

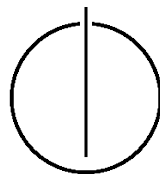
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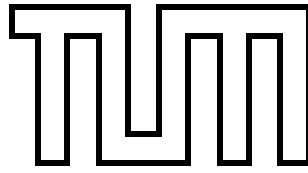
DER TECHNISCHEN UNIVERSITÄT MÜNCHEN

Master's Thesis in Wirtschaftsinformatik

**Empowering Users to Collaboratively
Structure Innovation Processes**

Alexej Utz





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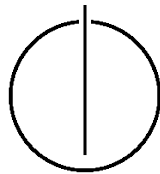
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Empowering Users to Collaboratively Structure
Innovation Processes

Befähigung von Nutzern zur Kollaborativen
Strukturierung von Innovationsprozessen

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Ich versichere, dass ich diese Masterarbeit selbständig verfasst und nur die angegebenen Quellen und Hilfsmittel verwendet habe.

München, den 23. Juni 2014

Alexej Utz

Acknowledgments

I would like to take the opportunity and give special thanks to my advisor Matheus Hauder who guided me throughout the entire project and showed great patience in our discussions.

In addition, I would like to thank the DATEV eG, that provided valuable insights into the company's internal processes and allowed for an interesting topic.

Finally, I would like to give special thanks to my family and Maria Kozlova for the support throughout my whole studies.

Abstract

Innovation has a tremendous impact on companies and society. The ability to innovate is considered as the most important growth driver and a key requirement for competitiveness. Rapid technology shifts and short product lifecycles necessitate continuous innovation, that is characterized by a high complexity. Mastering that growing complexity is a tough challenge, that many organizations struggle to overcome. Managing innovation is therefore a risky and difficult task. There exists a variety of process models for that purpose. Many of them are based on the stage-gate process that applies process-management methodologies to the innovation process consequently adding structure and increasing transparency. However, the widely adopted stage-gate process introduced in 1990 is unable to meet modern challenges due to its rigid nature. The constantly changing market environments and customer preferences dictate new requirements for organizations. Nowadays they must feature agile and flexible business processes and structures. Therefore a new-generation of the stage-gate process was introduced. It provides flexibility and supports adaptability in the innovation processes.

The main goal of this thesis is to develop a prototypical solution for the innovation process at one of the leading software companies in Germany, while the last generation of the stage-gate process provides the basis for implementation. Apart from the specific requirements requested by the cooperation partner, the required features include comprehensibility: business users without prior modeling experience must be able to modify the process. Another key requirement for the tool is the ability to apply changes during the run-time of the system as opposed to design-time modification. Furthermore, collaborative capabilities are intended to foster creativity and increase productivity. A prototypical implementation with regard to these requirements is presented and finally evaluated together with representatives of the cooperation partner.

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Part I.

**Innovation as knowledge-intensive
Process**

1. Introduction

The Industrial Revolution gave birth to the concept of mass production in the late 19th century. This concept assumes a large investment of resources into preparation for an efficient and automated production process. The high up-front costs are later amortized through a large number of manufactured products. The concept of mass production served as a basis for scientific management introduced by Fredrick Winslow Taylor. Its main idea is a thorough beforehand analysis and optimization of work. Every single process step must be understood and precisely described before the actual execution. The description of work is used as a plan for process automation and production of qualitatively identical goods. This allows for a high efficiency and productivity. The industrialized society dominated by mass production has, however, become history, making rigidly specified organizations with fully defined business processes vulnerable in the face of constant change [44, 15].

Modern organizations have to keep pace with a continuously increasing amount of complexity that is driven by constantly changing market environments. They have to provide flexibility and adapt to change in order to stay competitive. Constantly improving organizations are referred to as learning organizations. Instead of defining their business processes once and for all they continually measure and improve the performance. Such organizations embody the concept of anti-fragility i.e. they become better when subjected to stress. In today's turbulent times of global economy such stress is generated by tough competition, rapid technology shifts, unexpected consumer behavior, fluctuating market situation and other factors [47].

