service tests which are published in the magazine "test" and "Finanztest". Since its foundation it has conducted 6125 product- and 3607 service tests (Stiftung Warentest, 2021). As of 2019 it has 362 employees and uses Projektron BCS to plan testing-projects and the IM in the front-end of PM. The author conducted the interview with EG in the position of quality assurance and process optimization. Additionally, SW's customer consultant CF & an anonymous technical consultant of SW (AN) are interview subjects on Projektron's side to confirm insights and provide a second perspective.

SW only collects one type of ideas for which all employees can be the source: ideas for product test. SW captures ideas in the Projektron BCS interface in a textual form and organizes the knowledge structure around the questions: "*why was this topic proposed? For which target audience could this topic be interesting and which consumer questions do we want to answer?*" (EG, CF). This indicates that solving the customer problems is the value creation logic. But at a later point in the interview EG says, that: "*the magazine needs to be filled. Nothing can stay open. […] This means that one needs to see to something coming in regularly. […] and that is what one needs such a tool for.*". This corresponds with the capacity-oriented chain value creation logic. Customer value (cost reductions and performance improvements for the customer) also corresponds with the value chain logic as EG outlines: "*we want to make the most possible users smarter [and help them use their] money optimally*".

The IMS (SW1) processes ideas sequentially starting from the capture. The source then forwards ideas "*to the respective group, where one thinks, where it should be tested*" (EG). This serves as a reduced screening stage conducted by the source and followed by the improvement and evaluation of the idea in the suitable team. During the improvement, the information quality as well as idea quality are subject to improvement by specialized market analysts (EG). Additionally, the IMS improves ideas through information acquisition of qualitative (e.g., colleagues) or quantitative (e.g., Google Trends) or object identification of previous ideas and projects (EG). The evaluation takes place in the same stage: "*we conduct a multifactor [analysis in which] there are multiple dimensions*". The evaluator decides to forward the idea and "*then respectively discuss(es) them with the chief editors*" in the selection stage (EG). The chief editor decides whether to reject, shelf or approve ideas and create a

project proposal for a testing project (EG, CF). SW performs the activities in a sequential chain but ideas which have a lower quality or quality of information are processed in an intensive, cyclical approach during improvement and evaluation. This shows that the primary activity interdependence is sequential at a IMS level but pooled at the level of an improvement- and evaluation stage. The following drivers underline this differentiation: According to EG they are "*planning backwards because the magazine must be filled*" which indicates the focus on capacity and flow control. But during the evaluation/improvement it is about more than costs therefore experts who are "*scientific or journalistic leaders of the [suitable] team*" create value (EG). The combination of a shop inside a chain configuration is also in line with Stabell & Fjeldstad (1998) who state that a single unit or function can follow a shop-logic when overall the logic of a chain applies (cf. Appendix I).

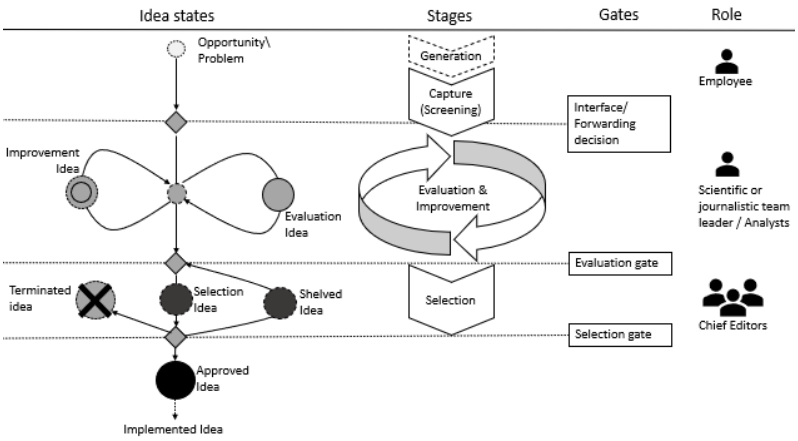

Figure 5: Conceptual IMS Configuration of SW

4.2.2 Hörmann Antriebstechnik – Idea collection and Specialist Suggestions

Hörmann KG (HA) is Europe's leading manufacturer of doors and gates and employs more than 6000 employees in Germany and 12 other countries (Hörmann, 2021). Hörmann Antriebstechnik, a subsidiary specialized on drives and controls, utilizes Projektron BCS for IM in the front-end of product development-, research-, organizational- investment and IT-projects. The author conducted the interview with EU, the head of division assistant andadditionally interviewed their customer consultant CF.

HA has two separate IMS in the front-end of PM: The first IMS (HA1) in Projektron BCS collects product development-, research-, organizational- investment and IT-project ideas. The second IMS (HA2) is not part of Projektron BCS (EU). The difference between the two are the idea types that are processed: "*We differentiate this for ourselves in the direction, that when one wants to improve something at their own workplace […] then it is an idea. But when one improves something about other's workplaces […] then it is a suggestion which would also be part of the compensation context if it is evaluated positively.*" (EU). This study analyzes both because EU states that the suggestion system could be implemented in Projektron BCS.

In IMS-H1, an employee submits an idea in textual form "*in their own words […] and attach files, pictures, […]*" (EU). The idea concerns their own field of work. The source is a specialist: *"[the idea] is from someone in the field [and] they know exactly what they write*" (EU). The source subsequently evaluates the idea characteristics in a checklist concerning "*innovation, image, market potential, customer advancement and economics*" (EU). The idea then proceeds to a selection stage where decision maker screens it and conducts the selection (EU). The process instructions state that the decision maker "*should always be the head of division or team leader […] because they have the expertise*" (EU). This case is unique because there is no formal evaluation, but a screening takes place instead during which the examiner assesses the quality of information. "*If the explications are not enough, the examiner says, 'this is not matured, look at it again and rework it again please*" (EU) and a "*reworking process goes out again, where the source should rework the whole idea*" (EU) with a feedback concerning what should be changed. This restarts the process and „*all starts again from the beginning*". The overall process therefore remains sequential with a long-linked technology (Stabell & Fjeldstad, 1998). In the selection stage "*there are no formal criteria […] and it is in the examiners discretion*" (EU). If the decision maker judges the idea to "*have real potential and [it] is qualitatively good, it is approved, and the process continues*" (EU). The decision maker provides written feedback for tracking and retrospective assessment of ideas (EU).

The IMS has a chain logic (cf. Appendix J.) with standardized sequential stage order and with the value driver of efficiency in processing: "*We try to process the projects – no matter which type they are, no matter which idea type they are – all exactly the same and also process the ideas the same. […] It is about optimizing the processes*".

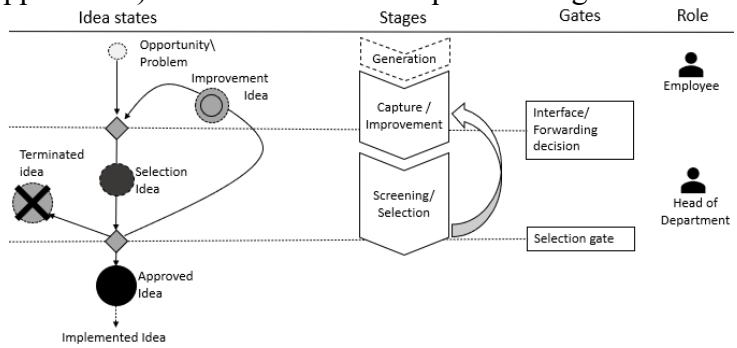

Figure 6: Configuration of IMS1 in the case of HA

IMS-HA2 already differs during the capture stage: "*everyone […] who has an idea can hand it in in a printed form*" (EU). The idea consists of the following: "*a [relation to a] workflow, material, resources which are relative […] and a title, short description, […and answers the questions] 'which problem did you identify?', 'how can this problem be solved', 'Which benefit can be achieved with the suggestion', 'which attachments are added?'*"" (EU). This indicates the value creation logic of solving problems. In the next stage the screener screens the idea and makes a processing decision: "*He decides in the first place what happens next, and, in the case, if it has to be evaluated. If it is a technical suggestion by the people in*

the production for example, they evaluate whether it is viable" (EU). The screener also assesses if the quality of information and if there an evaluation and improvement is necessary. Subsequently the expert evaluator passes the idea on to the CEO: "*this decision is made by [the] CEO*". The decision maker also provides a feedback and decides upon the compensation.

IMS-H2 follows a shop logic (cf. Appendix K.) because it processes each idea based on the screening. This stage processes the information and decides for the appropriate course of action as well as evaluates the resulting quality and quality of information. This indicates a pooled and reciprocal overall process. The focus on the problem during the generation, evaluation, and improvement also indicate a shop logic. Lastly, the increase of quality due to experts conducting stages shows that it is the shop's value drivers.

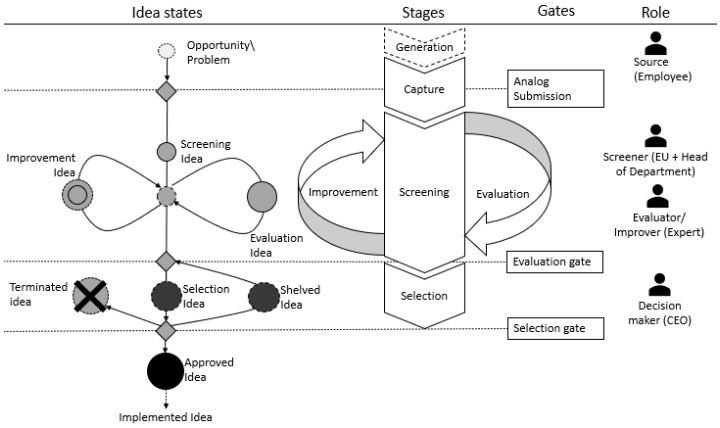

Figure 7: Configuration of IMS2 in the case of HA

4.2.3 Projektron GmbH – Internal and External Suggestion Systems

Projektron GmbH has around 100 employees who use all Projektron BCS including a ticket system (in which the current IM system is implemented) and PM. The author conducted three interviews with the CEO/Head of Sales MD and the experienced employee RF The interview with MD revealed that in addition to Projektron's internal IMS (IMS-PR1) a second IMS (IMS-PR2) for the capture and processing of customer ideas.

In IMS-PR1 the source submits ideas using the internal ticket system. The source records the knowledge structure of the idea: "*there is a short introduction [including] 'what does the idea consist off'[… and] 'I conceived the idea because I had this problem, I had this situation' to give the people the opportunity to understand the own behavior or also the own use case. This means that they can view what problems I had, and which are solved through this or could be improved upon*" (RF). This indicates the solving of a problem which indicates the shop logic. The source also records an idea type: "*new service, new tools, new employee search methods, new training, and new internal activities and events*" (MD). The source "*record[s] everything [in Projektron BCS] so that the idea becomes a ready concept*" (RF).

The analysis of suggestion tickets showed that they are screened by department heads or assigned to screeners. The screener checks the quality of information and makes a processing decision based on its source, characteristics, and type.

For IMS-PR1 the sources of internal ideas are usually experts with experience and knowledge in the field (MD). They are often involved in subsequent stages and the source characteristics play a role for processing decisions as well as the evaluation (MD). The reputation and expertise are a key value driver which indicates a shop logic (cf. Appendix L).

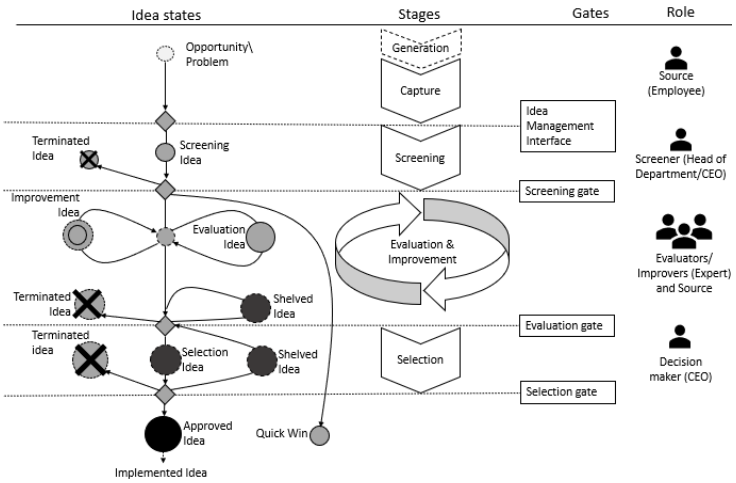

Figure 8: IMS Configutation of the internal system of Projektron GmbH

The IMS processes ideas also according to their characteristics such as costs: "*If the company is growing more – and it is already partially like this – the team leaders have budgets over which they can decide themselves […] and for this it is important to set boundaries within which they can decide themselves*" (MD). This indicates the existence of quick-wins which the IMS processes in a sequential chain instead of the shop to ensure short lead time and process efficiency: "*ideas are then evaluated and implemented in a timely manner*" (MD). The chain logic is possible because Two the source characteristics (expertise) and screening (Quality standards) ensure the idea quality. The IMS-PR1 can also include a in-person screening when the source presents ideas directly to MD who decides on the further processing: "*It is like that, because I communicate with employees a lot, that often ideas are told directly to me. For example, in the sales meeting or in the support meeting. And this is good on the one hand, but I always say: talk it out and come back to me when you have an improved suggestion*" (MD). But MD outlines the importance of using more formalized in larger companies: "*It depend on the size of the company. We are now at a size where it is good if people clear up things before and make sure that the criteria are fulfilled. So that everything is in such as the costs and so on. So that I am only involved if the idea is at that point.*" He therefore indicates that a future IMS should ensure that the idea is screened, improved, evaluated before he selects them.

After a screening, an IMS processes ideas accordingly in an evaluation and improvement stage based on a shop logic: "*I want that at least two more consultants involved. I want to have this on a level where multiple employees have a similar thing to a hackathon. There the bad ideas are quickly rejected because multiple people must work together. And the good ones are left. So, I want to only receive an idea [for selection], if multiple people have said that the idea is good*". This indicates that involved people solve problems and improve the idea in both information quality and quality. Before an idea is submitted for selection "*people [should] clear everything and make sure that all criteria are fulfilled, that everything is*

included: what is the benefit, what is the cost and so on" (MD). This follows a cyclical shop-logic: "*between the selections there is an improvement process which can repeat itself*" (MD).

During the selection stage the decision maker assesses all the arguments and decides whether it is implemented in a project, shelved, or terminated (MD). MD points out that next to the benefits "*the internal resources is the most important point*" and only if there is capacity an idea can be implemented. Otherwise, the decision maker also shelves good ideas (MD). RF points out the importance of feedback in a written form for this stage. Overall, IMS-PR1 is a shop because it applies resources (experts) according to the requirements of the problem (idea).

The source for IMS-PR2 are externals: customers may submit product improvement ideas in the ticket system. These are subject to a separate process during which they are screened, evaluated, improved, and selected. This is conducted by the support and development teams and by the product owners and the ideas can become an input in the scrum-product development process. MD outlines that the future development of this system may utilize a network approach: "*That's why we try now to also build up such a system outside, for the customers, where customers can evaluate the ideas of other customers. […] I hope that this will run in one year.*". In this system customers are linked to work together so that "*the best themes are automatically selected*" (MD). Therefore, the value creation logic follows that of a network. The users are customer administrators and potentially also users with guest access. But MD also mentions bottlenecks for the implementation of such ideas: The generated or promoted idea may not fit the corporate strategy which corresponds with Lee et al. (2015). Also, an idea in the customer idea system is captured and then a simultaneous and parallel user improvement and user evaluation follow. The primary technology is mediating, and the interactivity logic is simultaneous and parallel, therefore this system is a network.

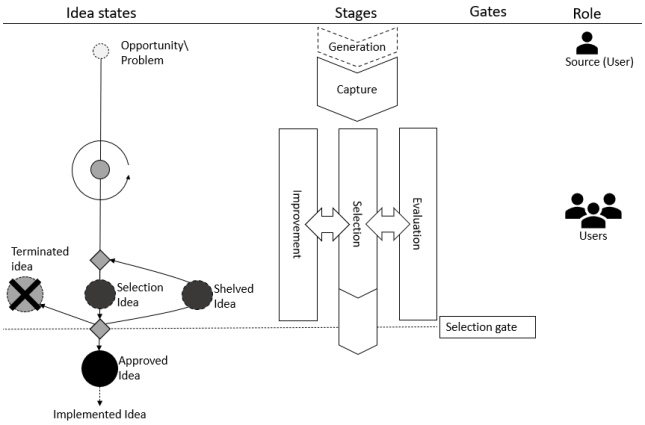

Figure 9: IMS Configuration of the External IMS

4.2.4 Consultant insights – Insights into overarching patterns of IMS

CF is an experienced consultant for companies using Projektron BCS. He has insights into companies from various industries and with a wide range of size and organizational context. He is also the customer consultant for SW and HA and consulted them during their

implementation process. AN is an experienced technical consultant and implements configurations for customers and implemented the IMS in the case of SW.

In addition to their insights into the implementations of IMS configurations, CF outlines two types of IMS configurations he commonly recommends: a simple system and a complex system: "*when I [consult a company] I first ask some questions: how is this done in the company currently and which information is required. Depending on this I decide what I present. When I see it is very complex, I present a ticket-based system, where show how [an idea management system based on that] can look like. And then I would how the simplest form, the standard-idea system which we have.*". He describes the simplest form as a system in which only capture, screening and selection take place in a sequential process. This indicates that the simple system is based on a chain-logic. The complex system includes all stages, and the idea is developed cyclically. He points out the importance of a communication log which enables the communication between evaluators, improvers and the source in an intensive process which solves the problem underlying the idea. This indicates that the complex system is a shop. The next chapters, compare the two systems CF outlines with the previous approaches.

4.2.5 Configurations corresponding with each IMS

The analysis of the interviews outlined above, identified the configurations of the corresponding IMSs. In some cases, two configurations were identified. The configuration mentioned first is the primary configuration.

Table 9: Configurations of each IMS

Interviewee	EG	EU		RF	MD		CF	
Organization	SW	HA		Projektron			Consultant	
IMS configuration name	SW1	HA1	HA2	PR1	PR1	PR2	Simple	Complex
Configuration	**Chain**/Shop	Chain	Shop	**Shop**/chain	**Shop**/chain	Network	Chain	Shop

4.3 Stages in the IMS Configurations

IMSs consist of stages which process sequentially, cyclically, or parallel. The literature review previously identified these stages, and they are further investigated in relation to the configuration of the IMS in this chapter. The following subchapters outline in detail which concepts the analysis identified and relates them to the configuration logics of each IMS instance.

Based on the analysis this study confirms the existence of all five stages indicated by theory. Table 10 shows the stages of the IMS configurations in the organizations. An exception is the interview with CF who provided knowledge based on his experience as a consultant for multiple organizations and outlined two distinct approaches – a simple and a complex system.

Table 10 shows the stages identified with grey indication in the cell. A light grey cell indicates that some of the relationships of concepts were present and the stage is conducted at partially. A dark grey cell indicates the presence of most or all concepts.

Table 10: Stages present in each IMS Configuration

Interviewee	EG	EU		RF	MD		CF		Sum
Organization	SW	HA		Projektron			Consultant		(out of 8)
IMS configuration name	SW1	HA1	HA2	PR1	PR1	PR2	Simple	Complex	
Capture									8
Screening									6
Improvement									7
Evaluation									6
Selection									8
Configuration	Chain/Shop	Chain	Shop	Chain/Shop	Chain/Shop	Network	Chain	Shop	

Legend:

	Core concepts related to the stage are not present
	Some of the core concepts related to the Stage are present
	Most or all of the core concepts related to the Stage are present

Each of the IMSs has a capture stage. In all IMSs but the network configuration the organization conducts a screening stage. This study did not identify a screening stage in the interview with RF either, but a triangulation of information indicates that a screening stage is present but not observed by RF. Furthermore observe chain configurations only showcase partial screening stages. The difference is rooted in the configuration which is further analyzed in 4.3.2. An improvement stage on the other hand is also present in most of the IMS's but the lower intensity in the case of IMS-HA1 and the absence of such a stage in the simple system (CF) indicates that the improvement is not an integral part of a chain configuration. This study proposes that the same is true for the evaluation stage which in both cases (simple system, HA1) was not identified. An evaluation stage as well as the improvement stage are an integral part in any shop or chain/shop configuration. Lastly, the Selection stage is present in all IMSs and appear as a requirement in an IMS.

No previously unknown stages emerged from the interviews but the structure of some of the stages differed from what is expected from theory. Firstly, EG outlines a capture stage which is integrated with a screening stage. Secondly, EU in her description of the idea system outlines a combined capture and improvement stage as well as a combined screening and selection stage. This indicates that components of one stage can be transplanted into another stage if the relational logic between the transplanted components stays intact. The subchapters regarding the respective stage discuss the combined stages (4.3.2-4.3.3). Overall, an IMS consists of a combination of the five stages. From these insights, the following insights are important for the configuration of an IMS:

- An IMS must include a Capture and a Selection stage.
- The interdependence of Screening, Improvement, & Evaluation depends on the IMS.
- In a shop configuration, the Evaluation and Improvement stages are present.

4.3.1 Capture Stage

Based on the interviews all five concepts related to the capture stage are identified (Table 11). All interviewees agree that at the beginning of the processing of ideas stands the capture of ideas by the source. This study identified the sources internal employees (EG, EU, RF, CF), internal experts (HA1, PR1), or customers (PR2). MD, EG, & EU indicate that source characteristics have an impact on the idea quality & Information quality. Appelman & Sundar (2016) confirm this. The IMS should therefore record the source of the idea. This also enables later attribution of the idea to the source for compensation (EU).

Table 11: Concepts related to the Capture Stage

Interviewee	EG	EU		RF	MD		CF		Sum (out of 8)
Organization	SW	HA		Projektron			Consultant		
IMS configuration name	SW1	HA1	HA2	PR1	PR1	PR2	Simple	Complex	
Idea Capture									8
Source									8
Interface									8
Tacit Idea									3
Knowledge Structure									8
Emerging Concepts									
Idea type									5
Configuration	**Shop**/chain	Chain	Shop	**Shop**/chain	**Shop**/chain	Network	Chain	Shop	

All interviewees mention that the source submits an idea in an IMS interface through a form – either in Projektron BCS or analog. Thus, sources record text-based descriptions, characteristics, and the situation. These characteristics corresponds with the idea's knowledge structure. In some cases, the source also selects an idea type (EG, EU, MD). Based on the theory this study assumed that the screener identifies the type in the subsequent stage. But for the interviewees an early collection of this information enables easier processing. In addition, the information about the idea type enables automated processing of ideas (CF).