Things that become better as a result of stress are also known as complex adaptive systems. Anti-fragility is their emergent feature. Complexity distinguishes such systems from their machine-like counterparts. Machines may be complicated, but it is always possible to decompose them into single components that are themselves easily comprehensible and their behavior, at a certain level of granularity, is defined by very simple rules. Machines do not adapt to change, but either break or resist stress representing the concepts of fragility or robustness. Complex systems, instead, feature a dynamic nature and cannot be understood by simply looking at their single parts. They learn and flexibly adapt to situations. Although organizations represent complex systems, they are often treated as machines by their management. The applied tools are, for the most part, based on the approach of scientific management, which is appropriate for mass production and machine-like systems. They are therefore suitable for highly predictable and repeatable processes. Learning organizations are, in contrast, characterized by a declining amount of routine processes. Knowledge is increasingly playing a key role for them [47].

1.1. Motivation

“The most valuable asset of a 20th century company were its production equipment. The most valuable asset of a 21th century institution, whether business or non-business, will be its knowledge workers and their productivity” [14]. Although knowledge work plays such an important role, most organizations hardly manage to leverage it.

Knowledge is different from all other resources, since it constantly depreciates. Hence the work and the involved processes must change as fast as knowledge does. In contrast to routine work, whose repeated instances have a high degree of similarity that enables automation, differences between the process instances of knowledge work are much higher than their similarities. This makes up-front modeling and process automation useless, since the additional efforts for managing the differences overwhelm the advantages of automation [44].

The current tool support for knowledge work is insufficient and can hardly facilitate it. Most of the applied tools are based on the principles of scientific management. They are not adequate for the up-to-date requirements. The decisive limitation of such tools is the need for up-front modeling of the processes. It works for routine work with repeatable and predictable processes, but contradicts with the ideas behind knowledge work. The full automation that utilizes formalized work processes prevents the ability to do what is actually needed. The business community is starting to realize that the most business processes cannot be modeled beforehand. Routine processes are estimated to make up only about 20%–40% of the overall processes in modern organizations [44]. Nevertheless, many of them apply tools that are based upon inappropriate principles to support knowledge intensive processes. More than this, such processes are frequently not supported at all [21].

The two key principles that will shape the next generation of software tools are “design for people” and “build for change”. That way, new tools must adapt to the way people want to work, not vice versa, as well as allow fast changes to keep pace with new business requirements [38]. There is not only a strong need for new technology that will facilitate knowledge work but also for a new way of thinking: instead of imagining how new technology can be used in the existing environment for existing use cases, it is rather important to imagine how new tools would change the organization itself. By applying new tools and attitude towards the unpredictable, uncertainty stops being a threat and the ability to manage it becomes a competitive advantage. Therefore instead of trying to make all the decisions in advance, the decision makers should be provided with all the necessary resources to be able to make the right decisions at the right time [44].

One is tempted to ask why does knowledge work require tools for its management since it is unstructured and cannot be automated? The value of process management for routine work is clear: the better up-front analysis and optimization the higher the efficiency and productivity of the consequent process execution. But there is more than just automation. The management of knowledge work is necessary to achieve understanding, control and visibility over the business processes employed by an organization, thus increasing the productivity of knowledge workers [44].

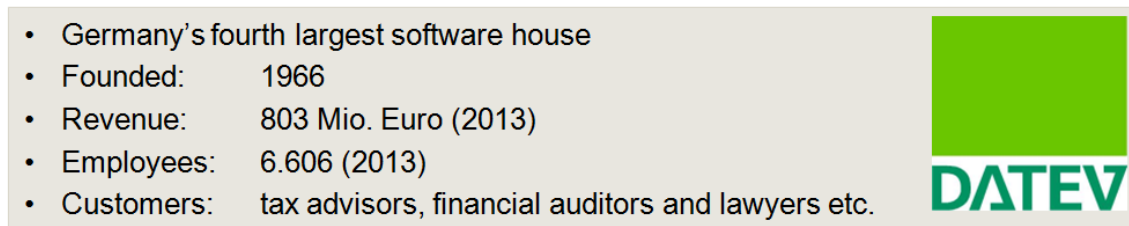


Figure 1.1.: Facts about DATEV

1.2. Problem Description

Management of innovations is extremely knowledge intensive and characterized by a high uncertainty. It requires a high degree of freedom for creativity and is therefore a prominent example of knowledge work. "There is no such thing as a logical method of having new ideas, or a logical reconstruction of this process. My view may be expressed by saying that every discovery contains 'an irrational element', or 'a creative intuition'" [39]. No predictability and repeatability can be expected, as it is highly unstructured and therefore difficult to manage. At the same time innovation management is central to the success of a company. The world is undergoing significant technology shifts at a great pace. The lifecycles of modern products are constantly decreasing. To keep that pace organizations have to innovate and manage their innovations to make them productive and sustainable [44, 30].

This thesis is conducted in cooperation with DATEV eG which is one of the largest software companies in Germany. The company employs about 6.5 thousand people. Its main customers are financial auditors, tax advisors and lawyers. A brief overview of the facts about the company is given in Figure 1.1. DATEV embarked on its innovation management journey in the early 1990's. Today, innovations are coordinated by the department of strategic company development, with the head of this department being present in the management board of DATEV. The company resides in the city of Nuremberg, which has quite a long record of once large and successful companies that went bankrupt because of insufficient innovation management. This serves as an additional motivation and stresses the high importance of innovations for DATEV. The core of its tool support for innovation process is formed by two custom software solutions. The tools basically provide functionality for submission and evaluation of ideas for improvement. Both solutions exhibit numerous shortcomings and represent areas for improvement. One of the major drawbacks of the existing tools is the lack of flexibility, which is common for traditional process management tools that are applied to support knowledge intensive processes. A simple sequential workflow execution is implemented. Thus the innovation process, being highly unpredictable, cannot be performed effectively. DATEV is working on a new solution since no standard software (commercial off-the-shelf product) fulfilling their requirements could be found.

1.3. Research Scope and Objectives

The goal of this thesis is to develop a prototypical solution for the integrated innovation process at DATEV. First, a conceptual solution addressing the identified shortcomings of the current tools will be produced. The resulted concept will be implemented on the basis of a prototypical process management tool developed at the chair of Software Engineering for Business Information Systems at the Technical University of Munich. The research prototype is implemented following the concept of adaptive case management (ACM). This approach promises to meet the requirements for successful management of knowledge work. The final result will be evaluated together with DATEV's employees. The fulfillment of functional requirements, comprehensibility of the solution as well as the achievement of flexibility objectives and feedback for the future work represent the major topics for evaluation. The research objectives for this thesis therefore include:

- Development of a conceptual solution for integrated innovation process at DATEV
- Prototypical implementation of an ACM-based solution for support of the integrated innovation process at DATEV
- Evaluation of the implemented solution

1.4. Structure of the Thesis

In the first part the fundamentals required to comprehend the topic are presented. The theoretic part describes the nature of knowledge work and challenges associated with its management. Moreover, it explains the specifics of ACM as the core technology for implementation and the basics of innovation processes in general. Furthermore, the status quo of the innovation process at DATEV is analyzed. The first part is completed with the related work on management of innovation processes from academia and practice.

The second part of the thesis targets the first research objective – the conceptual solution. The description of the concept for the integrated innovation process is divided into three chapters. The first one contains the use cases and scenarios covered in the solution. The second chapter comprises the formal process definition. The implementation requirements are presented in the last chapter.

The actual implementation of the prototypical solution, i.e. the second research objective, is addressed in the third part of the thesis. It describes how the adaptive nature of ACM is utilized for the realization of the DATEV's innovation process, explaining the corresponding technical and functional details.

Finally, the evaluation of the implemented solution conducted in cooperation with DATEV's employees, including the results, is presented. The thesis is completed with a conclusion and some ideas for the future work on the topic.

2. Overview

This chapter describes the basic concepts underlying the thesis. First, the notion of knowledge work and its difference from routine work is introduced. Furthermore, this section explains why traditional process management tools fail at supporting knowledge work. The second part presents the approach of adaptive case management (ACM) that provides the basis for implementation of the solution. In the third section the basics of innovation processes are explained.

2.1. Knowledge Work

In the recent decades knowledge work has attracted a lot of research attention. The increased interest is caused by the belief that the proper usage of knowledge is critical to economic success in post-industrial societies. Knowledge work primarily comprises the activities of acquisition, processing, refining, packaging, and transfer of knowledge [46].

2.1.1. References

There exist various and ambiguous definitions of knowledge work. Two major categories may be distinguished. On the one hand knowledge work is defined by the means of professions that are associated with it. This approach is usually found in the origins of research. On the other hand, knowledge work is described by common descriptive characteristics. Such definitions are often found in more recent publications [46].

After the concept of knowledge work was introduced in the late 1960s, it was often used as synonym to white collar work and as opposite to manual work. The definitions referred to specific occupations characterized by special skills, high level of education and the use of theoretical knowledge. In [12] the following definition is given: “Knowledge worker have high degrees of expertise, education, or experience, and the primary purpose of their jobs involves the creation, distribution, or application of knowledge.” Knowledge work encompasses traditional professions such as accountancy, lawyers or scientific work as well as the more contemporary ones: consultancy, software development, or public relations [46].