Three interviewees describe a tacit idea in the source's mind (EG, RF, MD). But the tacit form of the idea is not clearly outlined in any interview and interviewees did not reach a consensus and more research is needed to clarify this concept. In summary, only the knowledge structure and source of the idea are the input for the capture stage.

Based on the observations, the capture stage is nearly identical in all configurations. The only observable difference is that shop configurations focus on the capture of the underlying problem or situation: the idea presentation (cf. 3.2.2). Stabell & Fjeldstad (1998) state that a shop includes the problem-finding and acquisition, therefore this is confirmed in theory. Based on these identified insights and relationships this study proposes the configuration framework of the capture stage in figure 10 and the following findings:

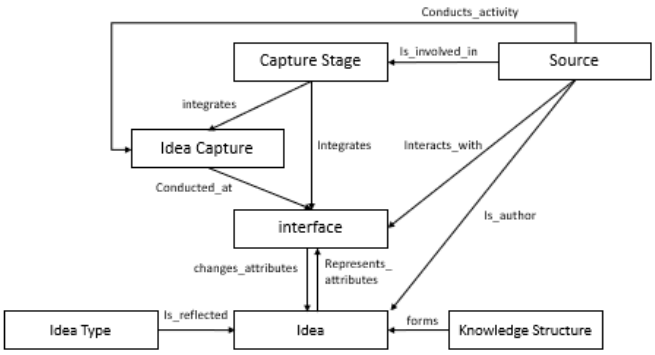

Figure 10: Conceptual Framework of the Capture Stage

- The capture stage is standardized for chain, shop, and network configurations.
- In a shop configuration the idea presentation dimension must be captured.

4.3.2 Screening Stage

Table 12 shows that opposed to the capture stage, the screening stage is not standardized across different configurations and can include different components.

Table 12: Concepts related to the Screening Stage

Interviewee	EG	EU		RF	MD		CF		
Organization	SW	HA			Projektron		Consultant		Sum (out
IMS configuration name	SW1	HA1	HA2	PR1	PR1	PR2	Simple	Complex	of 8)
Screening	■	■	■		■			■	5
Screener	■	■	■		■			■	5
Processing decision	■	■	■		■		■	■	6
Quality of Information		■	■		■			■	4
Quality			■		■			■	3
Type			■		■		■	■	4
Emerging Concepts									
Communication log		■	■	■					3
Interface	■	■	■		■			■	5
Configuration	**Chain**/Shop	Chain	Shop	**Shop**/chain	**Shop**/chain	Network	Chain	Shop	

The absence of the screening stage in the case of customer ideas (MD) – a network configuration – is consistent with theory. Previous research into open innovation models and network idea processing did not mention a screening stage (i.e., Björk & Magnusson, 2009; Du Preez & Louw, 2008; West & Bogers, 2014). It can be concluded that for configurations following a network-logic there is no distinct screening stage.

RF also did not mention screening stage related concepts. This may indicate that also in shop configurations a screening stage is not always necessary. But the second perspective on the same IMS (MD-PR1) indicates that a screening stage is present which secondary data confirmed. Therefore, MD's description of the screening stage is considered predominantly.

This study therefore focuses on the 6 remaining IMSs for the further analysis. Based on the literature (e.g., Froehlich et al., 2016; Gilson & Lichtfield, 2017; Martinsuo & Poskela, 2011) a screening stage is the preselection and includes a processing decision conducted by a screener. Based on this a screening stage can be identified in all interviews. The lower number of total mentions for other concepts does therefore not imply the absence of a screening stage. It also does not indicate a lower significance of the concept for the screening stage in general. The data shows that the concepts and their related screening-stage components are only present in certain configurations: E.g., interviewees only mentioned the concept quality 3 times (EU, MD, CF) but each time it is mentioned in for shop configurations. The same is true for the concepts information quality and type which interviewees mention 4 times each. Of these, 3 out of 4 are shop configuration. Therefore, depending on the configuration of the IMS also the structure of the screening stage changes and there arehree options: Firstly, the screener identifies and assesses the idea type (EU HA1, MD PR1, CF). Secondly, the screener assesses the idea's information quality (EU, MD PR1, CF complex). Lastly, the screener assesses the idea quality (EU HA2, MD PL1, CF complex). These correspond with the reflective constructs of the idea (cf. 3.2.6). A combination of multiple operations is possible. It is visible that all shop configurations include complete screening stages with all components.

Two special cases are present for chain configurations: EG describes a screening stage in which the source makes the processing decision whereas EU describes that they conduct the screening in combination with the selection. Ideas which do not fulfill the quality of information standards are subject to improvement and others are subject to selection. The chain configuration CF describes also has a unique structure: he indicates that to increase usability and efficiency there is no screening, but the IMS conducts the processing decision automatically. This is underlined by the absence of a screener and interface. From this follows that chain configurations have integrated or automated screening stages to increase efficiency.

In the interviews an additional concept emerged: the interface. At the interface, the screener observes the idea presented to him and conducts the screening (MD, EU). The screener also interacts with the interface to make a processing decision (CF, MD, EU, EG). CF describes this in the following quote regarding the screening: "*There is often the requirement that the idea type can be provided in the interface through a classifier. And, depending on the idea type, it […] an evaluator could be defined here*". Figure 11 represents the framework based on the analysis. It outlines a complete screening stage as it is present for shop configurations. The following propositions follow from this analysis:

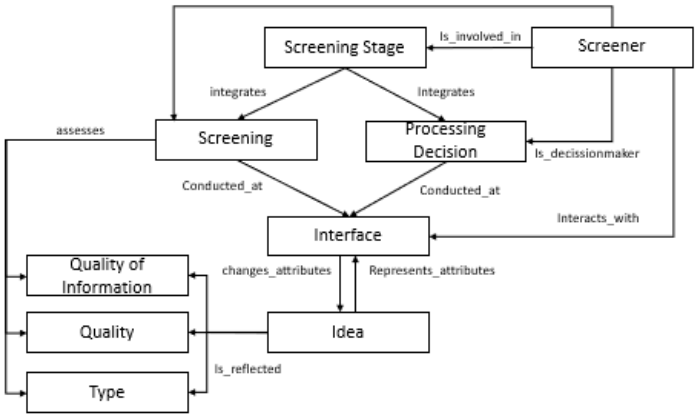

Figure 11: Configuration of a Screening Stage

- A Network configuration does not include a screening stage.
- A screening stage is defined by a processing decision.
- In chain configurations, the screening stage is automated or integrated with other stages.

4.3.3 Improvement Stage

In the improvement stage, the improver modifies the knowledge structure of the idea with the aim to improve its quality or the information quality. All but one IMS configurations have an improvement stage, but they vary in their usage of methods and object of improvement activities. This study identified 3 methods which are used alone or in combination. Firstly, The improver most commonly uses information acquisition which is utilized in all improvement stages (see table 12.). EG outlines

Table 13: Components related to the Improvement Stage

Interviewee	EG	EU		RF	MD		CF		Sum (out of 8)
Organization	SW	HA			Projektron		Consultant		
IMS configuration name	SW1	HA1	HA2	PR1	PR1	PR2	Simple	Complex	
Information acquisition	■	■	■	■	■	■		■	7
Object identification	■								4
Integrity constraint	■								2
Improver	■	■	■	■	■	■		■	7
Quality of Information	■	■	■	■	■	■		■	7
Quality	■								4
Knowledge structure	■	■	■	■	■	■		■	7
Emerging Concepts									
Communication log	■	■	■	■				■	5
Specialist	■				■				3
Source	■	■	■	■				■	6
Interface	■	■							3
Configuration	**Chain**/Shop	Chain	Shop	**Shop**/chain	**Shop**/chain	Network	Chain	Shop	

that specialized market analysist provide detailed quantitative information about the idea. Based on the information acquisition also the concept of a communication log emerged: "*with a communication log and the ability to send requests […] one can ask questions and say 'yes, it is a good idea, but these items are still missing*" (CF). He explains that it increases usability, represents the communication flow, and may also include reasonings for decisions made. This is a viewpoint shared by EU, EG and RF. Secondly, the improver can use object identification and identify similar ideas or projects which indicates information about the target idea (MD, EU, EG) and enables the emergence of novel combinations of the ideas (CF). Lastly, an IMS can include integrity constraints such as quality standards (Samset & Volden, 2015) as is the case at SW where multiple factors such as 'number of google searches' or 'number of customer requests' exist that need to be provided correctly. This indicates that quality constraints can be applied in the case of quantitative information about the idea.

The identity of the improver depends on the configuration of the IMS. In 3 configurations it is specialists who improve the idea. Surprisingly, the source conducts the improvement in all IMS configurations. This indicates that the source is primarily the improver and is supported by specialists if its knowledge is not sufficient for the operation.

The comparison of the cases indicates that improvers in all configurations prefer information acquisition. In shops the method object identification is utilized additionally. An explanation for this is that the more intense problem-solving activities lead to the application of the more resource- and time intensive object identification.

Based on these insights and the relational coding the following propositions and framework are developed (figure. 13). The concepts 'source' and 'specialist' are not included because they are instances of 'improver'. The coding shows that the 'communication log' reflects the idea. It is therefore considered an additional construct of the idea.

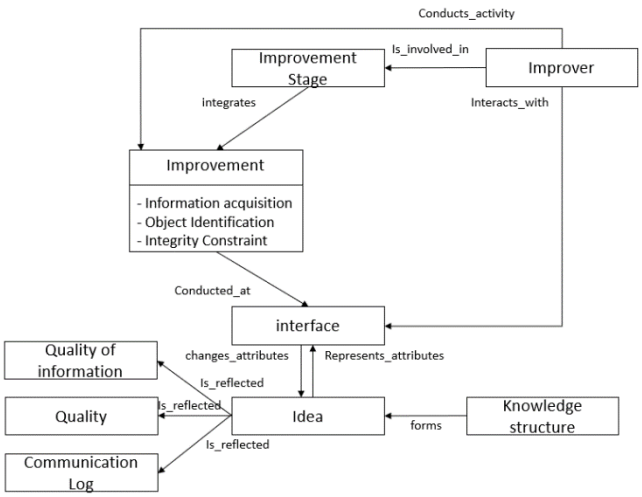

Figure 12: Configuration of the Improvement Stage

- The improvement stage integrates information acquisition and object identification.
- The idea source can be the improver.
- A specialist can be the improver if the source's knowledge is not sufficient.
- A communication log increases usability in the improvement stage.

4.3.4 Evaluation Stage

In six of eight IMSs this study observed an evaluation stage (see table 14). The exceptions are EU who outlines that their selection is not based on specific criteria and none are evaluated. And RF, who explains: "*what I did not use yet, because for most ideas I had it was not necessary, was an evaluation. […]*". This nevertheless means that an evaluation stage can be present.

Table 14: Concepts related to the Evaluation Stage

Interviewee	EG	EU		RF	MD		CF		Sum (out of 8)
Organization	SW	HA			Projektron		Consultant		
IMS configuration name	SW1	HA1	HA2	PR1	PR1	PR2	Simple	Complex	
Evaluator	■		■		■	■	■	■	6
Evaluation Method	■		■		■	■	■	■	6
Quality	■		■		■	■	■	■	6
Evaluation Criteria	■		■		■	■	■	■	6
Presentation	■				■			■	3
Portfolio	■				■			■	3
Governance	■								1
Emerging Concepts									
Interface	■				■		■	■	4
Configuration	**Chain**/Shop	Chain	Shop	**Shop**/chain	**Shop**/chain	Network	Chain	Shop	

The concept presentation as a core component is rejected because in the interviews it emerged that the presentation is the idea represented in the interface of the IMS. The concept is therefore replaced by the concept 'interface' which showed a higher number of mentions.

In taking a closer look at figure x. one can deduce that the concepts 'Evaluator', 'Evaluation Method' and 'Quality' are present in all relevant IMS configurations. These are the components necessary to conduct an evaluation stage.

EG and EU specify that the evaluator is an expert. MD describes that the evaluator for internal ideas is the source which he assumes is an expert or experienced. For customer ideas on the other hand MD outlines that customers evaluate each other's ideas.

The evaluation methods used vary from organization to organization. EG describes the use of multi-criteria analysis including criteria for significance and customer interest. Based on this Stiftung Warentest conducts a portfolio analysis in a discussion comparing different ideas according to these criteria. EU describes a viability analysis as well as a cost-benefit analysis to evaluate the value of the idea. MD also mentions a cost-benefit analysis for PR1, but he adds that a viability analysis or even an impact assessment are beneficial. He also mentions that evaluators compare ideas regarding resource usage and opportunity costs which relate to the portfolio analysis. Customer ideas are rated intuitively by the user or evaluated on the base of a multi-criteria analysis. Lastly, CF argues for the use of multi-criteria analysis or checklists which were also mentioned by RF. IMS's employ each of the methods except the scenario analysis and the risk-opportunity analysis which are too resource intensive. According to the interviews these methods deliver good results for the evaluation of the quality of an idea. Which method is suitable for an organization depends on the organizational context (cf. Appendix F).

CF for example describes SW's evaluation interface and presentation as the same concept when he outlines that the interface is configured to represent a Kanban board for idea evaluations.

The concept portfolio is also rejected because the portfolio analysis is part of the evaluation method and the portfolio is presented in the interface. It is therefore a subcategory of evaluation method and interface, respectively.

The following framewok is based on these insights and the relational coding (figure 14).

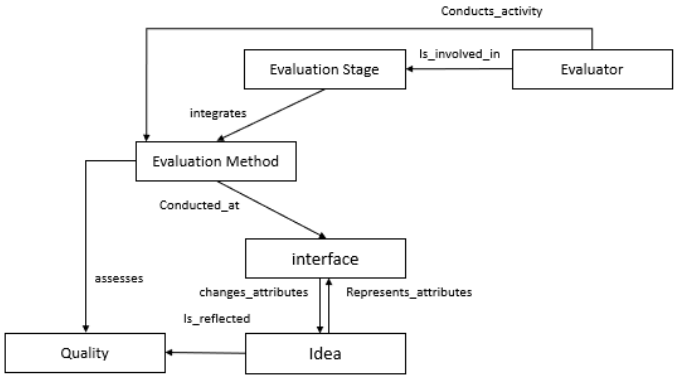

Figure 13: Configuration of the Evaluation Stage

4.3.5 Selection Stage

In literature (i.e., Gerlach & Brem, 2017) the selection stage is integrated with the evaluation stage. But the interviews showed that the selection stage is a separate stage which different persons conduct. The decision maker, as MD explains, should only receive ideas once they are fully processed. At this point he decides whether the idea is approved, terminated, further improved, or shelved. If an Idea is approved, it becomes a new project proposal (EG, EU, MD, CF) or it is integrated into an existing project (EU). Each of the selection stages therefore shows its relation to the formation of a project.

Table 15: Concepts related to the Selection Stage

Interviewee	EG	EU		RF	MD		CF		Sum (out of 8)
Organization	SW	HA		Projektron			Consultant		
IMS configuration name	SW1	HA1	HA2	PR1	PR1	PR2	Simple	Complex	
Decision Maker									8
Selection gate									8
Project									8
Decision Method									1
Emerging Concepts									
Interface									5
Feedback									5
Presentation									5
Configuration	**Chain**/Shop	Chain	Shop	**Shop**/chain	**Shop**/chain	Network	Chain	Shop	

All interviewees mention the decision maker and the selection gate. The decision maker is the CEO (EU, MD) or a group of decision makers in a discussion (EG) where the chief editors share the decision-making role and utilize a discussion as a method. RF & CF mentioned a decision maker but did not specify their identity.

The concept 'decision method' was only described by EG. In SW multiple decision makers conduct the decision based on a discussion from which the approved ideas emerge. In the other IMS configurations the decision maker appears to not conduct the decision using a specified decision method. Therefore, opposed to recommendations from theory, the decision maker does not follow a formalized decision-making approach (Martinsuo & Poskela, 2011) but utilizes an informal approach. Nevertheless, the decision maker uses rational decision-making because they base their choice on the evaluation analysis (Abubakar, Elrehail, Alatailat, & Elci, 2019). MD for example analyzes presented ideas, prioritizes them according to their benefit

and resource requirements and makes use of the available information. This implies that IMS presents the idea in the interface in form of a portfolio.

The presentation is a concept which emerged in the interviews with EU, MD, and CF. This is also confirmed by findings in literature which outline that the presentation of the knowledge has a direct impact on the selection (Lamberti & Wallace, 1990). Lamberti & Wallace (1990) recommend the use of abstract and conceptual representations. This is for example the case for the Portfolio approach which both EU and MD describe. The second concept which emerged from the interviews is feedback. RF for example points out the importance of receiving written feedback about his ideas whether they are rejected or approved. This is supported by theory where Zhu et al. (2018) explain that feedback is a knowledge exchange process which also benefits the source. In addition, reward and recognition are important factors to motivate employees (EU; Van Dijk & van den Ende, 2002) Lastly, the interface is mentioned by EG, RF, and CF. This supports findings from previous stages regarding the presence of the interface mediating between the idea and IMS.

This study identified a selection stage in all IMS configurations based on the presence of a decision maker and a selection gate. This stage does not have observable differences for different configuration-logics. The configuration of the selection stage is dependent on the decision maker's requirements. This study indicates that a portfolio is useful if resources required for idea implementation are scarce (MD, EG). Feedback appears as an important part of the selection (EG, EU, RF). A reward structure for ideas appears only relevant if decision makers can assign a monetary value to ideas (EU).

The following framework in figure 14 is based on this. The presentation and the feedback have a reflective relationship with the idea because they represent attributes and insights about the idea.

- The presentation reflects the idea
- The presentation represents the idea to the decision maker in the interface.
- After the decision is made, a feedback is authored by the decision maker.

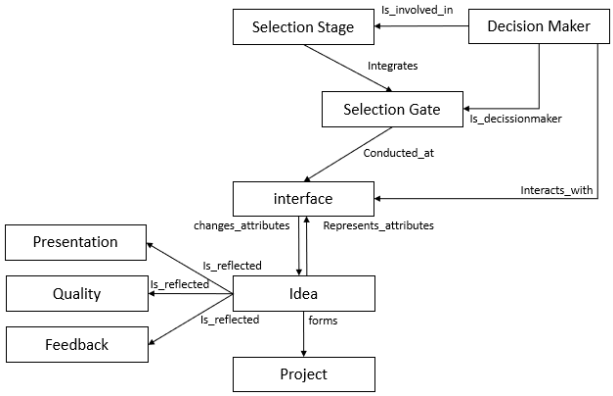

Figure 14: Configuration of the Selection Stage

- A portfolio benefits the selection if resources required for implementation are scarce.

4.4 The IMS Framework

In the previous chapters this study first introduced a framework of an idea and then outlined frameworks of each idea processing stage and their interactions with the idea. Based on the identified concepts and their relationships, a framework representing a configurable IMS and the idea within it are developed. This framework is based on both the analysis of literature in a grounded theory literature review and the analysis of the qualitative data collected from interviews. The framework is based on the following propositions based on previous chapters:

- The IMS and its configuration stands at the core of the IM of an organization. The configuration defines which attributes the classes have. The configuration is suitable for the organizational context and for the ideas which are processed (cf. 3.4). The following chapter 5.5 discusses this.
- This study identifies two types of operations. Activities which are conducted by a role to processes information. And gates at which a person with a role is a decisionmaker. Combinations of one or multiple activities and gates are possible (cf. 3.3, 5.3).
- A role is a set of functional responsibilities which an agent holds (Curtis, Kellner, & Over, 1992). In the IMS a role conducts the activity or is the decision maker at a gate. An individual can hold multiple roles and multiple persons can hold a role (cf. 3.3., 5.3)
- The activity and gate are each conducted by the role at the interface. The interface represents the activity and gate and offers interaction possibilities for the role (cf. 5.3)
- The interface represents and initiates change of the idea's attributes. The idea is based on the idea framework (cf. 3.2, 5.1)
- Opposed to the initial models of the framework, the stages do not have defined inputs and outputs. An object-centric approach on the IMS makes the idea the input and output of each stage and operations and decisions are conducted by changing the attributes of the object. This object-centered approach can represent simultaneous or cyclical configuration logics in the shop or network (cf. 3.4, 5.3, 5.5).

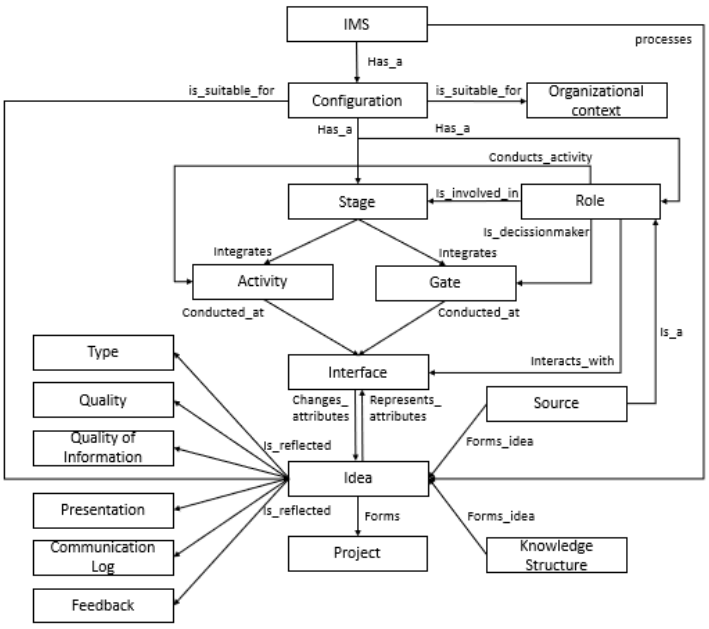

Figure 15: Framework of a configurable IMS

This framework has a high level of abstraction and shows core concepts which are valid for any of the observed IMS configurations. The author ensures the validity of this framework in two ways: firstly, the framework is iteratively developed by using it to describe the IMS configurations and identify missing or irrelevant concepts and relationships. The missing links and relationships are then tested and compared across the cases and if confirmed implemented them in the framework. Secondly, the framework is applied to an additional case: an industrial multinational corporation seated in Switzerland. Projektron GmbH provided secondary data about a conceptual IMS solution based on Projektron BCS that they developed for this company. MD provided insights into the case and secondary data in the form of presentations and reports created during the development phase of the IMS. This case also confirmed the concepts in the framework and their relationships.