Instead of classifying special occupational categories for knowledge workers, the second group of definitions emphasizes their common characteristics. Following points are identified:

- processing of large amounts of information
- use of information and communication technologies
- problem-solving capabilities

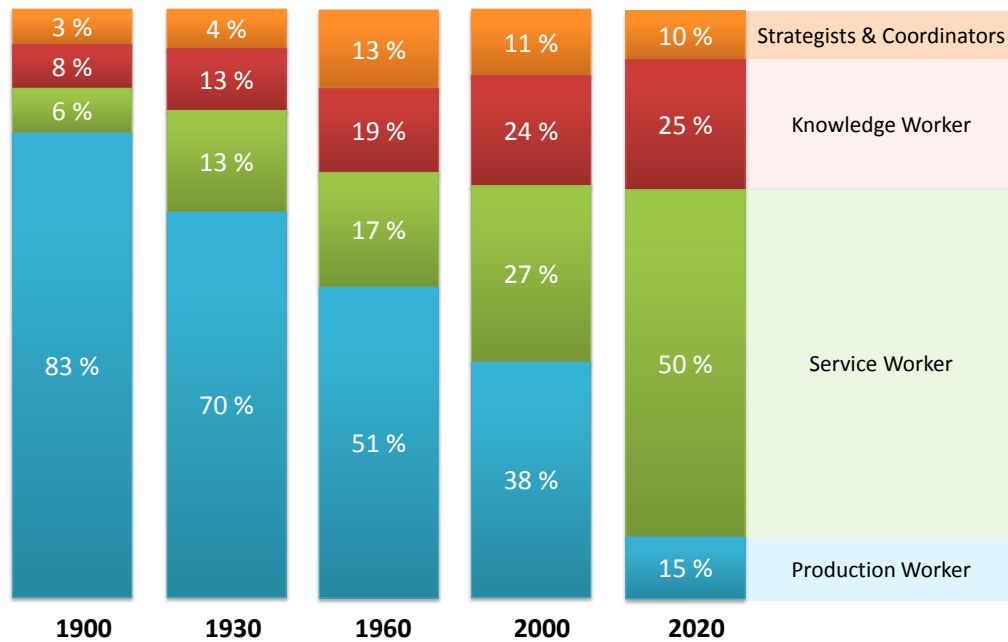


Figure 2.1.: Types of work [3]

- non-routine work
- increased autonomy over work
- collaboration

Despite some discordance of opinions about the definition of knowledge work, its essential significance is widely recognized. The knowledge workers are considered as “the most valuable asset” of an organization [14]. They constitute 9% of the global workforce while making up 27% of employment costs [31]. Their productivity is becoming the central success factor and is described as “the great management task of this century” [13]. Concurrently, the number of knowledge workers continues to grow as illustrated in Figure 2.1¹. According to [12] they tend to hold the positions responsible for organization’s growth. Knowledge workers develop new strategies in management roles, create new products in R&D. They make products and services appealing to customers in marketing. “Without knowledge workers there would be no new products and services and no growth”[12].

The facts mentioned above may create the illusion that knowledge work and workers were invented in the course of research. In fact, they have existed for thousand of years and used paper files, books, pens and brushes instead of computers. What is new is the categorization of knowledge workers, their activities, and tools into a new field [11].

¹The number of knowledge workers presented in [3] markedly differs from the estimation in [31].

2.1.2. Qualities

When speaking about business processes, people usually imagine highly structured routine processes. Their knowledge-intensive counterparts are characterized and distinguished by the following qualities [44]:

- **Non-repeated**

Knowledge intensive processes are usually not repeated the same way many times. There are always elements of similarity or common patterns but the differences are greater. E.g. a merger of two companies usually follow a very similar pattern: initial contact, a due diligence phase, negotiations, contract etc. This high-level process, however, does not determine what the involved individuals should do at a particular point of time. The course of actions is defined by the specifics of the situation, in response to certain events.

Routine processes may be very similar but not necessarily identical. A bank employee may open numerous bank accounts for different customers and on different terms and conditions. These differences, however, do not significantly affect the course of actions. Therefore the degree of repeatability plays a key role in distinguishing between knowledge and routine work. The routine processes are repeatable enough to benefit from a formal definition and automation. In contrast, trying to formalize and automate knowledge work will, if at all possible, end up in costs that exceed the benefit. Additionally, following a formal plan will prevent knowledge workers from doing what is actually needed.