4.5 Configurations of an IMS

Based on theory this study suggested that an IMS follows three generic configuration logics based on Stabell & Fjeldstad's (1998) value configurations logics (cf. 3.4). These are the chain, shop, and network. An idea processing chain is a long-linked process in which the IMS processes the idea and creates a project proposal or project. In an idea processing shop the IMS processes the idea through a mobilization of resources and conduction of activities which process and develop the idea into a refined idea which can be turned into a project proposal or a project. Lastly, the idea processing network facilitates the relationships between individuals who work together to process and develop ideas with the help of a mediating technology.

This study explores the characteristics of the stages through a grounded theory literature review (cf. 3.4) and the analysis of eight IMS configurations through the analysis of data collected through semi-structured interviews (cf. 5.2). Table 16 summarizes the main difference of the configurations. As previously outlined (cf. 3.4, 5.2, 5.3) these configurations differ in the technology employed, the primary stages and their relationship logic. Also, the primary activities and gates differ as well as the roles and the required characteristics of the roles as outlined in the stage configurations (cf. 5.3).

This study found that each configuration excels at the management of different ideas and offers unique value drivers. For example, an organization that employs a chain assumes that quality ideas are provided by employees which can be turned into projects if they are useful. This requires an input of refined ideas which do not require improvement to reach the quality standard. This system aims at efficiently processing ideas and creating a stable flow of ideas suited toward the organizations capacity for projects. The logic underlying the shop on

the other hand assumes that every idea has a problem or opportunity as its foundation through which it offers value if solved or exploited. A shop enables the processing of a variety of ideas and ensures that a complex idea, its quality, and underlying problem is accurately and comprehensively understood and tested and promising ideas which do not fulfil the requirements are improved to reach the quality standards. Lastly, based on the underlying logic that users have unique insights and are functionally distinctive, an organization can choose to link users who work together to create and improve novel combinations of concepts in the form of ideas. The value driver is the linkage of divers users whose interactions create valuable ideas.

Table 16: Configurations of an IMS

	Idea Processing Chain	Idea Processing Shop	Idea Processing Network
Idea processing logic	Transformation of ideas into projects	Improving ideas to solve problems	Linking users
IMS technology	Long-linked	Intensive	Mediating
Primary stages	• Capture • Selection	• Capture • Screening • Evaluation • Improvement • Selection	• Capture • Improvement • Evaluation • Selection
Main stages relationship logic	• Sequential	• Cyclical	• Simultaneous
Primary activities	• Idea capture	• Idea capture • Idea screening • Idea improvement • Idea evaluation	• Idea capture • Idea improvement • Idea evaluation
Primary gates	• Selection Gate	• Screening Gate • Selection Gate • Evaluation Gate	• Selection Gate
Source Characteristic	Expert		User
Evaluator/ Improver Characteristic	-	Expert	User
Decision Maker characteristic	Management Level	Management Level	Aggregated Users
Idea Characteristic	Refined	• Complex • Unrefined	• User ideas
Value drivers	System Efficiency & Capacity utilization	Idea Quality (-improvement)	User interactions

Every organization has different requirements of their IMS and therefore requires a different configuration. As shown previously, the configuration of an IMS depends on the types of ideas processed and the organizational context. An organization can have the goal to collect refined ideas regarding a small variety of topics from internal sources and transform them into projects.

It would employ a chain and profit from resource efficient and quick processing of ideas because neither improvement nor a classification and differentiated processing of ideas is needed. A second organization collects ideas varying in type, quality, and complexity and requires testing or processing by experts because the idea and its proposed solution to a problem or opportunity are not understood easily. This organization profits from a cyclical process which ensures a quality standard for processed ideas and increases the probability of success. Another organization aims to improve its innovative capabilities by opening their innovation process and values insights of users on its products or services. This organization utilized a network-logic and relies on its userbase to generate, improve, and select quality ideas and focuses its resources on network promotion and infrastructure operation.

A IMS therefore has to offer three distinct presets from which an organization can choose. The organization can customize their IMS in more detail by configuring each stage individually. Because the framework above enables choice of one of three standard configurations but also the detailed configuration on a stage level (cf. 5.3, 5.4) it provides additional value for companies who aim to develop or improve their IMS and IM capabilities.

4.6 The Projektron BCS IMS Configuration

With the insights above as a foundation this study proposes that a configurable IMS in the front-end of PM must fulfil four requirements. If fulfilled, the IMS can be applied by different organization for the processing and identification of quality ideas. Therefore, these propositions are the base for the prospective configurable IMS in the front-end of PM in Projektron BCS:

- The object ‘idea’ in Projektron BCS represents all attributes of the idea framework (cf. 5.1).
- The Projektron BCS IMS represents all identified stages (cf. 3.3, 5.3).
- An administrator can configure the Projektron BCS IMS on the stage-level to customize activities, gates, roles, and interface of each stage (cf. 3.3, 5.3).
- The Projektron BCS IMS can be configured as a chain, shop, and network (cf. 3.4, 5.5).
- The Projektron BCS IMS can be represented by the IMS Framework (cf. 5.4)

The author designed the conceptual user interfaces and object-logic based on these requirements and the insights from theory and interviews iteratively and consistent with Projektron BCS. Throughout the design process multiple rounds of feedback with the Chief Product Owner of Projektron BCS MD and the responsible person for GUI topics LA ensured validity of the proposed IMS and ensure its fit within Projektron BCS. The key findings are presented here (see Appendix L-S for extended description of functionalities).

4.6.1 The Idea in Projektron BCS

To enable the use of ideas in an IMS, a type ‘idea’ is necessary (cf. Appendix M – Data structure of object types in Projektron BCS). The type ‘idea’ has attributes which represent the characteristics that form the idea. This is for example the source ‘[A] Provider of idea’ or an attribute relating to the knowledge structure such as the situation in which the idea occurred ‘[A] Situation’ ([A] indicates an attribute). In addition, it has attributes which represent the idea such as ‘[A] Quality’. Custom attributes can be added by an administrator and labels of attributes can be adjusted to change the representation of the attribute in the interface.

Fig. 16 presents a conceptual data structure of the Idea in Projektron BCS. It includes previously mentioned attributes regarding knowledge structure and source but also preliminary attributes representing type, quality, quality of information, communication log, and feedback. It also shows the type ‘[T] Relation’ to illustrate how subtypes of the relation such as ‘[S] Relation (Related Idea)’ enable the linking of different ideas ([T] indicates a type and [S] indicates a subtype). Some of the attributes outlined here are represented in the interface of Projektron BCS and can be edited by the user. Other attributes describing the idea metadata such as object-ID or a change log are also available and are updated automatically.

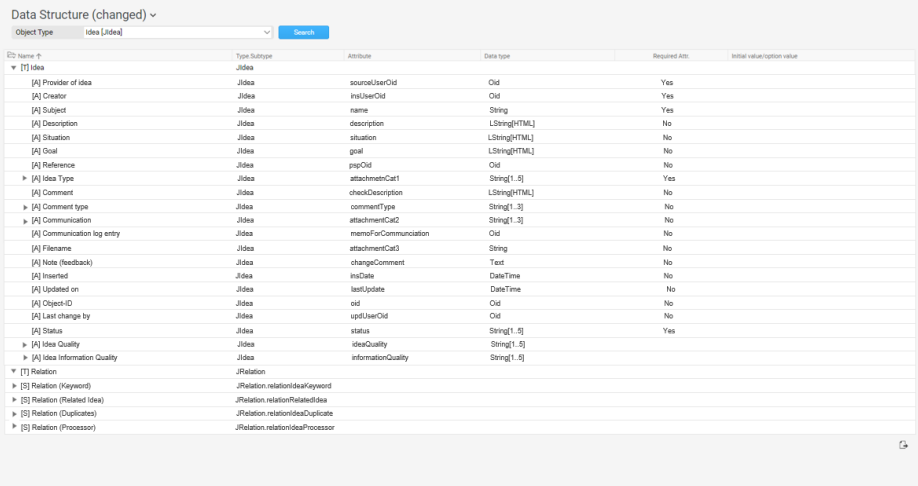

Figure 16: Conceptual Data structure of the Object 'Idea' in Projektron BCS

4.6.2 Presentation of IMS Framework Components in Projektron BCS

Projektron BCS’ user interface presents information to the user (role) in each stage as an object view. It represents attributes of the idea and a user can interact with it to change the attributes. The user can change attributes in selection menus or through methods that result in a change of the underlying attributes. Gates present a processing choice or results subsequently initiate a follow-up stage by changing the attribute ‘state’. In the following this study presents an example for each concept and provides a full conceptual presentation of each stage in the Appendix O - S.

First, this study presents the object view during the capture stage which represents the activity of capture by a source (role). It also represents how a user can change idea attributes. The source can submit the idea in a form in Projektron BCS (fig. 17) or in the mobile version of the software. As outlined in 5.3.1 the capture stage is consistent across configurations. The source creates the idea by outlining the knowledge structure in the fields subject (1), description (2) which is based on a rich text editor and with a file upload, thus enabling the provision of additional files and documents (3). The interviews have shown that properties such as the idea type and keywords are useful to enter at this stage already to provide information about idea characteristics (4). This study uncovered that it is useful to provide information about the context of the idea especially if it relates to an existing product or project or has certain stakeholders (5). It also found prove for situations in which more than one person are the source or the source does not enter the idea themselves. Therefore, a separate field allows for the adjustment of the source (5). The idea presentation is completed with a description of the idea's situation (6) and the ideas intended change (7). This stage can be customized by disabling fields or creating new attributes. In Projektron BCS the user roles define who can view and edit

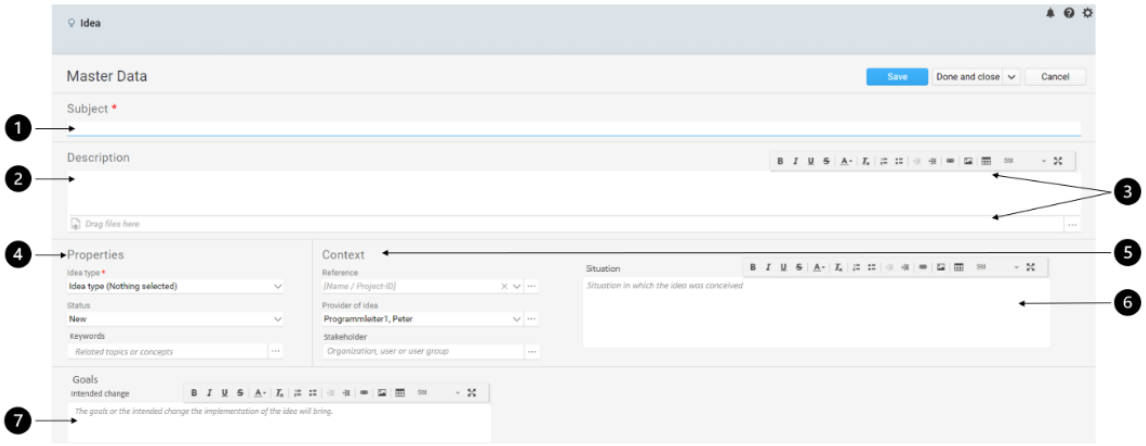

Figure 17: Capture Stage in Projektron BCS

Objects. The organization decides who can submit ideas by assigning the user role 'Idea source' to limited user groups, to all users, or to customers with system access.

The second user interface presented is the screening stage which illustrates a processing decision as a gate and represents idea characteristics such as information quality, quality, and type (Figure 18). The representation of the attributes is screened by the screener who observes the information entered previously during the capture stage in an idea profile representing the knowledge structure (1). The previous results indicated that processing decisions can be based on the idea type. This is represented in the properties (2). If the type or keywords are incorrect, the screener can also change them to ensure correct processing. An automation based on the keywords or idea type is possible: the screener (2) can automatically be selected based on these

attributes or in a configuration of the system, these attributes can serve as a screening stage and indicate the further processing (cf. 5.3.2). This study showed that also the source has a

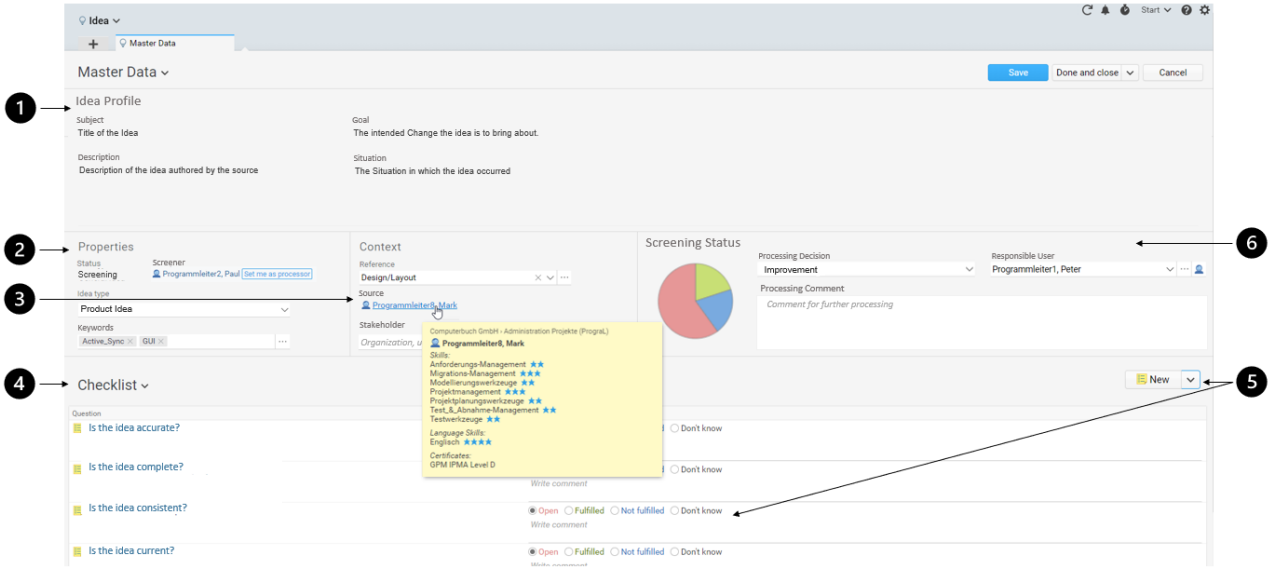

Figure 18: Screening Stage in the Projektron BCS IMS

formative influence on the idea (cf. 3.2.1, 5.3.1) and source characteristics can indicate information about the ideas such as information quality and therefore influence processing decisions. Therefore, the source characteristics are presented in the context (3). The screener conducts a screening through the analysis of the information quality. A method used for this can be the checklist based on Batini & Scannapieco's indicators of information quality (2016) (4). Based on all attributes the screener conducts a processing decision (6) and sets the further development path by selecting a follow-up stage and responsible user, and by providing information about the development path of the idea in the comment or adding additional checklist points which need to be fulfilled and supplementing these with comments (5).

The application of a method is showcased by an example of the evaluation stage. Each organization utilized different evaluation methods. The organization can choose from 11

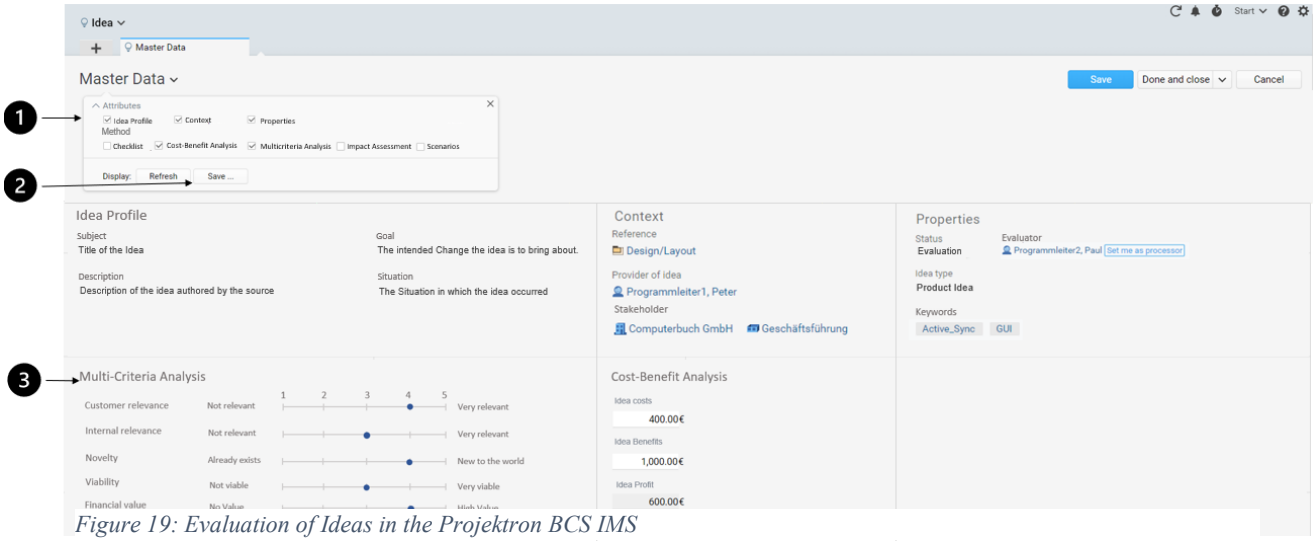

Figure 19: Evaluation of Ideas in the Projektron BCS IMS

methods (cf. 3.3.4, 5.3.4). The selection of the method takes place in object view presets (1). Additional methods can be custom build by Projektron GmbH and the methods can be customized by changing labels for example for the criteria of the multi-criteria analysis.

An Organizations chooses the Methods it utilizes, and an Administrator can set these methods as a default (2). The method is represented as a block in the object view of the idea (3). This study additionally presents methods for aggregate evaluations by multiple users in network configurations and comparative analysis of multiple ideas in Appendix R. These evaluation methods are a list form to enable the comparison between objects.

4.6.3 IMS configurations in Projektron BCS

An organization can configure their IMS in Projektron BCS depending on their requirements as a chain, shop, or network. As outlined above, the capture and selection stages are consistent across configurations and serve as the inbound and outbound logistics. Therefore, they are based on the configuration of a sequential chain. The primary activities in between follow the configuration logic of a chain, shop, or network. It enables the support of multiple configurations through a flexible framework for processing ideas. Each configuration consists of a present which is activated by the administrator and can be customized on a stage level to account for different roles, activities, and gates. The IMS configuration is presented on the customizable idea board. The organization can choose presets for the idea board (1) and choose list view (enables comparison of ideas), keyword views (grouping of ideas), file views or settings. The board represents the relevant stages of the configuration and the results in the

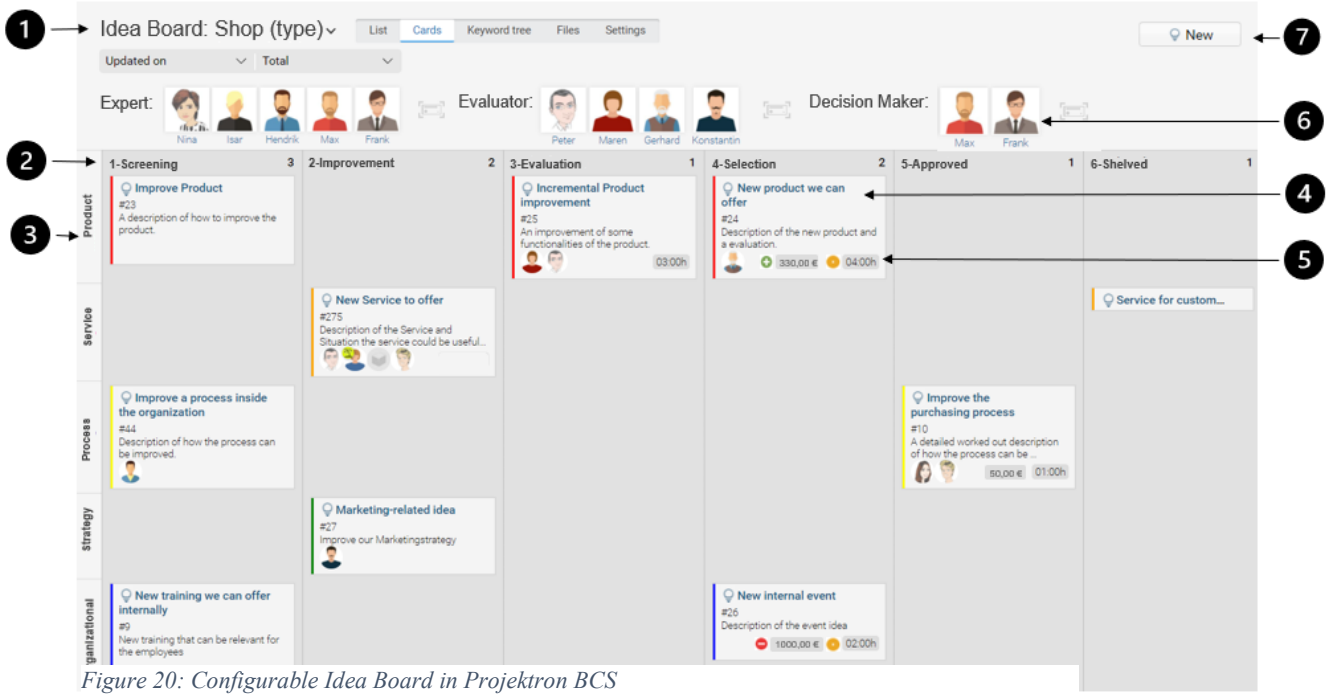

Figure 20: Configurable Idea Board in Projektron BCS

horizontal row (2) and the idea types in the vertical column (3). The stages, results, and types can be customized. An idea card with key information presents the idea (4) Key information is for example cost and resource requirements and the editor of the respective stage (5). The organization can customize the indicators in the settings and choose different indicators as for example ‘quality criteria’.