- **Unpredictable**

Knowledge work is unpredictable as apposed to routine work. At this point the level of unpredictability must be taken into account. E.g. a bank employee may not know in advance who will be the next customer, but the process of opening a bank account remains predictable. The unpredictability at the level of significant human acts is considered here. Obviously, at the micro level there will always be uncertainty. Prediction must be based on actual information known at the moment. Omniscience, i.e. knowing everything, may make knowledge work predictable. But omniscience cannot be assumed. Knowledge worker must therefore make assumptions about unknown information and be able to change the course of actions as soon as new information arrives.

The unpredictability of a process does not mean that no one knows what will be done. Instead, it is not possible to specify the process in advance to the level of details that would allow an automated execution.

- **Emergent**

An early step may yield some knowledge that determines the next step. The second step determines the next one etc. The course of actions unfolds iteratively as the work proceeds. The emergent nature of knowledge work is responsible for its unpredictability. Even the concept of a plan has a different meaning. A plan is always temporarily feasible, until the next piece of information is discovered.

Investigative work may be considered as an illustrative example. At no point can more than a few steps be mapped into the future. Often, there is a breakthrough that determines the next few steps. Routine work, in contrast, may be predicted fairly accurately. The possible changes have a little impact on the overall structure of work. A breakthrough that is also known as “ah ha!” moment cannot be expected in the context of routine work.

- **Robust**

Robustness and reliability of knowledge work are rather non-intuitive since such qualities are usually common for machines, while humans are error prone. This assumes that knowledge work is done erroneously, which is usually not true. When it comes to process management, highly formalized routine work may be considered as equivalent of machines. The reliability of an extremely rigid automated process is compromised by the first exceptional situation. If such situation is ignored during the analysis and formal definition, then the process will fail to handle it and therefore break.

Knowledge work allows to change the course of actions in the face of variable conditions and adapt to a new situation. In that manner, the goal can be achieved reliably, although the exact details are not known in advance.

The above-mentioned qualities indicate the difference between knowledge and routine work, which are often considered as the opposites of each other. However there is never work that is 100% routine, nor is there 100% knowledge work. Almost all work people do consists of predictable routine phases mixed with unpredictable knowledge work. Figure 2.2 illustrates the spectrum of work types.

2.1.3. Management of Knowledge Work

Knowledge work may seem chaotic: processes are unpredictable and unrepeatable, there is not much space for automation. Even though there is a strong need for management of knowledge work. It is required to achieve understanding, control and visibility over the processes taking place within an organization. Management of knowledge work allows to communicate goals of the processes and the way they are executed. Further, it provides a possibility to track the achievement of objectives and deadlines to be able to take measures as needed. Moreover, the responsible parties and finished actions with corresponding output present a valuable information that is made available by the means of process management [44].

An increased autonomy and personal judgment are, amongst other aspects, common characteristics of knowledge work. But it does not mean that knowledge worker are left completely on their own to decide what to do. There are rules, regulations and laws that constrain their actions. Moreover, organizations have their internal customs, standard procedures and company culture that knowledge workers are expected to follow. The standard procedures may be considered process fragments, but there is a significant difference between these fragments and fully defined processes. The fragments are used during the process execution, they can be easily brought together into a plan in the context of a specific situation[44].