A user conducts an activity by clicking on the card. This opens the stage object view of idea in a new window (cf. 5.6.2). A user can move the idea between stages via drag-and-drop or by making decisions in the object view. This is restricted by state-rules defined in the settings. For a shop, commonly no rules apply whereas for a chain the exact process is defined. A user can assign a role to conduct the stage via drag-and-drop of the person icon (6) or in the object view. The user can also create a new idea which opens the capture stage (cf. 5.6.2). Each action results in changes of the ideas attributes. This view is user dependent. This means that depending on the permission settings a user can see and/or edit all ideas, ideas he is responsible for, or only his ideas.

Figure 21 shows the configuration settings. The administrator can customize the configuration preset by choosing the configurations chain, shop, or network or a saved custom configuration (1). The administrator set filters and can show them in the idea board for all users by clicking on the eye (2). The organization decides on the primary stages they use and can select and order them in the status field (3). The order decides for the order in the idea board. If a combination of stages is a requirement these must be customized by changing the label and adjusting the activities in the object view. An example for this is the improvement/evaluation stage in networks which combines activities from both stages. In addition, the administrator can customize the display of the idea card (4) and the user icons (5). He saves the edited preset (6) and a prompt opens where he chooses whether to save it for all users or for a selected user group (e.g. evaluators).

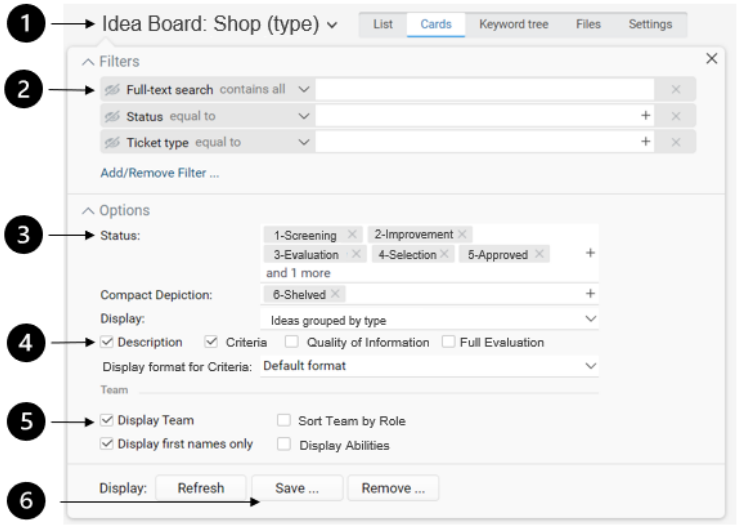

Figure 21: Configuration Settings in the Idea Board in Projektron BCS

Thus, Projektron BCS offers a flexible and customizable IMS solutions that can be adjusted to process and identify quality ideas depending on the organizational context and the type of ideas processed.

5. Discussion and Conclusions

5.1 Discussion

This study aimed to explore '*what configuration of an IMS enables the processing of project related ideas?*' with the goal to investigate how ideas can be captured, evaluated, and selected using a web based IMS and to develop a framework of an IMS. Several distinct approaches emerged which were defined as configurations: formal process-based approaches (e.g., Martinsuo & Poskela, 2011; Westerski et al, 2011), systemic approach focused on interrelated patterns in shops (e.g., Vandenbosch et al., 2006), and open network-based approaches (e.g., di Gangi & Wasko, 2008; Walsh et al., 2014). Each is relevant in a different context and takes a different viewpoint but also shares an underlying logic and a set of related concepts. This study also found supporting empirical evidence of these patterns in the three observed cases. By focusing on the underlying logic and the components of these configurations the gap between the different configurations is closed and a framework of IM as an IMS is created.

But the only way to ground such an approach is to start from a shared subject of all three approaches: the idea itself. Based on the literature this study builds a framework of an idea in an IMS and confirmed it in subsequent interviews. The results show two core constructs which form the idea: 'knowledge structure' and 'source'. In addition, it identifies five constructs which reflect the idea and may be used as indicators of the idea's characteristics: The constructs 'quality', 'information quality' and 'idea type' emerge from the literature, whereas the two constructs 'communication log' and 'idea feedback' are based on the insights from the interviews. This framework of an idea in an IMS serves as a guideline for its processing which takes place in any of the above-mentioned approaches. Based on the idea and interlinking of the idea with the steps of processing it different idea processing stages are identified. By applying insights from related fields such as PM-, innovation-, decision making-, knowledge management-, and information systems literature patterns appear resulting in five distinct stages throughout which the idea is processed: the capture-, screening-, improvement-, evaluation-, and selection stage. This study confirms these stages in the empirical world and furthermore uncovered the concepts that make up each stage. This enables me to identify such stages in different IMS configurations and helps analyze how stages may differ depending on the configuration and organization. Based on this, this study explores the configuration of each stage individually in different IMSs and organizations. My findings include the following:

This study shows that the capture stage follows the same logic in any configuration and confirms the related concepts and their relationship. The framework proposed is flexible

enough to encapsulate differences in the dimensions that describe the source (network position, trustworthiness, & expertise) and the presentation of the idea. But simultaneously it can describe the stage conceptually in any configuration.

This study develops a framework of the screening stage and shows how the screener can screen ideas and make processing decisions based on constructs reflecting the idea. This study confirms this in the empirical world and uncover differences between the configurations: namely that it is not part of network approaches and is automated or integrated in other stages in process-based chain approaches. This is the case because in the network approach there is no need for processing decisions because the idea is developed and evaluated simultaneously. Whereas in the chain processes these decisions are based on available attributes and indicate one previously defined standard path. Only a shop requires a complex analysis and decision making during a screening stage to ensure the correct processing and application of resources.

This study explores how an IMS helps improve ideas and outline three methods used for this based on an evolutionary perspective (Martins et al., 2015) of the idea and an information processing viewpoint (Batini & Scannapieco, 2016). This study connects this with the idea framework and show how organizations can use these different methods to increase information quality and idea quality. It furthermore proposes that the role improver may be filled by experts, the source, or various users simultaneously.

This study outlines how an IMS supports the evaluation stage in which the evaluator uses a method to assess the idea quality. It furthermore provides a list of possible methods which an organization can utilize. This is important because in some organizations a simple cost-benefit analysis may indicate the quality of an idea while for other organizations expert tests of the technological underpinnings of the idea are necessary.

Lastly, this study shows how a selection stage serves as the outbound logistics of an IMS at which a decision maker decides for approval (creation of a project or project proposal), termination, or shelfing of an idea. This stage provides further insight into reflective characteristics of the idea and how the ideas presentation influences the selection. In addition, this study identifies feedback by the decision maker as an integral part of this stage.

The results show that the identified stages follow a shared underlying logic and the concepts related to the stages can be grouped into classes thereby creating a framework of an overall IMS. This framework aims to represents all possible configurations of the system. In this framework the configuration of a firm IMS is suitable for processing specific idea types and it is suitable for the organizational context. A configuration consists of a set of stages which integrate activities and gates. The activity is conducted by a role who is involved in the stage.

A role also acts as the decision maker at the gate and interacts with the IMS interface at which both the activity and gate are conducted at. The interface represents the idea's attributes and changes in the idea's attributes are initiated from here. It is therefore the link to the above-mentioned framework of the idea. This study shows that this framework represents the underlying logic of an IMS and can represent any of the observed IMS configurations. Based on the framework and eight observed IMSs the value configuration logics by Stabell & Fjeldstad (1998) are adapted to represent the three IMS configuration logics which orchestrate an IMS (Table 16):

- The long-linked chain is a sequential process of capture and selection and is most suitable for refined ideas by experts. It is driven by efficiency and capacity utilization.
- The intensive shop solves problems and improves ideas by applying a set of activities in stages cyclically. The resources the IMS uses and activities it applies depend on the idea and are appropriate for it. This configuration depends on expert users conducting the stages and making processing decision and can process complex or unrefined ideas.
- Lastly, the network is based on a mediating platform in which users simultaneously capture, improve, and evaluate ideas through their interactions. It is a system which can process large amounts of ideas and benefits from user interactions and linking users.

This does not mean that an IMS must precisely follow either logic. As also Stabell & Fjeldstad (1998) outlined, it is possible for multiple configurations to exist and interact within a firm which also two of the observed organizations prove. This is covered in the framework which enables the design of a customized IMS guided by these configuration logics.

Based on these elements this study proposes a configuration of an IMS inside Projektron BCS which can process and select quality ideas, but which is not bound to one configuration. Underlying this IMS is an object "idea" which has the attributes represented in the idea framework. The conceptual tool inside Projektron BCS provides all stages and possibilities for stage level configurations of activities, gates, roles, and interface thereby enabling the orchestration of the system following a chain-, shop-, or network logic.

5.2 Theoretical Implications

This study contributes to the fields of project management, idea management, and information systems in several important ways. With a renewed focus on the idea (Froehlich et al., 2016), it reconceptualizes what is an idea in the front-end of project management and provides a framework of this idea in the idea management systems context. This study provides a novel

approach by developing a framework based on constructs with formative and reflective relationships with the idea. This approach enables the representation of a dynamic idea (Gochermann & Nee, 2019) and increases knowledge on measures of idea characteristics

This theory builds on Stabell & Fjeldstad's (1998) value configuration typology and outlines a typology of three distinct configurations of an IMS and their characteristics. In addition to conceptually developing these configurations, it also offers empirical evidence for the existence of all three configurations in organizations. Based on the typology this study also enables the identification of a configuration in future research and provides insights into how creative inputs can be translated into a valuable project.

This study introduces a conceptual framework in the form of an ontology and interlinks it with the idea framework and the IMS configuration typology. It therefore offers a comprehensive framework of an IMS in the front-end of PM which fills the observed gap between generation and implementation of ideas in the front-end of PM (Pinto & Winch, 2016, Williams et al., 2019). Overall, this study contributes to the field of PM by investigating its front-end through the lens of an idea management approach. Approaching the front-end of PM through idea management is a promising approach opening new fields of research.

5.3 Limitations & Future Research

This study is limited by four factors. Firstly, it is subject to the limitations of its methodology. Due to its exploratory nature and case study approach, it provides qualitative insights into how organizations can orchestrate an IMS. But it only shows limited significant proof of the workings of the proposed theoretical framework. Therefore, a quantitative explanatory study investigating the concepts and their relationships is an important next step to expose the workings of IM in the front-end of PM.

Secondly, the study is limited by its sample. Both the sample size and the composition of the sample may inhibit generalizability of the results. The study is based on six interviewees who describe the IMSs in the three organizations and offer a minimum of two perspectives on each organization. Additional interviews for each of the organizations and the observation of additional organizations may provide further insights into the topic. While the shop and chain configuration each were utilized in multiple IMSs, the network configuration was only outlined in one case. Therefore, future research should aim to explore this configuration in detail. Regarding the sample also the composition limits the study: all companies are German, and findings may therefore not apply for other cultural contexts. In addition, the sample was selected based on organizations using Projektron BCS and using IM practices for project-

related ideas. This enabled a focus on the project related idea and ensured the presence of a functioning IMS but also limited the sample. Therefore, this study may profit from a larger randomly selected. While the sample's diversity in industry (IT, NGO/media, Industry) and the size (100-6000 employees) already offer variety, additional research into project-based companies in other industries and larger multinational corporations may offer new insights.

Thirdly, the researcher limited the study. A single researcher conducted interviews and the analysis which increases the changes of omitting variables in the analysis. Furthermore, because the researcher is working in Projektron GmbH beyond the end of the study, a potential bias is possible. Research independent of Projektron GmbH is therefore promising.

Lastly, the focus of the study limits the findings. Stabell & Fjeldstad (1998) outline a set of supporting activities. Supporting activities such as reward & recognition, idea generation and idea implementation are also relevant in framework of an IMS. Therefore, future research may expand the scope and explore the stages and activities preceding, supporting, and following and IMS. Specifically, the topic idea generation which usually takes place outside the IMS is of interest because an assumption that the generation process ends with the capture may not be true for all cases. Specifically, in networks, the simultaneous activities can also include further generation activities which interact with the IMS stages. Therefore, future research should explore the idea generation stage and the relationships with the IMS extending beyond the idea itself. This may also lead to additional findings regarding the two nodes in the IMS without ingoing relationships: the source and the knowledge structure. Their positions in the framework indicate that they should be explored further, and a knowledge management perspective may lead to additional insights.

In addition, the findings of this study suggest multiple fields of additional research: Firstly, a design science research approach based on the outlined propositions for the design of an IMS is promising. This would further underline the applicability of the framework in Projektron BCS or similar software tools. In return this study is a valuable base for design criteria of such a research and offers a clear proposition on what the designed artifact can look like. Testing this would further prove the proposed framework. Secondly, additional research into each of the stages including possible configurations on a stage level would enable further insights into possible configurations. Finally, a research on an organizational level investigating the integration of an IMS with other organizational IS would offer important context for the IMS.

5.4 Managerial Implications

The findings of this study are relevant to organizations and their managers which already have implemented IM solutions or intend to establish an IMS. The findings regarding the framework and configurations help an organization to evaluate their current system and to make conclusions about the fit of the IMS with the organizational context and the type of ideas processed. It also helps organizations identify needs for improvement in their IMS and provide them with an underlying logic for the development of their IMS. Furthermore, for organizations which are considering the implementation of an IMS, the framework and the configurations provide a roadmap for the development of an IMS in their organizational context. Based on the analysis of the organization's needs, a manager may decide for a configuration and initiate its implementation. The implementation or improvement of an IMS results in an increased value organization can draw from ideas, increases their innovativeness, shapes future opportunities, and improvs products, services, strategies, and organizational form. It creates a connection between organizations, its employees, and its customers by enabling the co-creation of value through ideas thus contributing to the long-term success.

Furthermore, the findings of this study have a potential impact on up to 850 organizations using Projektron BCS as well as Projektron GmbH itself. This study introduces a conceptual IMS inside Projektron BCS and the findings of this study impact the further development of the software. Therefore, the introduced configurations may offer the organizations using Projektron BCS a customizable and cost-effective tool which is integrated with the other PM tools they already use inside Projektron BCS. By utilizing an already existing software platform the development costs are lower, it is already well integrated into the organization and their IT systems, and problems of a change to a new tool are partially mitigated. It also profits from existing interfaces with other systems which are integrated with their Projektron BCS.

For Projektron itself this study offers a business opportunity to expand its software further into the front-end of project management and supplement the already powerful tools based around the methods Scrum, PRINCE2, IPMA with an IM solution in their front-end. This may lead to new customers and new business opportunities as MD, the CEO of Projektron GmbH, outlines: "*I saw that this company paid one million euros for […] a solution with which they could not work. That is when I noticed how valuable this was to them. And if we would still have them as customers and we would offer an idea management, then they would think that this is great*".

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7. Appendices

A. Criteria for inclusion and exclusion

Inclusion criteria:

Time frame: 2010-today; preferred: 2015-today

Citations: >20 (for Papers before 2017)

Language: English, German

Journal Impact Factor: >1

Topic/Subject area: Business, Management and Accounting, Decision Sciences, Economics, Project Management, Innovation Management, Information Systems, Idea Management, Product Development

Source type: Journals, conference proceedings, books

Exclusion criteria:

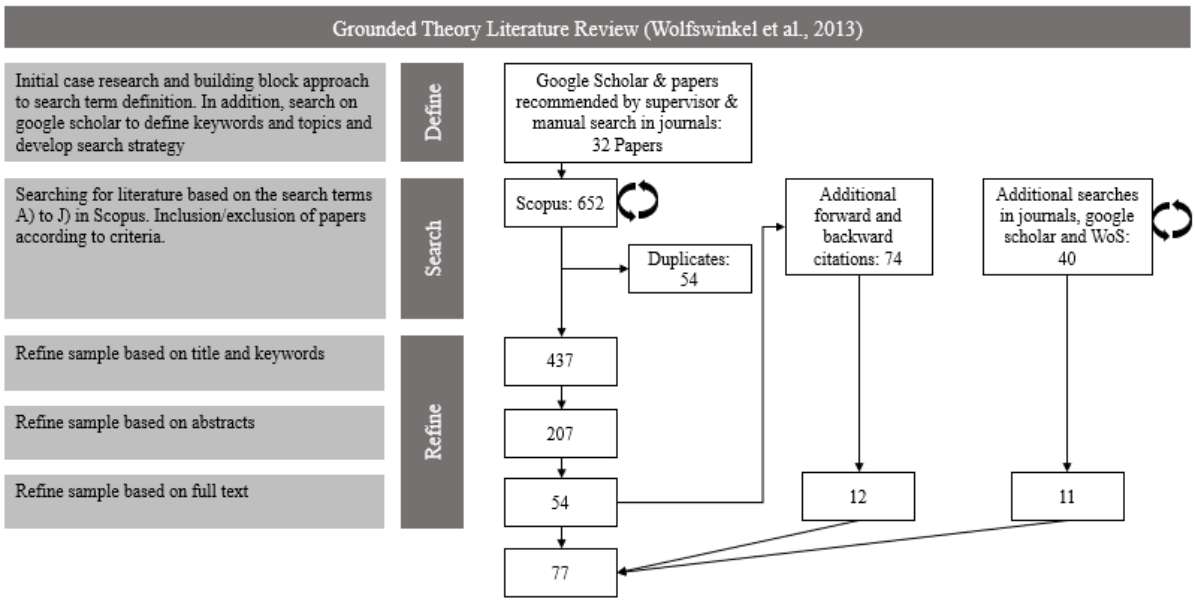
Topic: Papers very specific to engineering and/or computer science topics and to specific cases unrelated to the context of idea management

Papers concerning only idea generation

B. Search Terms and Results of the Literature Search

Best search terms based on an initial literature search and the research question and sub questions:

A) idea AND quality
B) “front-end” AND “idea management” AND “project management”
C) (“idea management” OR suggestion) AND system AND configuration
D) idea AND (evaluation OR assessment OR analysis OR selection OR ranking OR screening)
E) “front-end” AND “idea management” AND “project management”
F) idea AND management AND (framework OR system OR configuration OR process OR mechanism)
G) “idea management” AND “information system”
H) (idea OR “idea management”) AND (processing OR identification) AND quality
I) idea AND (Classification OR Categories OR Typology)
J) idea AND (selection OR “decision making” OR portfolio)



C. Interview Questionnaire

Die Idee

- Beschreiben Sie, was eine Idee in dem Kontext ihrer Firma ist?
- Welche Arten von Ideen gibt es?
- Welche Charakteristiken hat eine Idee?
- Woran erkennt man vielversprechende Ideen?

Der Prozess:

- Führen Sie mich bitte Schritt für Schritt durch den Lebenszyklus einer Idee, bis sie ein Projekt wird?
- Wie wird eine Idee eingereicht?
- Wie kann eine mangelhafte Idee weiterentwickelt werden?
- Wie kann die Qualität einer Idee beurteilt werden?
- Welche Faktoren sind bei der Auswahl einer Idee wichtig?
- Welche Prozess Entscheidungen werden im Ideen Management getroffen?

Fragen für Ideengeber:

- Beschreibe das reichen einer idee

Frage für technische Berater

- Wie wird ein Ideen Management System konfiguriert?
- Welche Möglichkeiten zur Konfiguration gibt es?

Fragen für Berater

- Was sind übliche Anforderungen der Kunden an ein Ideenmanagement System?
- Wie würde ein Prozess des Anpassens des Ideenamangement Systems aussehen?

Frage für Controller

- Wie sieht das Ideenmanagement aus Controlling Sicht aus?

D. Categorization of Idea Types

Classification	Relation	Authors and Year	Topic of the paper
Compliance, organizational, or strategic projects	Business relation	Yim et al., 2013 Gray and Larson, 2008	Engineering design projects
Nature of the change it brings into effect (i.e., the degree of novelty)	Nature of Change	Flynn, Dooley, O´Sullivan and Cormican, 2003	Innovation Ideas
Incremental, radical, and architectural change	Nature of Change	Burgelman et al., 1996	Innovation Ideas
Technology, administrative and ancillary innovations	Business relation	Damanpour et al., 1989	Innovation Ideas
Continuum from incremental adaptations to radical frame-breaking shifts from the status quo	Nature of Change	Sternberg, 1999 Gilson and Litchfield, 2017	Creative ideas and outcomes
By complexity rather than uncertainty	Complexity	Martinsuo & Poskela, 2011	Projects
Degree of novelty	Nature of Change	Kornish & Hutchison-Krupat, 2016	Innovation Ideas
Business function the idea relates to	Business relation	Oesterle, 2000	
Product-, service-, organizational-, process-, and strategy-related innovations	Business relation	Rowley, Baregheh & Sambrook, 2011 Spieth & Schneider, 2016 Van den Ende et al., 2015	innovation Ideas
Administrative and technical	Business relation	Damanpour, Szabat and Evan, 1989	Innovation Ideas
Incremental innovation, innovation that changes consumers' behavior, innovation that destroys existing competencies	Nature of Change	Darroch and McNaughton, 2002	Innovation Ideas
Geographical location, industrial sector, stage of project life cycle or product	Origin / Process relation	Youker, 2017	Projects
Part of the resource life cycle the idea relates to	Process relation	Ives & Learmonth, 1984	Customer ideas

E. Methods for Evaluation

- **Checklist**: Checklists are commonly used for planning and assessment. A checklist must consist specific and clear criteria which are used for the assessment of a concept (Stuffbeam, 2000) – in this case an idea. Checklists improve objectivity and credibility of the evaluation but because they require specific criteria, they are both a formal and narrow method.
- **Cost-Benefit Analysis:** When evaluating the success of a business project, the costs and (financial) benefits play an important role. Thus, also in the front-end these indicators should be used for the evaluation of ideas. Samset & Volden (2016) note the importance for establishing rough but realistic estimates of the costs and comparing them with project benefits for the idea in question. It is important to estimate the financial value of benefits to ensure comparability. Ideas, for which the potential profits are higher than the costs should be selected. It is doubtful, though, whether such methods can predict the actual value of a project and they ignore issues such as viability of projects and should thus not be trusted in informed decision making (Flyvbjerg, 2013).
- **Viability analysis**: The viability analysis takes an opposite approach, evaluating the chances of success of an idea. This is done by an analysis of potential future scenarios while a long-term perspective is taken (Samset & Volden, 2016). The chance of occurrence of such scenarios are estimated by the evaluator.
- **Impact assessment:** Social, environmental, and economic impacts of an idea can be estimated and form the base of a decision (Flyivbjerg, 2013). The impact can be estimated through (long-term) future scenarios and the outlining of dependencies and relating activities and infrastructure.
- **Scenario analysis:** Quality of ideas must be assessed with a long-term perspective and the planner should think creatively about future scenarios (Samset & Volden, 2016). Scenario analysis thus can be useful in the front-end as a creativity enhancing tool which enables the focus on uncertainties and future developments by considering external factors (Postma, Broekhuizen & Bosch, 2012). As such, also the above topics of impact assessment and viability analysis fall under this category while having a narrower approach by focusing on specific topics for the future scenarios. Scenario analysis supports creativity, the creation of knowledge and improvement of ideas by enabling rational discussions (Postma et al., 2012). Additionally, scenario analysis

offers a platform for strategic conversation with a focus on managing uncertainties and predicting future outcomes (Postema et al., 2012). By utilizing experts in this method, relationships and outcomes can be estimated which are impractical or expensive to observe directly (Krueger et al., 2012, Uusitalo et al., 2015). An additional advantage of this method of analysis is the lower cognitive effort needed for understanding by the decision makers selecting ideas and the broadness of information presented (Froehlich et al., 2016). To ensure this, the analysis should focus on practical problems the idea can solve (Froelich et al., 2016).