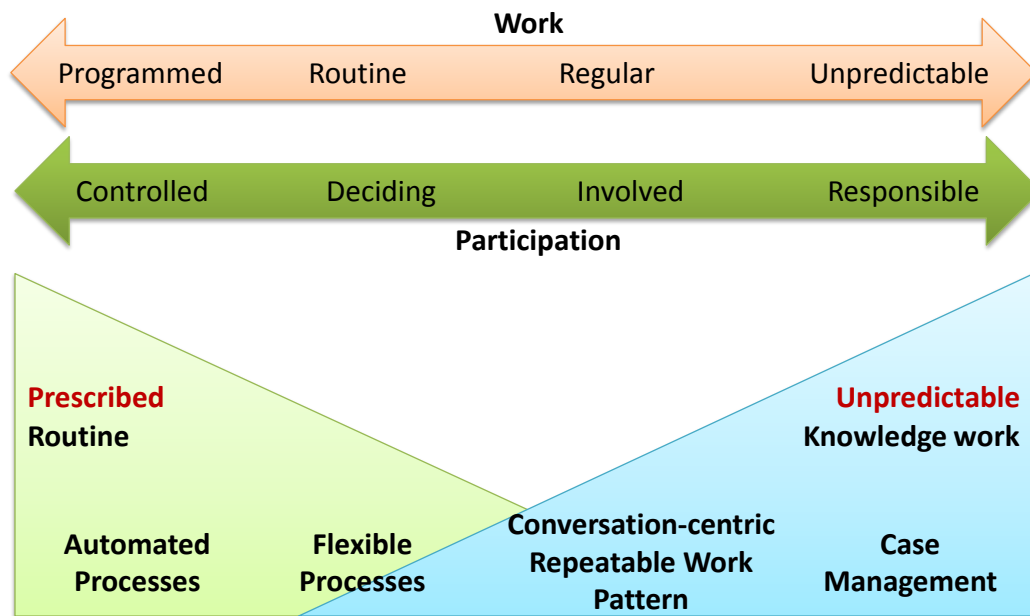


Figure 2.2.: Spectrum of work [34]

Consequently, knowledge work must be managed and therefore requires appropriate tools. Today, knowledge workers use a mix of applications for information management (emails, communication, document) and workflow (process) management tools where applicable [34].

The traditional process management tools are based upon the principles of scientific management and are therefore suitable for repeatable and predictable processes i.e. routine work. They enforce a command-and-control management model, where taking unique actions based on personal knowledge and judgment has no place, where the object of work follows a predefined path. Certainly, current tools may handle variations during the process execution by utilizing branches with very sophisticated branch conditions. But this is not feasible to manage unpredictability. The choices that knowledge worker make are not simply branch points in a predefined process. The choices affect and modify the course of actions. So knowledge workers modifies the process itself [44].

Additionally to the inadequate support of process management, information management aspect represents an area for improvement. The state of the art in technology support for knowledge work can be described as systems of records. Knowledge workers have to maintain their data in a consistent state by using disparate applications and manually tracking pieces of information across different systems. Often a substantial amount of information lives in personal inboxes without being linked to and shared with other relevant applications. The missing integration decreases productivity of the knowledge workers and leads to errors [34].

Therefore, the concept of predefined processes as well as the majority of current tools is not appropriate for knowledge work. The reason is not a flawed implementation or lacking features. The tools are simply built for a different purpose. Thus, a different approach is required.



Figure 2.3.: Aspects of ACM [19]

2.2. Adaptive Case Management

As is known from above, knowledge work cannot be effectively managed by conventional process management tools. A completely different approach that meets following requirements is needed [44]:

- It is not based on scientific management
- It does not require a formalized beforehand process definition
- Neither large up-front costs nor a high number of process execution to amortize these costs are expected

In the recent years the approach of adaptive case management (ACM) has been gaining popularity. It fulfills the above-mentioned requirements and promises to facilitate knowledge work. Figure 2.3 illustrates the main aspects of ACM. As evident from the title, case handling is an integral part of ACM. It provides the basic methodology for the concept. ACM leverages the specifics of the organization, that determine the context, rules and restrictions, the objectives and the information to work with. At the same time, ACM follows the principle of adapting to work in real time instead of predicting how it will happen. All that aims at supporting knowledge workers while relying on their personal knowledge and judgment.

2.2.1. References

Case management may be defined as a “practice of coordinating work in response to a request by organizing all of the relevant information into one place – called a case folder, and acting upon the information to fulfill the request” [34]. All related actions like assessing the situation, initiating processes or keeping a history record take place around the case. The case is in turn defined as “a situation, set of circumstances or initiative that requires a set of actions to achieve an acceptable outcome or objective” [17].

Cases are not limited to legal, social work and governmental cases. Case management is appropriate for many types of knowledge-intensive business processes. Instead of the mass-production approach, whereby small pieces of work follow a predefined route, cases represent a more exception and event-based activity [27].

The concept of case management is not new. Various major vendors have been offering case-based solutions for several years. The technology behind these tools represent a combination of workflow, imaging, and document management. These tools, however, cannot keep pace with today’s challenges. Modern tools must support shifts in regulations, customer preferences, and worker demands that require a more ad hoc and collaborative approach [27]. “Design for people” and “build for change” are the two main principles that will drive the development of tools in the future [38]. Therefore adaptability is considered as a new mandatory requirement to support learning organizations. Regular users must be able to modify the system in order to comply with the changing environments and adapt it to the way they want to work. In order to achieve these goals, the existing solutions for case-management, primarily based on a combination of BPM and ECM, are extended with additional functionality to satisfy the need for adaptability [27]. Figure 2.4 illustrates the position of ACM in the context of existing tools.