- **Intuitive Rating & intuitive ranking**: In evaluating ideas though intuition, experts or users assign a score to an idea or rank it in order. The order/ranking does not correspond to a single criterion but answers the overall question for quality of the idea. Ranking differs from rating insofar as it takes a comparative approach to a pool of ideas instead of focusing on a single idea. Intuitively analyzing ideas enables high quality and speed but there may be biases due to an unconscious process (Eling et al., 2015). Shapiro and Spence (1997) recommend that intuitive analysis should be complemented with rational analysis following as a second step. Intuitive analysis can be either conducted by experts by building on their background knowledge or users and communities. In research, the accuracy has been proven for both.
- **Discussion:** Discussion is a qualitative team decision process based on experience and communication which excels at analyzing qualitative data (Lerch and Spieth, 2013). Research has nevertheless doubted whether groups can outperform individuals (Gilson & Litchfield, 2017) but in diverse groups innovative performance and knowledge creation can be increased (Walsh et al., 2016). Such diverse groups benefit from different knowledge backgrounds and perspectives available and a knowledge transfer between the sources creates new combinations of knowledge (Walsh et al., 2016). Simultaneously the integration of knowledge and documentation is an obstacle (Walsh et al., 2016).
- **Opportunity / Risk analysis**: Opportunities and risks of ideas must be considered in the evaluation of ideas (Samset & Volden, 2016). By placing risk analysis and accountability centrally in the selection of ideas, the management and estimation of such risks is enabled (Williams & Samset, 2010). But for comparing risks and opportunities within and to each other, a quantification is needed for assigning financial values and probabilities.

- **Multi-Criteria**: Using a multi-criteria assessment satisfies the need for the use of flexible but formal evaluations systems including perspectives such as strategic, marketing and technology (Martinsuo & Poskela, 2011). This approach brings both objectivity and a systematic approach together (Martinsuo & Poskela, 2011). Additional to strategy and market-oriented criteria, also process and finance-oriented criteria make the method more accurate and include a broader perspective that results in high management perception and satisfaction and overall performance (Lerch & Spieth, 2013). Lastly, also the prioritization of ideas is enabled by this method (Lerch & Spieth, 2013) and it can also form the base of a portfolio approach helping to strategically align and balance portfolios (Martinsuo & Poskela, 2011). This method can be either conducted as expert assessments or by users (Uusitalo et al., 2015) and furthermore benefits the quality at entry as it directs the attention of the source at the evaluated issues (Smith, Herbein and Morris, 1999).
- **(Strategic) portfolio analysis**: An approach based on strategic portfolio analysis, when conducted based on consistent knowledge about the different alternatives and the company's strategy and interest, can enable the value maximization of the portfolio value (Martinsuo & Poskela, 2011). This approach, because it considers the alternatives is broad and uses a formal approach centered around the company's goals. Thus, it is particularly suitable to do detailed assessments of a range of innovative project ideas but is dependent on the underlying analysis techniques. It is an approach based on market needs, risks, and cost and widely established in the field of project management and strategic management. Therefore, the usage of such an approach can interconnect easily with PPM in companies.
- Comparative analysis: The analysis of ideas should not be purely based on the concept and the information given in the idea, but a comparative analysis with similar ideas (Flyvbjerg, 2013). Thus, ideas should be challenged and compared to previous experience and similar undertakings (Samset & Volden, 2016). This can combat tendencies of evaluators to be too optimistic and can build an empirical base for further analysis (Flyvbjerg, 2013). This formal evaluation method can furthermore enable the comparison of different ideas and be the base for an objective and fair process (Martinsuo & Poskela, 2011). The bottleneck of this analysis is the availability of data from similar ideas.

Overall, evaluation methods can be distinguished by their formality and their focus. More formal methods apply common assumptions to all ideas and often use rigid processes and criteria. Such methods enable fair evaluation and enable comparability of different ideas while creating consistent output (Martinsuo & Poskela, 2011; Kock et al., 2015). Informal methods on the other hand are more flexible and are more adaptable to a variety of ideas such as radical and creative ideas and are utilizing more subjective assessments (Martinsuo & Poskela, 2011).

The focus of the evaluation method is related to the amount of information processed and the flexibility in processing a wide variety of information. Deeper methods require more time and potentially include multiple evaluators and often require more competences and knowledge on the evaluator side (Martinsuo & Poskela, 2011). But they enable the analysis of ideas from different angles in their context. The danger of problems due to the abundance of information decreases with depth and methods with a shallow focus on the idea itself can efficiently analyze data quantitively while focusing on few important perspectives of the idea.

I conceived of the matrix below to categorize evaluation methods and help companies decide for an evaluation system. The Matrix has the following dimensions:

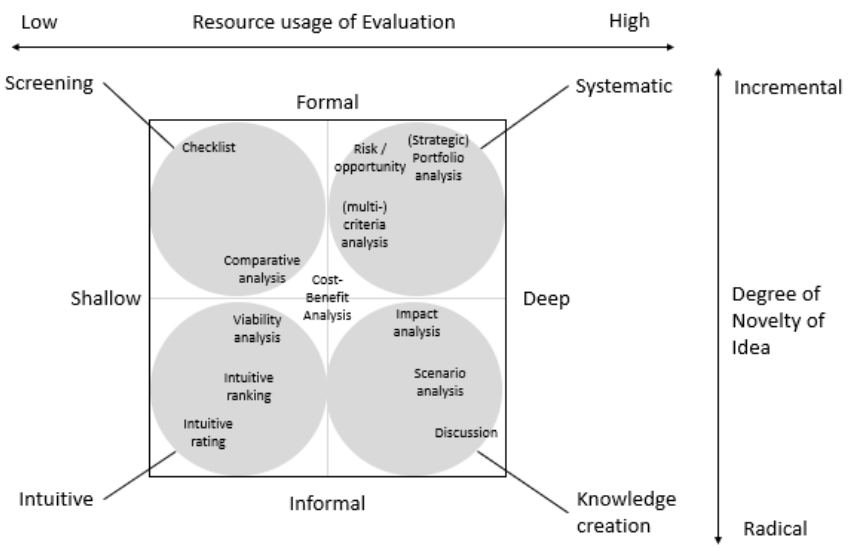
- Methods with a deeper focus enable the identification of radical ideas and create more knowledge about the ideas which is harder to process though. They may as well consider broader fields of information and analyze ideas in their context or compare them to others and thus account for the business environment and be more accurate.
- Methods with shallow focus are more efficient at evaluating ideas and excel for incremental ideas but also create less knowledge about the ideas. They may be more inaccurate but also easier to process.
- Methods utilizing formal evaluation document the decisions better and record knowledge about the ideas but are more labor- and training intensive. They may enable better accountability and transparency.
- Methods with an informal approach to evaluation are less resource intensive and use a wider variety of knowledge and people. Results are less transparent. Informal methods enable the use of groups or even communities unrelated to the organization.

Analysis methods in the knowledge creation quadrant (lower right) enable the comparison between ideas in informal settings while leveraging skills of one or multiple experts and are therefore suited for creative, novel, and radical ideas about which little is known. By analyzing ideas from a pool of ideas, relationships and comparisons can be drawn as is the case during discussions and intuitive rankings. Furthermore, the description of future scenarios such as impact and scenario analysis enable, create new knowledge about idea quality and idea context.

A bottleneck is the high resource and time usage for such methods. The discussion is found in this quadrant because in the case of Stiftung Warentest, informal discussions of experts were conducted for knowledge creation about the idea. Impact and scenario analysis are in this quadrant because both rely on informal assumptions to predict vague future scenarios and require experts for accurately doing so.

In the lower left, the intuitive analysis quadrant can be observed. Analysis methods in this field enable an analysis with low resource usage and within a short timeframe. Such an analysis can also be conducted by unskilled users and therefore enables easy crowdsourcing of evaluations. But a hinderance is the lack of documentation for the reasoning of the results and high resource consumption for quality assurance. Intuitive rating and ranking are found in this quadrant because an evaluation is based on the informal intuition of an individual and only the result is documented. Ranking creates additional knowledge about prioritization and other ideas and frames the idea and therefore is more formal and deeper. Viability analysis follows a similar logic but differs as it is a quantitative analysis and therefore more formal.

In the upper left quadrant, screening methods are found. Such methods enable quick and formal evaluation according to criteria which fit every idea type. Such methods excel at identifying general idea characteristics such as information quality but fail to evaluate radical ideas. Such methods are reliable due to their formality but create minimal amounts of new knowledge about the idea. The checklist is a standardized method and can therefore be found in the top left. The comparative analysis draws from data from past ideas. With the help of comparisons, it attaches new knowledge to the idea and has therefore a deeper focus, but it does not create any novel information.



In the upper right quadrant systematic methods can be found. Such methods enable the transparent and systematic evaluation of a wide range of ideas and create well documented results. But such approaches are also time intensive and inflexible. Multicriteria analysis can be found in this quadrant but in this case, it depends on the specific criteria how formal and

deep the evaluation is (for example intuitive rating can be considered a rudimentary criteria analysis). Risk / opportunity analysis as well as the portfolio analysis are located here, because of their systematic approach to the analysis of the context of the idea.

When an organization chooses an evaluation method, it should consider the quantity of ideas the IMS should process and the degree of novelty of the ideas. Few radical ideas are best evaluated using the knowledge-creation methods. High novelty ideas in high quantity should be evaluated using intuitive methods. High quantity incremental ideas can be efficiently evaluated using screening methods. Lastly, low numbers of incremental ideas can be accurately evaluated using systematic methods.

F. Criteria for Idea Quality with formative and reflective relationship

Formative Relationship	Area of influence	Reflective Relationship	Source
project risk planning, process formality, and goal clarity	NPD Project	Innovation success	Salomo, Weise, & Gemünden (2007)
Review proficiency	Innovation	Company level innovation performance	Schmidt et al. (2009)
Viability (long run), sustainable	Investment project	success	Samset & Volden (2015)
	project	Efficiency and effectiveness of project success (effectiveness standing for value generated)	Miller and Lessard (2001)
	International development projects	efficiency, effectiveness, relevance, impact, and sustainability	Samset (2009)
Strategic opportunity (competitive potential and future business potential)	Early phase product development concepts	technical feasibility, market potential, product uniqueness	Martinsuo & Poskela (2011)
Originality and novelty	Front-end Innovation	Success	Kim and Wilemon, (2002)
	Early phase product development concepts	Market and technical criteria (positive), strategic criteria (not significant)	Martinsuo & Poskela (2011)
	Early phase product development concepts	Strategic criteria (positive)	Carbonell-Foulquie´et al. (2004)
	Ideas and concepts	Short term innovation performance (Product attractiveness), long term strategic opportunities	Martinsuo & Poskela (2011)
Linkage with strategic goals at early stage of innovation process	Innovation ideas	Success, superior products, benefits for customer and user	Boeddrich (2004)
ten critical factors	Project implementation	Project implementation success	Pinto and Slevin, (1988, 1989); Pinto, (1990)
	Project ideas	Critical success factors of projects	Constantino et al. (2015)
	Project idea	Expected economic or financial return	Thomas & Mullaly, (2007)
	Project	Financial criteria, strategic criteria, fit with portfolio	Kaiser et al. (2016)
	Project idea	Same criteria as for running projects	Kaiser et al. (2016)
Good project management	Project	Tactical (short term performance target such as cost, timing and quality ofdeliverables)	Samset & Volden (2015)
Choosing most viable project concept / business case	Project	strategic performance (sustainable impact and remain relevant and effective in its operational phase, throughout its lifespan)	Samset & Volden (2015)
Delivery of outputs, contribution to fulfillment of agreed objectives,	Project	Success	Samset & Volden (2015)

consistency with needs and priorities in society, viability			
Uncertainty (negative impact)	Project	Success	Samset & Volden (2015)
meeting time, budget, and other requirements, impact on the customer, benefit to the performing organization, and preparation the future	Project	Success	Shenhar et al. (2001)
Meeting of objectives that make up project purpose	Project	Success	Yim et al (2013)
the external environment; the internal organizational structure; the proficiency of organizational management; the level of team member coordination; and project elements,	Project	Success	Yim et al (2013)
		Factors in decision making	Moenaert et al. (2010)
customer satisfaction, budget and schedule, as well as business success and future potential	innovation project	success	Lerch and Spieth (2013)
characteristics	Ideas	Success	Froehlich et al., (2016), Goldenberg & Mazursky (1999), Goldenberg et al. (1999, 2001)
Idea character	Idea		Froelich et al. (2016)
	Innovation idea	Novelty, usefulness	Björk and Magnusson (2009)
Fit with user need	Ideas	Market success	Di Gangi & Wasko (2009)
	Ideas	relative advantage, compatibility, promotion efforts, complexity, observability, trialability	Di Gangi & Wasko (2009)
knowledge source diversity	Ideas	novelty of innovation (e.g. radical or incremental), impact (e.g. patent citations), or commercial value (e.g. sales from the innovation)	Walsh, Lee & Nagoaka (2016)
Diversity of knowledge sources (including different knowledge backgrounds, representing different fields, institutions and sectors)	Idea	quality	Walsh, Lee & Nagoaka (2016)
matching the invention to existing routines, capabilities, and equipment, as well as modifying existing processes to accommodate the invention and detailed	invention	Commercialization success	Walsh, Lee & Nagoaka (2016)

understanding of the routines of potential customers or suppliers			
broad access to information sources or from upstream, radical or generic knowledge from U-I collaboration	Invention	quality	Walsh, Lee & Nagoaka (2016)
incorporate the requirements and capabilities of customers and other suppliers into the R&D search process	Innovation Development	success	Kubota et al. (2011)
Expertise, creative thinking skill, task motivation	Individual	Creativity of ideas	McAdam & McClelland (2002)
Value offering innovation, value architecture innovation, revenue model innovation	innovation		Spieth & Schneider (2016)
	idea	novelty, workability, relevance and specificity	Blohm et al. (2011)
	idea	customer relevance, strategic fit, communication potential and vision potential	Dzillas (2018)
	Idea evaluation	trust and credibility of the source	Appelman & Sundar (2016
	Idea credibility		Appelman & Sundar (2016)

G. Decision Making Methods

When comparing the different methods, these four factors need to be considered:

- **Formality**: A method with high formality sets clear guidelines for the process and outcome and are more commonly associated with mechanistic approaches, predictive technology as well as a stable environment (Edkins et al., 2013). This leads to more transparent and defendable outcomes and a less biased process (Edkins et al., 2013). At the same time, formalized processes are better performing and achieving a higher management acceptance because they ensure the equal treatment of ideas and consistency across time (Lerch and Spieth, 2013). Lastly, formality enables the comparison of ideas (Martinsuo & Poskela, 2011). But to succeed, this requires a stable quality at entry and a large amount of knowledge available about the idea and may be less effective at identifying novel solutions and harm creativity (Martinsuo & Poskela, 2011).
- **Flexibility**: A flexible method largely depends on the individuals conducting it as it sets little guidelines and procedures and enables decision makers to focus on the issues, the seeking of knowledge and the negotiation of a solution (Martinsuo & Poskela, 2011). It is thus very adaptable to the required problem or circumstance (Williams & Samset, 2010) and better fit the organization's characteristics (Martinsuo & Poskela, 2011).
- **Efficiency**: The efficiency mainly relates to the time required for the making of a decision (Caniels & Bakens, 2012). Furthermore, it may relate to the resource usage. This may concern the speed of screening one idea but is not limited to this. An efficient system may only require the screening of few ideas by decision makers due to good pre-selection.
- **Performance**: Each of the methods can ensure the selection of quality ideas depending on how it is implemented and depending on organizational context. But to assess the performance of the different methods, the purpose of a decision support system must be looked at: The purpose is the minimization of this uncertainty by supporting of the decision maker in evaluating consequences of various alternatives and decide for the one with the greatest relative advantage without unforeseen interventions or conflicts (Uusitalo et al., 2015; Di Gangi and Wasko, 2009. Taking a closer look at the roots of uncertainty in this context, Flyvbjerg (2009) observes mistakes in such decisions. In his study on the overestimation of benefit and underestimation of cost regarding projects he rooted these in three explanations. Firstly, political and economic. These are leading to the deliberate choosing of optimistic views due to politically motivated priorities which Williams & Samset (2010) categorized under systematic skewed estimation attributed to political

priorities and differing interpretation of information by different parties (2010). Secondly, psychological, such as for example the optimism bias which was also identified by Williams & Samset as psychological human biases. And lastly, technical explanations due to inadequate forecasting techniques and mistakes which is analog to the epistemic problems identified by Wright, Bolger and Rowe (2009). Uusitalo et al. (2015) also focus on the epistemic explanation and point out that from a managerial viewpoint any uncertainty can be attributed to a lack of knowledge. Oliveira et al. (2015) add that information in the front-end is inherently unknown or uncertain and due to divergent, imperfectly known processes it is impossible to predict with certainty the outcomes of a decision (Uusitalo et al., 2015). Thus, when considering a method as high quality, it is important that it better deals with uncertainties and risks. A system with low quality is one in which none or one of the mistakes are addressed, one of medium quality is one where two of the mistakes are addressed and one of high quality is one in which all mistakes are addressed.

Method	Formality	Flexibility	Efficiency	Performance	Suitable for:
Discussion/selection from pool	Low	High	Low	Low	Both
Prioritization	Medium	Medium	Medium	Low	Normative
Elimination	Medium	Medium	Medium	Medium	Exploratory
Decision criteria	High	Medium	Medium	High	Normative
Decision tree	High	Low	High	Medium	Exploratory
Analytic hierarchy process (AHP)	Medium	Medium	High	High	Both

- **Discussion/selection from pool:** Ideas can be selected in decision meeting through discussions with the knowledge from evaluation as a base (Clegg et al., 2018). Discussions are an open format that can be adjusted accordingly to the problem at hand. Thus, it is less formal and more flexible and suited for exploratory decision making but also performs well in a normative approach. Threat are biases of the participants and a low efficiency due to an unorganized approach and large amounts of information to process.
- **Prioritization**: Prioritization is considered a dynamic process for decision making during which ideas are ranked and compared and prioritized depending on the underlying discussions (Lerch & Spieth, 2013). This more systematic process balances out formality

and flexibility but is subject to the similar limitations as the discussion. Such an approach is particularly useful normative approaches ranking alternatives as a solution.

- **Elimination:** When deciding for an alternative it is useful to firstly eliminate the worst alternatives (Samset & Volden, 2016). Furthermore, Park, Jun & MacInnis (2000) have shown that such a subtractive option framing method perform better and avoid biases. Specifically, it addresses the optimism bias and the political and economic bias and creates more consistent results as well as guides the process with a higher efficiency.
- **Decision criteria**: Decision criteria, as discussed throughout the paper, offer some of the largest upside and are a widely accepted practice in companies (Oliveira et al., 2015). By defining accurate selection criteria and basing decision upon them, firms can select ideas purposefully and in line with strategy and business model (Constantino et al., 2015, Di Gangi & Wasko, 2009). Such an approach enables rationality and thus avoids mistakes and biases (Eling et al., 2015). But such an approach requires a normative approach where decision criteria are decided upon beforehand. This also results in a worse performance for radical ideas.
- **Decision tree:** Decision trees are a widely accepted and utilized approach to decision making and decision support. Using a decision tree based on decision criteria for the selection of ideas, provides the advantage of a better structured approach thus minimizing risks. But due to that also its flexibility suffers.
- **AHP:** Using an AHP as a method for selecting idea, the decision maker uses pairwise comparisons by experts of the respective fields to create priority scales (Saaty, 2008). Because AHP focuses on improving inconsistencies and judgements to achieve better results it is a high performing method. But the direct comparison of options by attributes is a formal and time-consuming approach. While in a normative approach, comparing similar ideas, the AHP can perform well, it can also be adjusted to compare a wide range of ideas in an exploratory setting.

H. IMS Configuration SW

Stiftung Warentest	**Chain**	**Shop**	**Network**
Value creation logic	Transformation of idea into project	Solving customers problem regarding product choice	-
Primary technology	Long-linked successive stages in the IMS	Intensive evaluation & improvement	-
Primary activity categories	• Inbound Capture • Improvement and evaluation operations • Outbound Selection	• Recording, reviewing, and formulating of idea and choice of idea • Generating and evaluating Information	-
Main interactivity relationship logic	Sequential stages	Cyclical improvement and evaluation	-
Primary activity interdependence	Sequential stages and pooled evaluation/improvement	Sequential stages and pooled evaluation/improvement	-
Key cost drivers	Capacity utilization in project pipeline	-	-
Key value drivers	-	Experts conduct improvement and evaluation stage	-
Business Value Structure	Interlinked chain of the IMS stages	Shop during the improvement and evaluation stage	-

I. IMS Configuration HA1

Hörmann - Idea	**Chain**	**Shop**	**Network**
Value creation logic	Standardized transformation of idea into project / rejected idea /shelved idea		-
Primary technology	Long-linked successive stages in the IMS		-
Primary activity categories	• Inbound Capture/Improvement • Outbound Selection/Screening	•	-
Main interactivity relationship logic	Sequential stages	Cyclical Improvement	-
Primary activity interdependence	Sequential operations but pooled screening/selection and capture/improvement	Sequential operations but pooled screening/selection and capture/improvement	-
Key cost drivers	Efficiency in idea processing		-
Key value drivers		Expertise of Decision maker	-
Business Value Structure	Interlinked chain of the IMS stages	Improvement Shop	-

J. IMS Configuration HA2

Hörmann - Suggestion	**Chain**	**Shop**	**Network**
Value creation logic		Solving of Problem in the company	-
Primary technology	Long-linked capture	Intensive Screening/Improvement/ Evaluation	-
Primary activity categories	• Inbound logistics (Capture)	• Problem-finding by source • Problem-finding and -solving by evaluator • Choice during selection and screening • Processing depends on idea	-
Main interactivity relationship logic		Cyclical with relative processing decisions	-
Primary activity interdependence		Pooled and reciprocal activities (screening, improvement, evaluation), sequential in overall process	-
Key cost drivers			-
Key value drivers		Expertise of source and Evaluator	-
Business Value Structure		Idea processing Shop	-

K. IMS Configuration PL1

Projektron - Internal	**Chain (Quick Win Ideas)**	**Shop (IMS)**	**Network**
Value creation logic	Quick win ideas are transformed into solutions or projects.	Solving problem of customer or employee or exploiting opportunity	Sources and improvers are linked
Primary technology	Long-linked stages (capture – screening/selection)	Intensive Screening/Improvement/ Evaluation	-
Primary activity categories	• Inbound logistics (capture) • Outbound logistics (selection)	• Problem-finding by source • Problem-solving by evaluator/improver/source • Choice during selection and screening • Processing depends on idea type, characteristic, and source	-
Main interactivity relationship logic	Sequential stages (capture, screening/selectin)	Cyclical or spiraling with relative processing decisions and repeating stages	-
Primary activity interdependence		Pooled and reciprocal activities (screening, improvement, evaluation)	-
Key cost drivers	Capacity utilization and efficiency		-
Key value drivers		Expertise of source and Evaluator	-
Business Value Structure	Interlinked chain for quick win ideas	Idea processing Shop	-

L. Designing an IMS in Projektron BCS

The IMS I introduce in this thesis is based on the data structure and application logic of Projektron BCS.

All the interfaces and views shown here are mockups created by me based on the findings and Projektron BCS. Except for App. 4, all designs are a custom design and are not available in this form in Projektron BCS.

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For comparison to the current IMS functionalities, the following server can be accessed:

Link: https://jwa-demo07.bcs-hosting.de/bcs/projectbrowser/idealist/display?oid=3_JProjects

User: pl1

Password: bcs

_____

In the following appendices I present different interfaces (views) in which the idea is processed. All interfaces are object views (if not indicated otherwise). This means that the views are views of object attributes and can be viewed by a user after clicking on the idea object in Projektron BCS.

M. The Idea in Projektron BCS

Projektron BCS is based on the logic that it manages all data in object form. An IMS inside Projektron BCS requires an Object 'idea' which has the internal type 'JIdea'. This object type has its own <JIdea> XML node created under the <ObjectTypes> XML node in the configuration file. The object type idea has a set of attributes for which a data type such as 'Sting' is specified. The data type defines which type of data can be stored in the attribute and how the data is displayed in Projektron BCS. The admin applies changes to the attributes of individual (<idea>) object types under the XML node. He creates an <Attributes> subnode, which would then contain the individual attribute definitions.

```
<?xml version="1.0" encoding="UTF-8" ?>
<BCS-Configuration
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xsi:noNamespaceSchemaLocation="schema/bcs-config.xsd">
  <ObjectTypes>
    <ObjectType Name=" JIdea ">
      <!-- Customisations to the Idea are defined here. -->
      <Attributes>
        <!-- Sets the initial value name as project name -->
        <Attribute Name="name" Default="name" />
        <!-- Makes description a required attribute -->
        <Attribute Name="description" Required="true" />
        <!-- Other attribute definitions -->
    </ObjectType>
    <!-- Other object types -->
    ...
  </ObjectTypes
</BCS-Configuration>
```

Appendix 1: Example of an XML Node in of the Idea

To enable the use of ideas in an IMS, a type 'idea' is necessary. The type 'idea' has attributes which represent the characteristics that form the idea. This is for example the source '[A] Provider of idea' or an attribute relating to the knowledge structure such as the situation in which the idea occurred '[A] Situation' ([A] indicates a attribute). In addition, it has attributes which represent the idea such as '[A] Quality'. Custom attributes can be added by an administrator and labels of attributes can be adjusted to change the representation of the attribute in the interface.

Data Structure (changed)

Object Type: Idea [JIdea] — Search

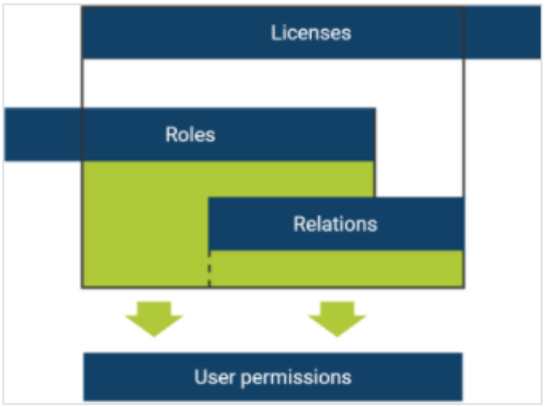
Name	Type.Subtype	Attribute	Data type	Required Attr.	Initial value/option value
[T] Idea	JIdea				
[A] Provider of idea	JIdea	sourceUserOid	Oid	Yes	
[A] Creator	JIdea	insUserOid	Oid	Yes	
[A] Subject	JIdea	name	String	Yes	
[A] Description	JIdea	description	LString[HTML]	No	
[A] Situation	JIdea	situation	LString[HTML]	No	
[A] Goal	JIdea	goal	LString[HTML]	No	
[A] Reference	JIdea	pspOid	Oid	No	
[A] Idea Type	JIdea	attachmetnCat1	String[1..5]	Yes	
[A] Comment	JIdea	checkDescription	LString[HTML]	No	
[A] Comment type	JIdea	commentType	String[1..3]	No	
[A] Communication	JIdea	attachmentCat2	String[1..3]	No	
[A] Communication log entry	JIdea	memoForCommunciation	Oid	No	
[A] Filename	JIdea	attachmentCat3	String	No	
[A] Note (feedback)	JIdea	changeComment	Text	No	
[A] Inserted	JIdea	insDate	DateTime	No	
[A] Updated on	JIdea	lastUpdate	DateTime	No	
[A] Object-ID	JIdea	oid	Oid	No	
[A] Last change by	JIdea	updUserOid	Oid	No	
[A] Status	JIdea	status	String[1..5]	Yes	
[A] Idea Quality	JIdea	ideaQuality	String[1..5]		
[A] Idea Information Quality	JIdea	informationQuality	String[1..5]		
[T] Relation	JRelation				
[S] Relation (Keyword)	JRelation.relationIdeaKeyword				
[S] Relation (Related Idea)	JRelation.relationRelatedIdea				
[S] Relation (Duplicates)	JRelation.relationIdeaDuplicate				
[S] Relation (Processor)	JRelation.relationIdeaProcessor				

Appendix 2: Data Structure of the Idea

Based on this I developed a conceptual data structure of the Idea in Projektron BCS. It includes previously mentioned attributes regarding knowledge structure and source but also placeholders of attributes representing type, quality, quality of information, communication log, and feedback. It also shows the type '[T] Relation' to illustrate how subtypes of the relation such as '[S] Relation (Related Idea)' enable the linking of different ideas ([T] indicates a type and [S] indicates a subtype). Some of the attributes outlined here are represented in the interface of Projektron BCS and can be edited by the user. Other attributes describing the idea metadata such as object-ID or a change log are also available and are updated automatically.

N. Permission Settings in Projektron BCS

In Projektron BCS, a user has permissions which allow him to conduct edit and view information, thereby allowing him to conduct and activity and change idea attributes, conduct a decision at a gate, or delete information. As illustrated in the graphic on the right, the permissions are based on the licenses, roles, and relations of the respective user. The user requires a license which authorizes the scope of functions that enable him to fulfil his responsibilities. Licenses authorize a particular scope of functions. In the context of an IMS, every user who takes part in the IMS requires a license. A role combines a certain number of individual permissions and specifies what a user can do in Projektron BCS. Lastly, a relation determines permissions selectively for an object – in this case the specific idea.



Appendix 3: Permission system in Projektron BCS

An example for the importance is the submission of ideas. Based on the findings in this thesis, I propose that all users should be able to insert ideas. As is visible below, in Projektron BCS, a wide range of licenses have the function “Idea insert” available to them. In the action permissions of Projektron BCS this is represented by both licenses for internal use such as EMP (Employee) as well as external access Cst (Customer) and TSC (Guest) having the permissions to insert ideas. In general, any user license should support the submission of ideas because the user permission is then restricted by the company respectively through roles and relations. This is shown in the action permissions of the user licenses below where all users except licenses for special functions (e.g., interface licenses) have the permission to insert ideas

	Attribute		User Licences																								
	Always/never	Provider of idea	Adm	TR1	TR2	EMP	PM	PgrM	Cst	TSC	PM	Sa	Inv	CM	VL	F/HR	CTI	C-WS	O365	MSEx	ExSP	ExTiK	JIRA WS	LoNo	ProcM	Rs	TiWS	TR WS
Idea Edit		+		*	*	*	*	*	*	*						*						*						
Idea Insert				*	*	*	*	*	*	*						*						*						
Idea View		+		*	*	*	*	*	*	*						*						*						
Idea delete		+				*	*	*																				
Idea Edit Files	*based on action permission(s) "Idea Edit"*			*	*	*	*	*	*	*						*						*						

Appendix 4: Permissions of Licenses

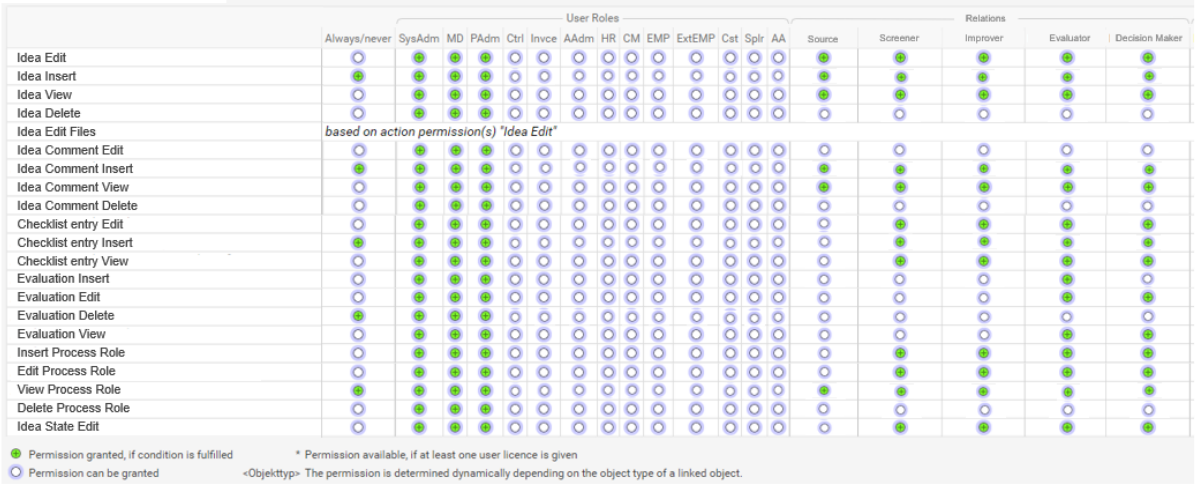
These licenses simultaneously enable the user to edit an idea. Depending on the configuration of the permissions, a user can only edit their own ideas or also the ideas of other employees as is required for the network approach.

In addition to the ability to insert, edit and view own ideas, the idea is administered by evaluators, screeners, or decision makers. I propose that for this, a Program Manager license is required as the program manager is responsible for the administration of projects.

The user organization of the IMS cannot adjust the permissions of a lincence but must purchase and assign the respective licences.

An organization can configure the roles and relations individually depending on their requirements. The administrator can configure these in the administration work area by defining the action permissions. I propose, that in addition to the general rules regarding the editing, viewing, deleting and inserting of the idea, a set of 21 permissing should be available as is displayed in the image below. I propose that general administrator roles such as the system administrator (SysAdm), the managing director (MD), and the project administrator (PAdm) have permissions to conduct all edit, view, insert and delete actions.

Because the IMS functions object oriented where ideas have a relation to a role, the permissions should be relations between the specific idea and the respective users. This means, that for example a source has permission to edit ideas, but only ideas for which they have the relation source. This ensures, that only the correct user can edit, view or delete information. All relations can for example insert and view comments of the idea but they cannot delete them. This ensures that all users can communicate on the idea, but only the administrators can delete unwanted comments. The checklist on the other can can only be edited by the screener, improver, evaluator, or decision maker who are invovled in the evaluation and improvement of the idea. Similarly, the evaluation is restricted to editing by the evaluator whereas the decision maker can view it only. Process roles refers to the inserting of responsible users and thereby the creation of new relations. Only roles invovled in the process such as screener or decision maker can enter this information. Lastly, the idea state deciding which stage the idea is in can be edited by all related users except the source. This ensures a fast flow of the idea through the IMS. Each of these permissions can be adjusted by activating or deactivating the green plus and therefore this can be adjusted easily. For example all user roles can be allowed to conduct the evaluation if it is a network approach.

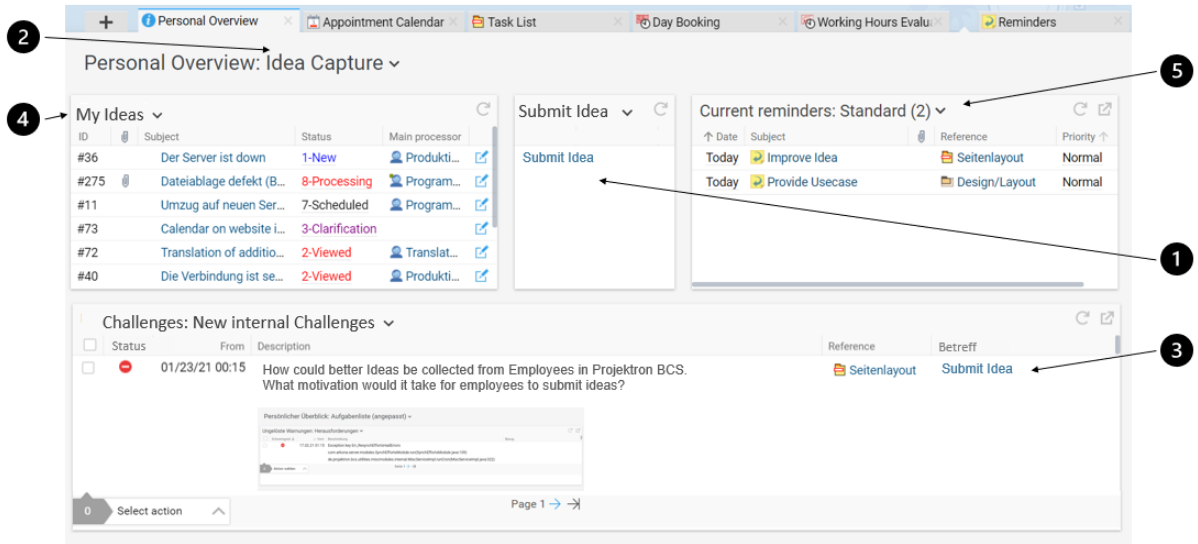


O. Idea Capture in Projektron BCS

During the capture of the idea, the knowledge gap between the exploiting organization and the source of the idea is closed with the help of the IMS (Di Gangi & Wasko, 2009). In this phase the tacit idea in the mind of the source is transformed into an explicit idea that is codified and presented in the IMS with an interface.

In the case of Projektron BCS, the source can enter an idea in the Personal Overview. The personal overview is the customizable digital dashboard which summarized core information for the user and is easily accessible for users. The digital dashboard consists of blocks which contain information regarding specific topics. The blocks displayed and their arrangement is saved in a view preset. In Projektron BCS, a preset for idea capture should be available for use by users. Different presets for other stages should be available to the users.

When a user clicks on "Submit idea" an idea process is started and an interface for idea submission is opened in a separate window (App. 5, 1). The option to submit ideas in this view is furthermore encountered by the employee multiple times per day which serves as a reminder to submit ideas. Predefined blocks in this view give the employee an overview over idea related topics and can be selected and deselected for the personal standard in the setup menu (App. 5, 2). Additionally, a user can answer a challenge and submit an idea in response in the block "challenges" (App. 5, 3). In this overview the user can also interact with the IMS to view the ideas they submitted previously in the block "my ideas" (App. 5, 4). The user can view information about the ID, subject, status of the idea and can filter ideas. They can open the respective ideas by clicking on the subject and view details about the object in a separate window. In the block "current reminders" (App. 5, 5) the user can answer requests for which they are the recipient.



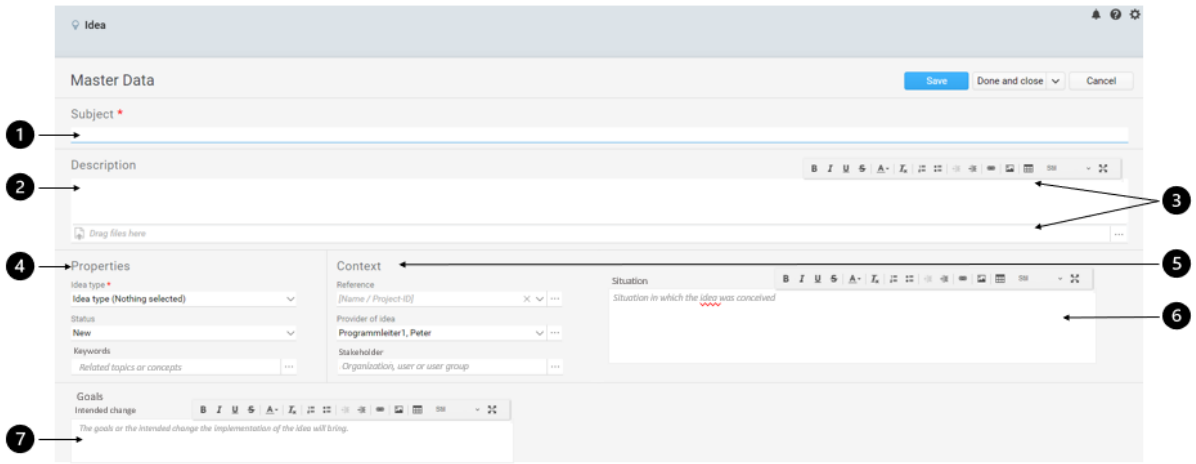
Appendix 5: Personal Overview of a User

When submitting an idea, the tacit knowledge in the sources mind is codified and presented in the IMS. For the efficient and effective processing of the idea in the next stage of the IMS, the quality of the information presented by the source should be high and meet the requirements for quality at entry. This is required because information about the idea is a formative of the idea which directly impacts idea quality (cf. 4.1). In chapter 4.1 it was outlined that the presentation of an idea benefits from the use of attributes and relationships and a thematic perspective enables the understanding (Martins et al., 2015, Froehlich et al., 2016). This can be achieved through an interface offering multiple text boxes and selection fields in in Projektron BCS in which the source can present the idea. The source is required to fill the fields of subject (the title of the idea) and the idea type (each marked by the red asterisk). Additional fields may be filled by the source at their discretion. The findings indicate that pre-defined fields that guide the source in the presentation of the information, and which enable the categorization of the information provided are beneficial for the quality of information. Furthermore, an instructional text supports the correct presentation of the idea. In Projektron BCS a page help serves this purpose as shown in App. 6.

Appendix 6: Instructions for submission of ideas

The subject of the idea is its name and serves as an identifier. It is a text-based attribute which should describe the idea shortly (App. 7, 1). It is followed by a description fields in which the concepts of the idea are described (App. 7, 2). The rich text editor enables the formatting of the text and additionally qualitative data such as images, videos, sound, and files can be included as recommended by theory (App. 7, 3). In the properties the attributes are defined (App. 7, 4): a type is selected, and a status is chosen from predefined values with string data type fields. The status new is preselected but an idea may be set to “planned” if it is stored for later submission. In a multi-string field related key words can be chosen which contribute to the classification of the idea. In the context (App. 7, 5) relational attributes are set: in a reference field related tasks, projects, products departments, or other objects may be chosen about the idea. The Source of the idea is the person entering the idea, but a different person or person group can be set if the source did not conceive of the idea themselves. Stakeholders is

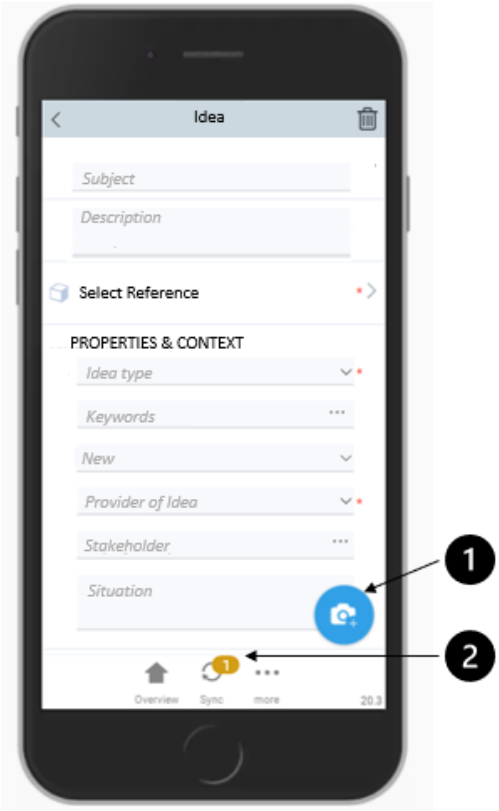
a relational attribute which references objects in Projektron BCS. In this reference either existing products, projects, tasks, organizations, or departments can be the object of reference. The findings indicate that information about the situation in which the idea was conceived



Appendix 7: Form for submitting ideas with predefined fields

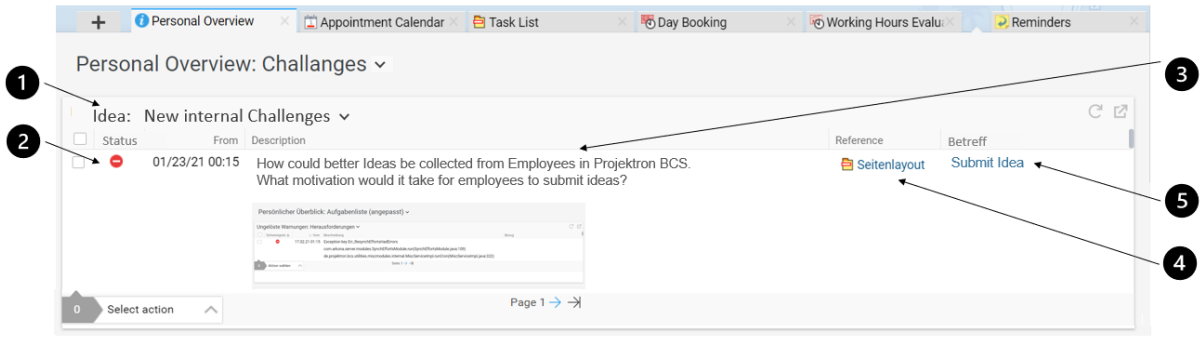
benefits the understanding during processing. The source enters this in the respective text field which supports a rich text editor in which formats, files and links can be added (App. 7, 6). Lastly, the findings indicate that a field in which the source can describe goals or intended changes of the idea is useful (App. 7, 7). Using a rich text editor, the source can outline the intended change.