The corresponding description of dynamic (or adaptive) case management can therefore be defined as follows [44]: “While it has roots in both content and process, it is enhanced by new technologies that enable dynamic, adaptive workflows to inform the design of real-world, people-oriented solutions.”

Swenson [44] uses following definition emphasizing adaptability: “Systems that are able to support decision making and data capture while providing the freedom for knowledge workers to apply their own understanding and subject matter expertise to respond to unique or changing circumstances within the business environment.”

At Forrester [27] adaptive (or dynamic) case management is defined as: “A highly structured, but also collaborative, dynamic, and information-intensive process that is driven by outside events and requires incremental and progressive responses from the business domain handling the case.”

ACM approach can also be describe by its underlying principles [44]:

- Planning is a low-cost effort that is part of the work itself
- Leveraging unstructured or semi-structured information documents instead of integrating systems with highly structured information sources
- Focus on increased autonomy of knowledge workers based on their knowledge and judgment instead of standardization of all cases

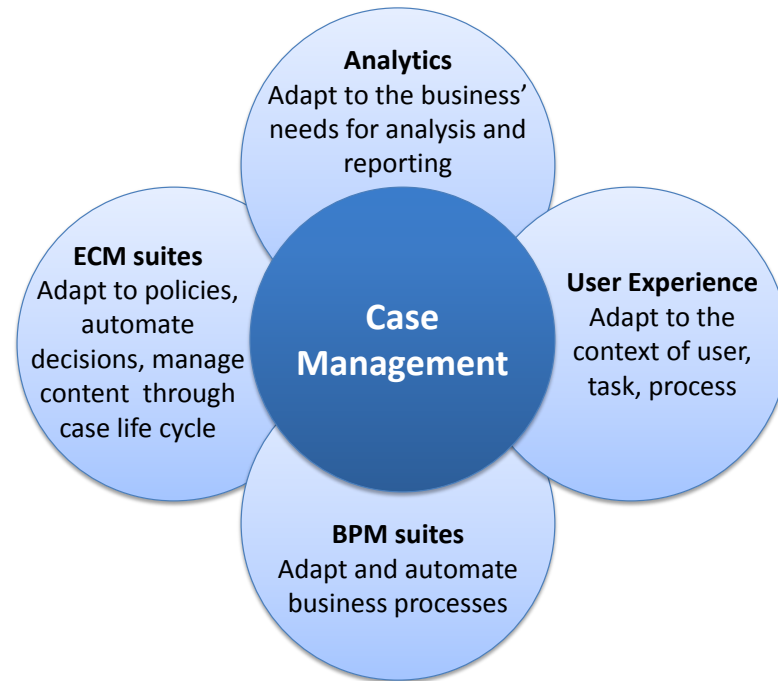


Figure 2.4.: Positioning of ACM [27]

- Organizing all information and informing people instead of isolating the specific data needed for a particular task

2.2.2. Requirements for ACM Systems

The requirements to an ACM system derived from the current literature are explained in the following [18]. An overview is given in Table 2.1.

- A1 Flexibility at run-time:** Editing of cases is supported in the process-execution phase. This is necessary due to unpredictable nature of knowledge work. End users must be able to define the course of actions at run-time in order to adopt to situational change.
- A2 Evolving cases and templates:** End users must have the ability to generalize best practices and process patterns to templates in order to facilitate, i.e. partially automate, case execution in similar cases. Users must be assisted during the case execution through recommendation of suitable templates.
- A3 Visible progress of the case:** Current state of the case and of its tasks must be indicated. Additionally, the remaining steps and obstacles that prevent the case from being solved must be indicated.
- A4 Transparent responsibilities:** In order to achieve traceability and control over the process, the system must be able to assign responsible case workers to objectives and tasks in the case. These responsibilities must be visible to all relevant case workers.