To enable the submission of ideas within the situation in which it is conceived and thus avoid temporal distortions the mobile application of Projektron BCS must enable the submission of Ideas (App. 8). Additionally, to the fields inside Projektron BCS, the application should offer a picture-functionality with which the situation can be captured (App. 8, 1). While Projektron BCS is a web-enabled software, the app already offers an offline mode (App. 8, 2). In this mode changes to object are stored on the phone and synchronized with the Projektron BCS server when a connection is enabled. This is beneficial for ideas because sources may conceive of ideas at any time.



Appendix 8: Mobile Application of the IMS

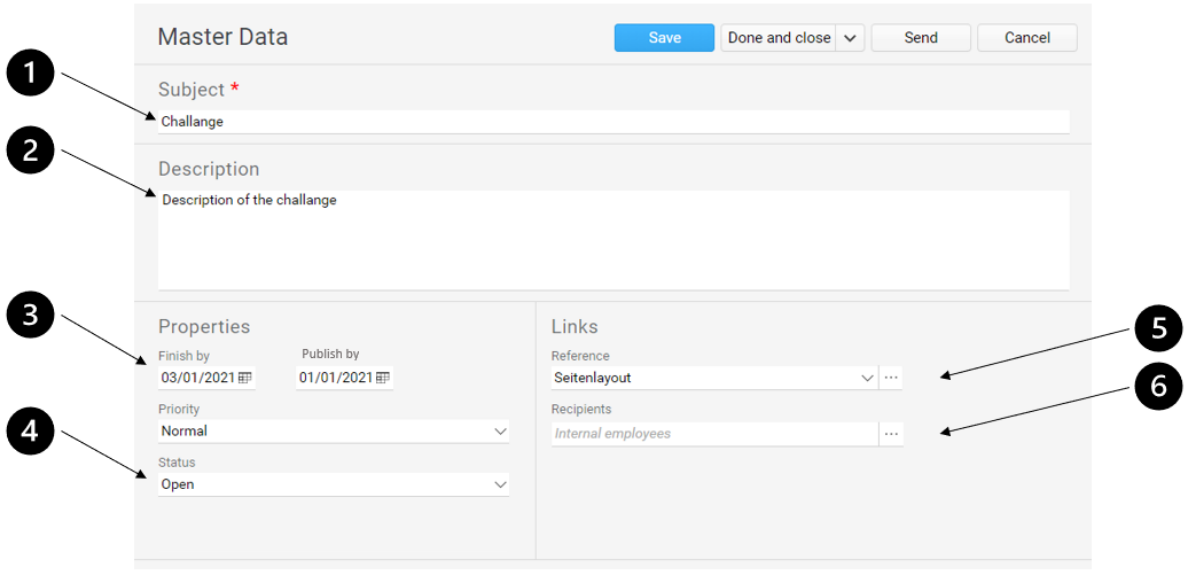
A source can conceive of an idea in a directed, conscious creative process or an unconscious process. The idea is either an answer to an opportunity or a problem. The idea can have its origin in the identification of an opportunity through a proactive action of the source. In the case of Projektron, the source uses an easily accessible interface to enter an idea (App. 7). But an organization may prompt a source to conceive an idea as a reaction to a situation. In this case, the source may react to a stimulation in the environment such as a competition or a brainstorming session. In the case of Projektron this such a reaction can stem from a challenge issued to users inside Projektron BCS (App. 9, 1). Such a challenge has a status of whether it is yet solved (App. 9, 2), a description (App. 9, 3), a reference to a project or other object in Projektron BCS (App. 9, 4) and a link to the interface for entering ideas (App. 9, 5). When the source uses this option, the reference in the idea should be the challenge to enable the tracing of the origin of the idea. Such a challenge must be easily accessible and visible for the user for example in the view "Persönlicher Überblick" which is commonly the first view an employee sees when opening Projektron BCS (cf. App. 7).



Appendix 9: Challanges in Projektron BCS

Administering these challenges, Projektron BCS requires an interface in which the challenge can be entered. An administrator can enter information such as subject (App. 10, 1,2) and a description outlining the scenario or problem for which a solution is searched for. Further parameters are a date by which the challenge is published and closed (App. 10, 3). The setting of a status (App. 10, 4) enables the opening of a challenge manually. Only an idea with the status "open" is shown in the interface of potential idea sources. A challenge in the state "planned" is published at the planned time. Furthermore, a status "closed" is possible for challenges which have expired or have been manually closed – no ideas can be submitted for such challenges. A challenge can include a reference in Projektron BCS to another object (fig. x, 5). This can be for example a product or a project. Due to a reference, challenges can be sorted by reference and a user conceiving of the idea can observe the object of the challenge

additionally to the description. Lastly, a set of recipients can be selected (App. 10, 6). Either one or multiple single users or groups can be selected.



Appendix 10: Administering Challanges

P. Idea Screening in Projektron BCS

The screening of an idea follows the capture. During the screening, the idea is subject to a gate which integrates the activity of screening. During this phase, the idea has the status “screening”.

The screening is conducted by a screener. The IMS administrator can assign a screener from a pool of screeners based on the idea’s attributes. When a user is assigned the relation “screener” to an idea the user gains permission to view and edit the idea.

Firstly, the screener screens the idea profile (App. 11, 1). The IMS presents information entered by the source in a concise profile. In addition, the screener views the idea properties and can correct them (App. 11, 2). The properties display the state of the idea and the screener. The screener can decide to adjust keywords and the idea type according to organizational guidelines because he may have better insight into the categorization of ideas because he is a specialist. The screener also views the idea context including reference, source, and stakeholder (App. 11, 3). He can adjust reference and stakeholder based on his specialist knowledge. He can also view additional information about the source to enable insights into the source’s characteristics which may support processing decisions (cf. 5.3.2). For example, if the source is a specialist, higher trust is placed in the source’s qualification and the IMS should process the idea in a chain.

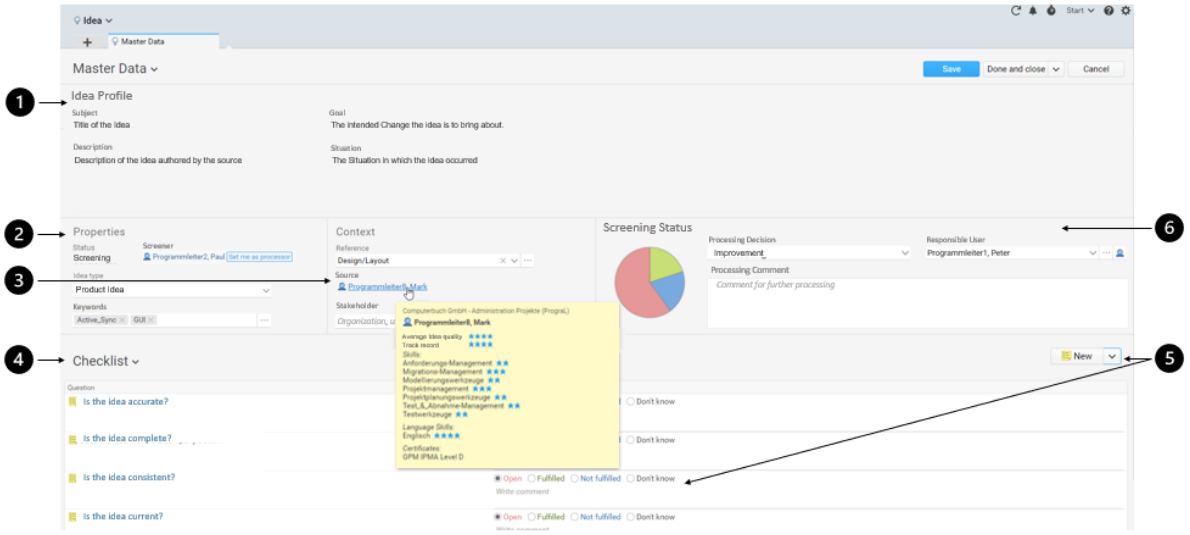
The screening measures the quality of information (cf. 3.2.4, 5.3.2) to which a quality standard appliles: the quality at entry. The findings indicate the dimensions completeness, accuracy, consistency, and currency of the information to assess information quality (Batini & Scannapieco, 2016). The standards are set in accordance with the organization and the organization configures a checklist (App. 11, 5). The checklist item can be open (not assessed yet), met, not met, or unknown and the screener adds a text-based commentary explaining the reasoning. Depending on the results, the screener conducts a processing decision and tracks the decision in the screening status (App. 11, 6). The following outputs are possible:

1. **Evaluation**: If the idea it meets the standards it is then is an input for the evaluation process and the IMS assesses the idea quality.
2. **Selection**: If the screener decides for Selection, the IMS skips the processing steps of improvement and evaluation because the quality of the idea is visible, and it meets the standards of quality and quality of information.
3. **Improvement**: The output of the screening process is the need for improvement of the idea if the idea meets the standards partially. A comment is added to the standards which are not met.

4. **Shelfing**: The screening process result in the shelfing of an idea if it meets the standards for quality at entry but does not fulfill a current need or solve a current problem. The idea receives the state “shelved” and is stored for future use and can become the input for the screening phase.
5. **Termination**: A screening process results in the termination of the idea if it does not meet the standards. A terminated idea receives the state “terminated” and is not processed further. It is stored for future analysis.

Depending on the output, the screener also sets the user responsible for the next phase. The screener can therefore decide for the role that should conduct the further processing. This is relevant for example when open questions require the improvement of the idea by its source. The screener adds the source, and the source receives the idea again in the state “improvement”.

The screener can also set integrity constraints for the improvement by adding items to the checklist, which the responsible role needs to fulfill for the idea to process to the next stage (App. 11, 5)

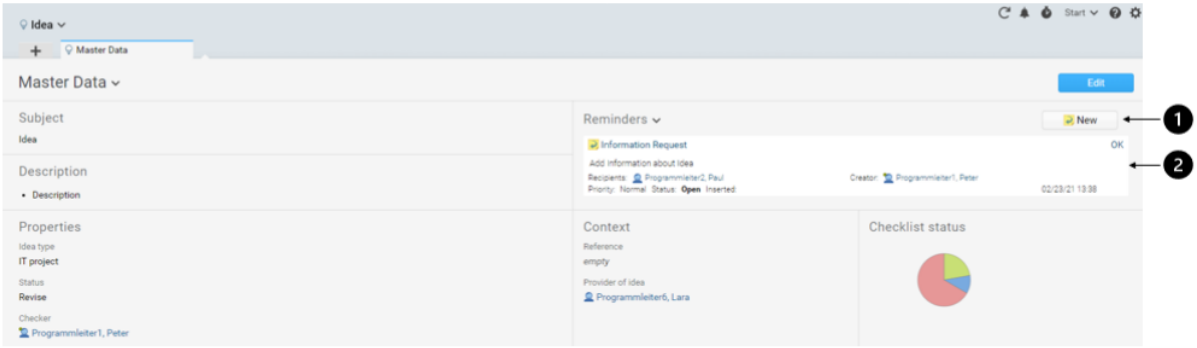


Appendix 11: Idea Screening in Projektron BCS

Q. Idea Improvement in Projektron BCS

In the findings I outline 3 methods which an organization should use to improve the quality of information of an idea and refine the idea.

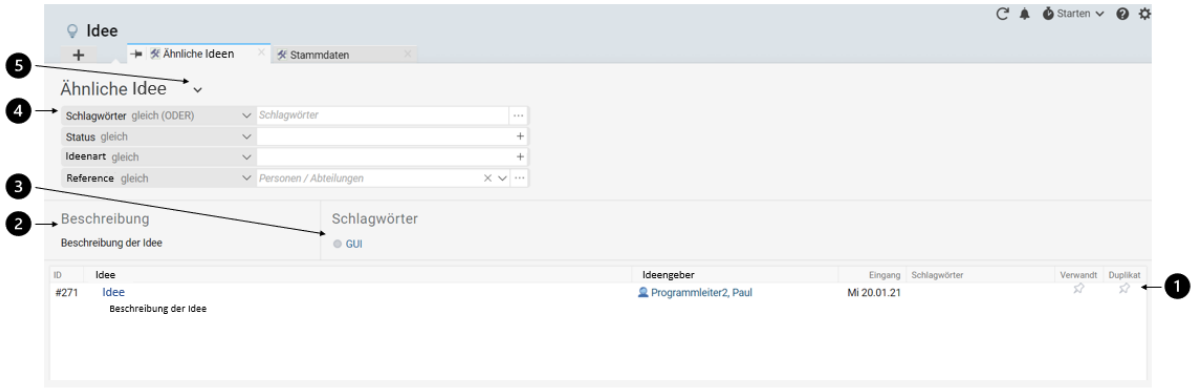
Firstly, additional information contributing to the knowledge about an idea can be acquired in an information acquisition activity (Batini & Scannapieco, 2016). In the case of Projektron BCS this is for example a functional expert who has specialist knowledge about topics related to the idea. If this expert is a user of Projektron BCS, the build-in tool of reminders can support the improvement. Reminders should be integrated with the idea (App. 12, 2). A reminder enables the submission of a question to another user or a group of users with a reference to the idea (App. 12, 1). The user can send the reminder also via E-Mail and the answer is received by the sending user.



Appendix 12: Information acquisition through reminders

The second approach to idea improvement is object identification. The IMS compares information available about the idea to a similar source which is known to be good (Batini & Scannapieco, 2016). The IMS in Projektron BCS enables the identification of similarities between ideas and therefore the identification of similar ideas as well as duplicates (App. 13, 1). The IMS assesses similarity between ideas according to similarities of the characteristics of the ideas (Type, keywords, reference, stakeholders). By additionally utilizing natural language processing (NLP) Projektron BCS can identify similarities based on the descriptions and titles of the idea (App. 13, 2). A tool for NLP is already integrated in Projektron BCS for finding similar or duplicate tickets and can be applied to the IMS. Additional attributes utilized for the identification of similar ideas in Projektron BCS can be keywords and references in the idea (App. 13, 3). The improver selects duplicates and similar ideas and can combine information from an object with the idea. This also enables the recombination of ideas. It must be possible to manually search for ideas as well. In Projektron BCS, filters support this (App. 13, 4).

Additional to the shown filters for keywords, status, type and reference, additional filters such as a full-text search and Stakeholder can be activated in the object menu (App. 13, 5).

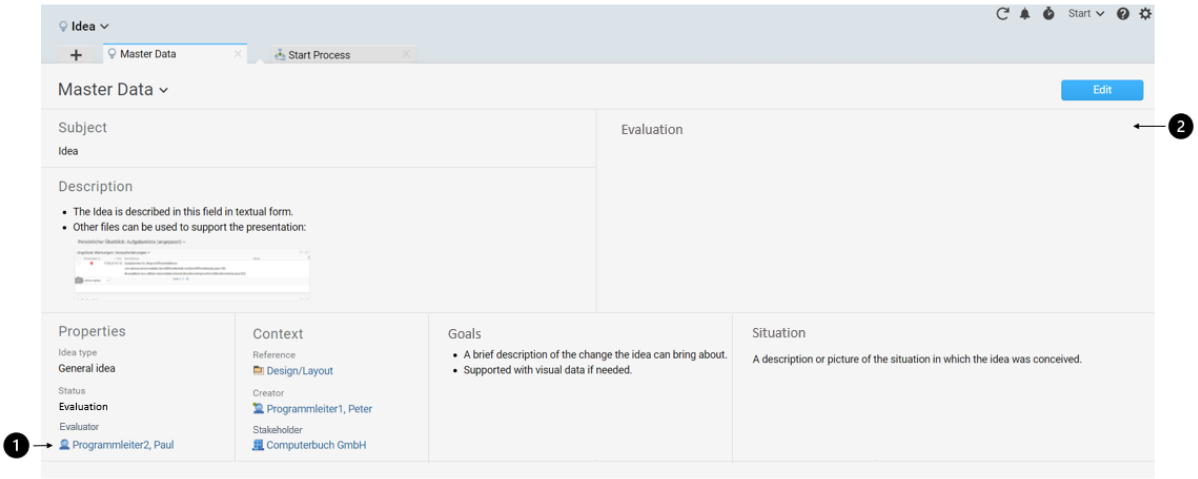


Appendix 13: Object identification in Projektron BCS

The third approach is the integrity constraint during which criteria are set against which the information in the idea is measured (Batini & Scannapieco, 2016). In Projektron BCS this takes place during the screening of the idea (cf. Appendix Q). When the idea contains inaccurate information, the error is localized by the improver and corrected or sent to the source with a request for correction.

R. Idea Evaluation in Projektron BCS

The input for this phase is the screened or improved idea. Information about the idea include relevant facts and judgmental information which must be part of the presentation (Williams & Samset, 2010). In Projektron BCS, information about the idea is summed up in the master data of the object (App. 14).

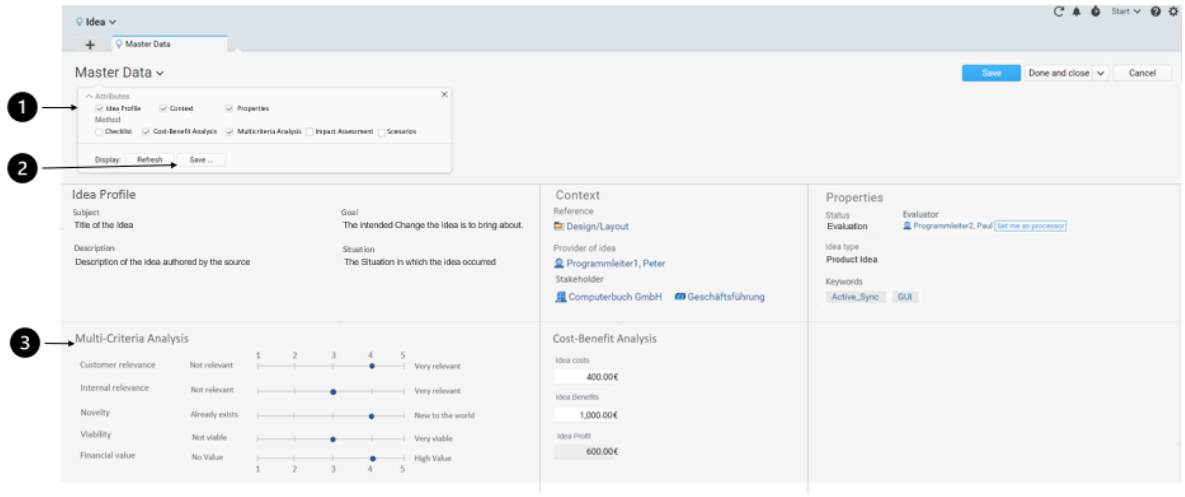


Appendix 14: Masterdata of the Idea

The evaluation phase has one or multiple evaluators (cf. 3.3.4, 5.3.4). The evaluator is shown in the properties of the idea (App. 14, 1). In the case of Projektron GmbH, the evaluator is a field expert for the topic of the idea. The attribute evaluator can also be adjusted during the evaluation. If, as is the case for Stiftung Warentest, the evaluation is conducted in mixed group setting, a group can be the evaluator. Also, the evaluation by user communities is possible. In this case a user draws an idea from a pool of evaluation ideas and the OID of the user is automatically added as an evaluator.

The evaluation which the idea is subject to is conducted in the block Evaluation (App. 14, 2). The evaluation integrates a method depending on the organization (cf. 3.3.4, 5.3.4, Appendix F). I show the relevant methods discussed in the findings in the following subchapters. Projektron GmbH can customize such methods for each organization and add additional methods if required.

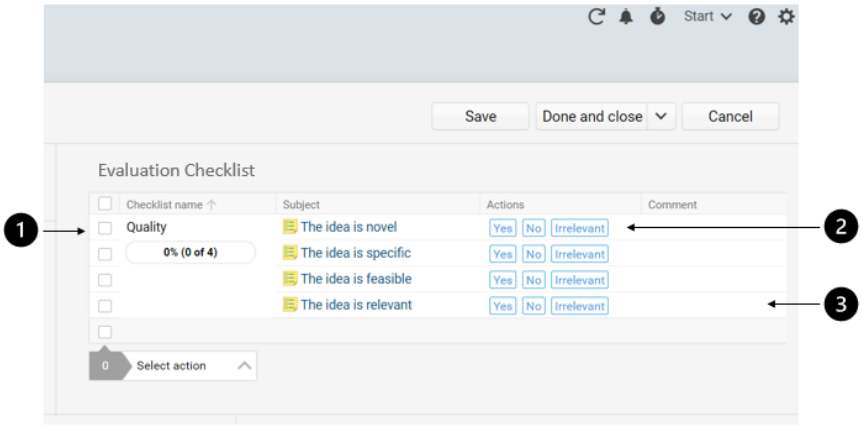
When configuring the IMS, an organization can choose which preset to choose and select on or multiple blocks for evaluation (App 15, 1). By clicking save the user can save the preset for himself or – if he is an administrator – save the preset for a user group or all users. The evaluation method blocks are then displayed in the master data of the idea (App. 15, 3).



Appendix 15: Selection of Evaluation Method

Checklist:

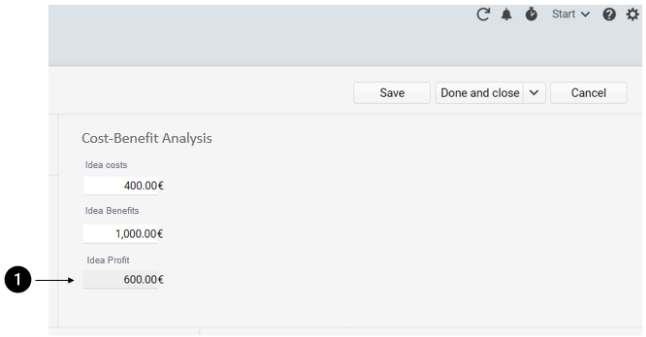
In the case of Projektron GmbH, a checklist is utilized for the evaluation of ideas. Such a checklist implemented in an IMS can have a set of criteria (App. 16, 1). These criteria can be defined for each organization individually and can be adjusted according to the type of idea being evaluated. As outlined in Appendix F., a checklist is clear, objective, and credible and enables the comparison in between ideas. But the attributes of the evaluation are narrowly defined, and the evaluator is required to choose one of two options or declare the checklist item as irrelevant (App. 16, 2). The scope of this method can be broadened and enable a distinct evaluation for every idea through a comment functionality.



Appendix 16: Evaluation Checklist

Cost Benefit Analysis:

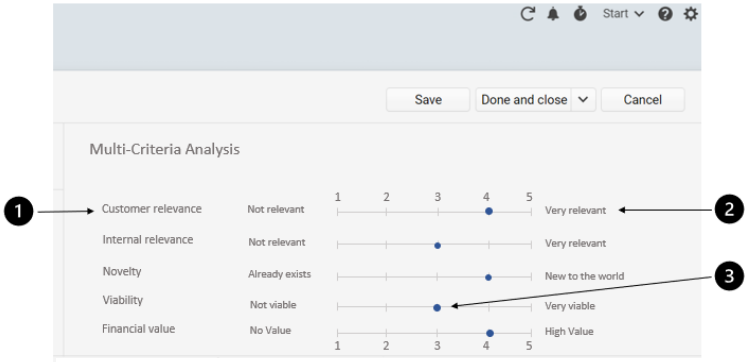
A second method, which uses important indicators for project success in the front-end is the cost-benefit analysis. Such an analysis has high acceptance among decisionmakers. Based on available information estimates about monetary costs and benefits are made by the idea evaluator. From this the potential profit is calculated by the software (App. 17, 1). Nevertheless, such a method should be used in combinations with others because according to Flyvbjerg (2013) the accuracy of such estimates is doubtful.



Appendix 17: Cost-Benefit Analysis

Multi-Criteria-Analysis:

A flexible but formal evaluation method is the multi criteria analysis. It is a systematic and objective method which enables the comparison between ideas. Depending on the criteria chosen in the organization (App. 18, 1), the evaluation can reflect multiple perspectives through different criteria dimensions. Each of the dimensions is rated on a scale (App. 18, 2) that enables the quantification of the results (App. 18, 3). In the case of Projektron GmbH for example, customer relevance, internal relevance, novelty, viability, and financial value are important criteria. The use of criteria is a recommended option because it also enables ranking and portfolio approaches based on the numeric results of the multi-criteria-analysis. Furthermore, it enables independent analysis by different evaluators and the calculation of averages for each of the dimensions.

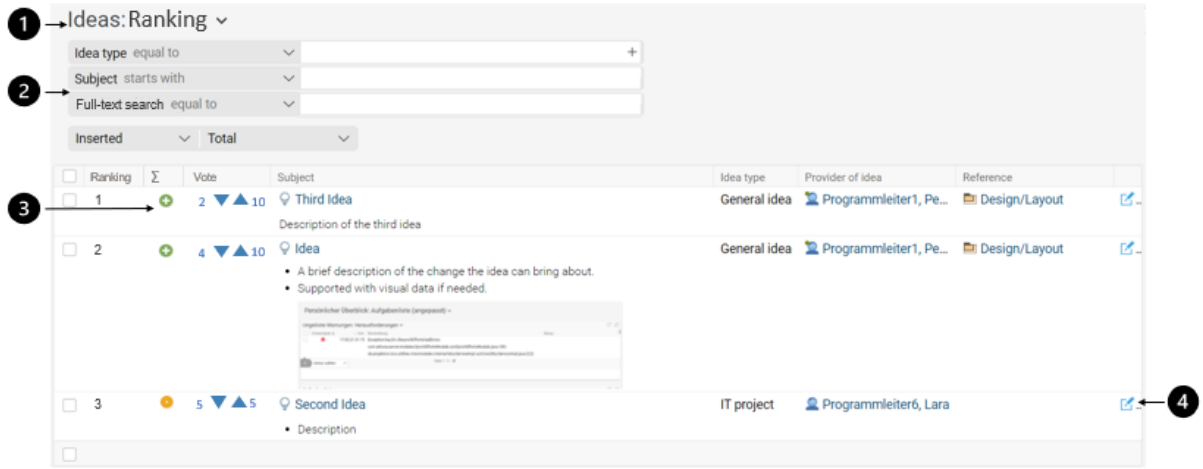


Appendix 18: Multi-Criteria Analysis

Intuitive Ranking:

A method which enables the processing of a high number of ideas is the intuitive ranking (Eling et al., 2015). The user compares ideas in a pool with each other. If there is a high quantity of ideas a collection of idea must be set accordingly by sorting or filtering ideas (App. 19, 1). In the case of Projektron BCS, such filters should include idea type, subject and a text search (App. 19, 2). A relevant collection enables the comparison between similar ideas according to their attributes (for example idea type). The IMS administrator can create presets

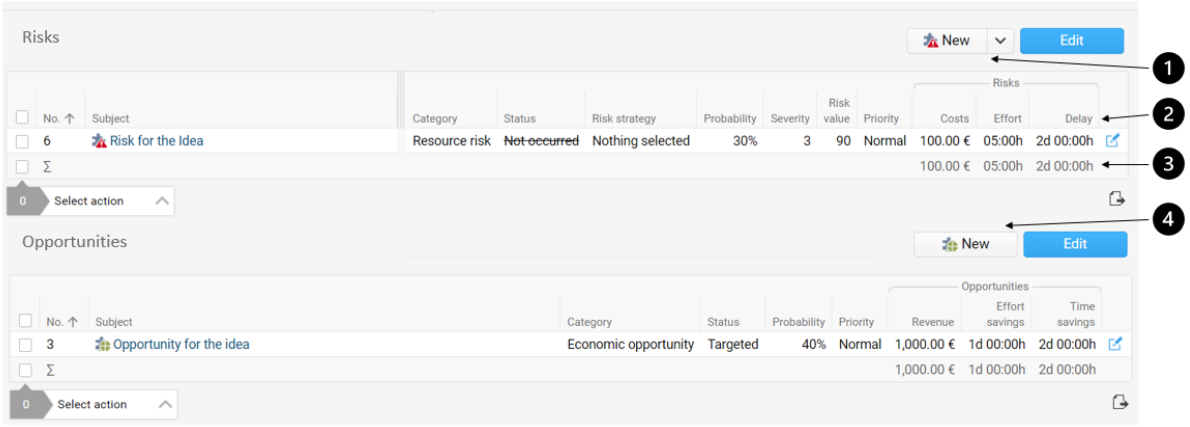
for the filters to ensure the appropriate user group views a collection (App. 19, 1). Each idea is moved up or down by the evaluator which results in a ranking in the list (App. 19, 3) This stage can be combined with the improvement stage if the organization enables the editing of ideas in the same list view. By clicking on the edit symbol, the respective improvement views open (App. 19, 4). This method is applicable in cases where due to the high quantity of ideas only a limited number of the best ideas can be proposed for selection. Alternatively, this method is applicable when ranked lists of options for a problem / opportunity is needed. This method is also the base for most network-based configuration because the results can be aggregated easily and a dynamic list enables users to interact with the ideas easily.



Appendix 19: Intuitive Ranking of Ideas

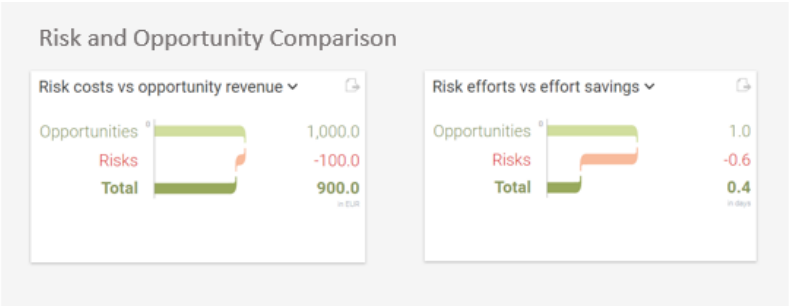
Risk and Opportunity Analysis:

A method which focuses on the environment of the idea is the risk and opportunity analysis. In the case of Projektron, it is already common to conduct a risk and opportunity analysis during the project preparation phase. An organization can utilize a similar method for the evaluation of the idea as for example CF indicates. A user can add a new risk to a list of risks (App. 20, 1) and the quantification is presented in the case of Projektron BCS with the field's probability and risks and its sub attributes costs, effort, delay (App. 20, 2). The values of the risks are summed up by the software (App. 20, 3). Similarly, the user can record new opportunities (App. 20, 4). For opportunities, the attributes probability and risks and the revenue, effort savings and time savings are relevant.



Appendix 20: Risk and Opportunity Analysis

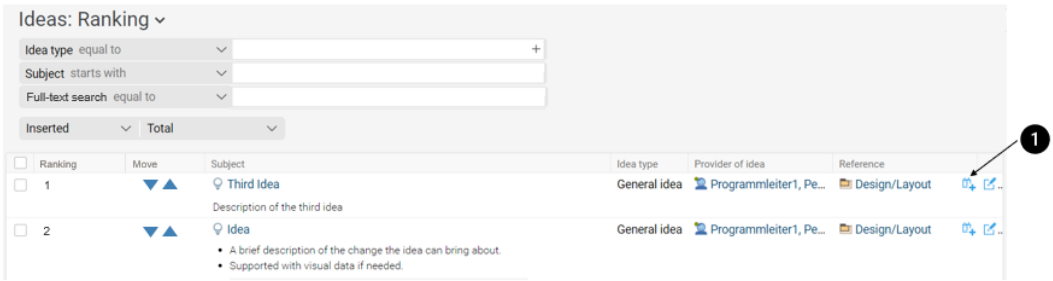
The IMS sums up the output of the risk and opportunity analysis and exports it as a diagram (App. 21). By analyzing the risks and opportunities. The risks an opportunities are presented in monetary terms and can therefore complement the cost-benefit analysis.



Appendix 21: Presentation of the Risks and Opportunities

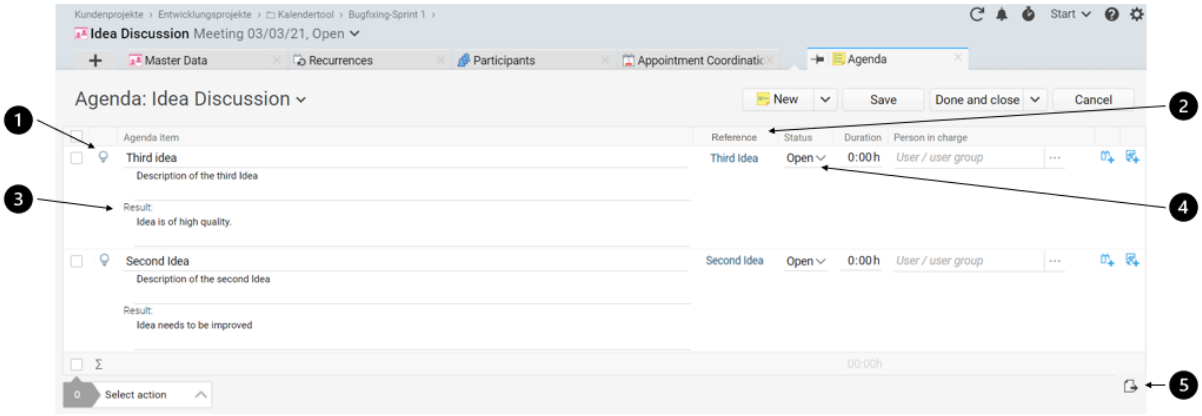
Discussion:

As is the case for SW, a discussion meeting can be the base for the evaluation. Multiple specialists discuss several ideas, evaluate them, and track the results. For this, the appointments in Projektron BCS are suitable. In preparation for the discussion, a user screens the list of ideas and adds ideas to an appointment agenda (App. 22, 1).



Appendix 22: Idea list with button to add ideas to appointment

After clicking on the button to add the idea to an appointment, a window opens in which the user can choose the appointment agenda to which the idea should be added. The agenda of the appointment is accessible to all attendees (App. 23, 1). The description of the idea can be viewed in the Agenda or the idea and its master data can be opened using the reference (App. 23, 2). The ideas are discussed in the meeting and results can be recorded in the agenda (App. 23, 3) and the status of the idea can be changed to enable further processing (App. 23, 4). From the discussed ideas a pdf report can be created and exported (App. 23, 5).

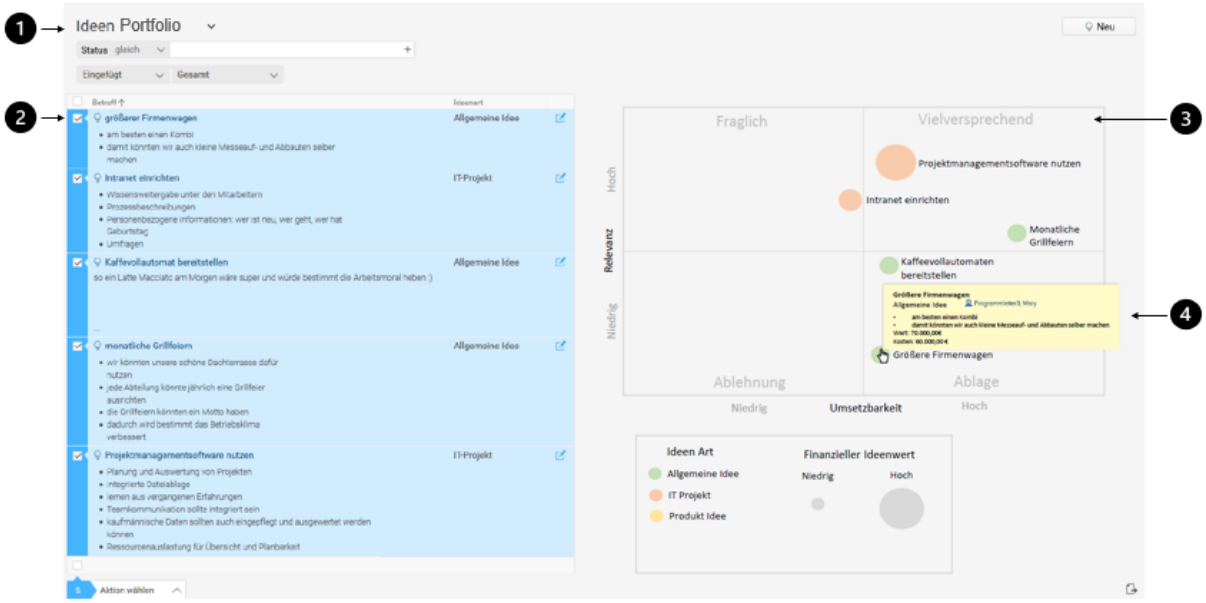


Appendix 23: Ideas in a Discussion Agenda

S. Idea Selection

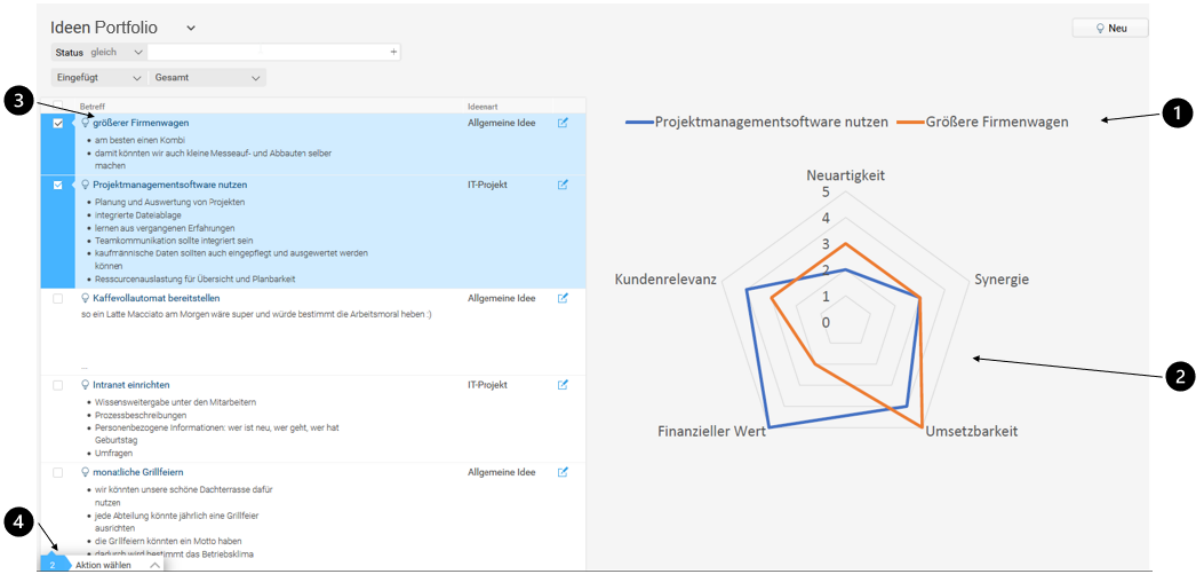
In the selection, a decision maker views an ideas or multiple ideas and selects one or multiple ideas to create a project or integrate the ideas in an existing project.

The findings show that the decision maker requires a collection of evaluated ideas that meet the quality standards and views their presentation. It is beneficial for the decision maker to utilize a portfolio view to get an overview over all relevant ideas (App. 24). He can access the bubble diagram in the work area Projects and display a view that summarizes all relevant ideas. The decision maker can choose from presets for the display of the ideas and select filters (App. 24, 1). He can for example change the criteria by which the ideas are displayed in the diagram. He can choose which ideas he wants to display by selecting the checkboxes (App. 24, 2). The IMS displays the selected ideas in the diagram (app. 24, 3). When hovering over an idea, details about the idea appear in a tool tip (App. 24, 4).



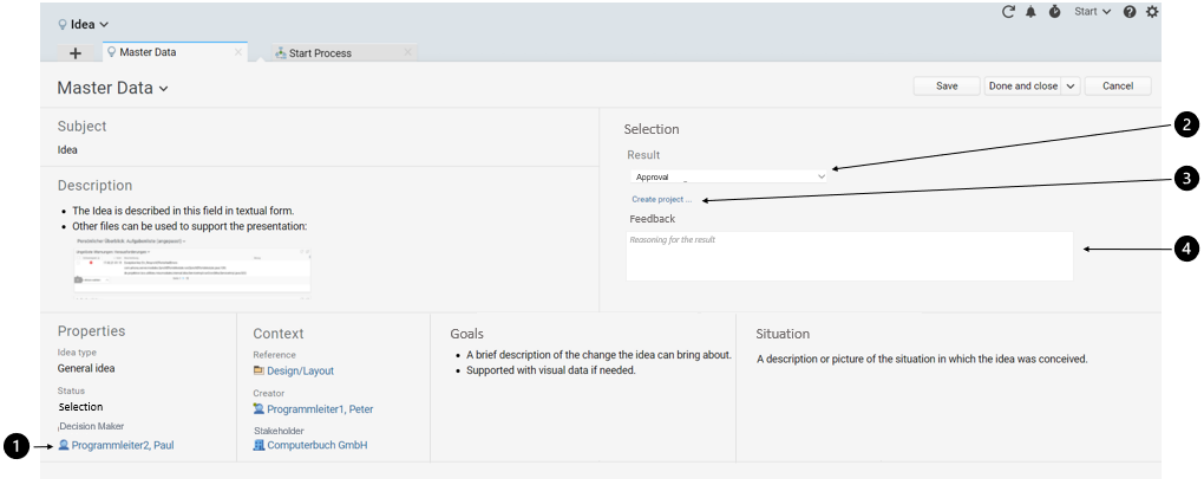
Appendix 24: Bubble diagramm of ideas

An alternative presentation is for example the spider diagram (App. 25). The decision maker selects the ideas and displays ideas color coded (App. 25, 1) in a spider diagram which can display up to five criteria based on the multi-criteria analysis (App. 25, 2). The criteria are dependent on the criteria of the multi-criteria-analysis. When a decision maker wants to select an idea, he has two options: Firstly, he can enter the object view of the idea by clicking on it and conduct the selection in this view (App. 25, 3). Secondly, he can select the idea one or multiple ideas and select “choose action” and select the appropriate result for the idea (App. 25, 4).



Appendix 26: Spider diagramm

In the object view of the idea, the decision maker (App. 26, 1) can screen the detailed information about the idea and select the result (App. 26, 2). The decision maker can also create a project directly from the idea by clicking "create project" (App. 26, 3). This will open a window in which additional information required for the formation of a project is entered. In addition, the decision maker should record feedback and a reasoning for the processing decision (App. 26, 4).



Appendix 25: Idea selection in the Object view