ID	Requirement
A1	Flexibility at run-time
A2	Evolving cases and templates
A3	Transparent responsibilities
A4	Visible progress of the case
A5	Flexible assignment of roles
A6	Definition of case objectives
A7	Hierarchical structure of tasks
A8	Integration of data in the case
A9	Definition of logical dependencies between tasks
A10	Understandable and adaptable for business users

Table 2.1.: Requirements for Adaptive Case Management

- A5 Flexible assignment of roles:** New case workers must have the ability to join an active case in a specific role. The user roles, however, should not always be mandatory and allow for enough flexibility during the case execution. The roles of case workers must be associated with the ability to define, skip and redo tasks for the case.
- A6 Definition of case objectives:** It must be possible to express the objectives for the case and its parts as well as communicate how to achieve them
- A7 Hierarchical structure of tasks:** Hierarchical structure is easier to understand and work with in comparison to complex process networks. Moreover, it allows for incremental refinement as the work proceeds.
- A8 Integration of data in the case:** ACM systems must, among others, serve as a system of record for business data entities and the involved content, and integrate structured data sources like data-bases as well as semi or unstructured ones e.g. documents. Case data is the focal point that drives the progress of the case.
- A9 Definition of logical dependencies between tasks:** The flexibility of ACM solution may overwhelm its users. Case tasks may have preconditions. Therefore temporal-logical dependencies like rules or constrains must be implemented in order to provide additional guidance to end users.
- A10 Understandable and adaptable for business users:** Apart from the case execution utilizing existing patterns, regular business users without any process-modeling and programming skills must be able to comprehend the functionality of case definition since adaptation to specifics of the situation, e.g. modifying the course of actions, is a fundamental characteristic of ACM.

2.2.3. State of the Art in Case Management

Case management has received a lot of attention from academic and business communities in the recent years. Currently there are numerous approaches and technologies that target case management. They can be divided into several categories [34]:

- **Business Process Management Hybrid**

BPM solutions enforced with flexibility for the support of case management are offered. They have recognized data as the second main focus in addition to process. However, such solutions are specialized on specific domains or products and do not offer a generic solution for knowledge work. Furthermore, there are solutions for adaptive business processes. They assume an existing process definition at some level of detail, that can be changed to a certain extent during the execution.

Another approach that falls in this category is the artifact centric approach for business processes. According to it, the process is defined based on the lifecycle of data. However, process aspect must be on the same level in case management applications.

- **Social BMP**

The rise of social media gave birth to new solutions based on the integration of BMP into social networks. The BPM products are extended with new types of tasks that can be exposed and accomplished via social media. But current tools focus on traditional workflow applications that are extended with social capabilities. There is a social-based solution for case management that represents a unified tooling for collaboration and communication of knowledge workers and management of tasks. The solution operates case, process and tasks as first class citizens in the social network [33].

- **Content Management Solutions**

Content management solutions extended their functionality to introduce a more structured management of content. E.g. new first-class objects like people, processes and business rules are integrated.

- **Task Management integrated with Communication and Collaboration Solutions**

There are web-based solutions that offer group-based task and document management in a more flexible and collaborative manner, compared to a workflow management system. Furthermore, there are tools that try to capture the work done over emails. However, these approaches are limited to task management or email communication.

- **Social Business Technology, Enterprise Social Technology**

There are numerous solutions coming purely from the social space. Often such tools are providing an organization-internal microblogging functionality similar to Twitter. The ability to express and track goals, tasks and cases make such tools useful for case management.

- **Pure ACM**

Mainstream system vendors do not offer pure ACM systems, since the traditional IT customer is still looking for office automation and the most of IT industry is covering this demand. Pure ACM is offered by rather small independent vendors. There is a variety of approaches on the market.

The next generation of case management solutions is expected to support more personalization and context identification in order to offer intelligent assistance and guidance i.e. provide the required information in the right time in a proactive manner, recommend course of actions.

2.2.4. Conclusion

Case management has existed for a long time. In the recent years it gained a lot of attention due to the increasing role of knowledge work. Case management may be used to manage it. The traditional tools used for case management, however, do not meet modern requirements for adaptability, which is crucial of knowledge work. This gave birth to a new approach called ACM.

ACM focuses on both processes and information. It allows regular users to adapt the processes to their needs and changing environment during the execution, which is considered a key functionality of ACM. There is no need for an expensive upfront analysis and modeling. Planing is part of the work itself. Moreover, ACM allows for a high degree of autonomy and personal judgment for knowledge workers as well as for collaboration.

Currently, only small independent vendors offer pure ACM tools. The market of ACM is, however, expected to grow due to increasing role of knowledge work and growing awareness among the customers.

Eventually, ACM will not replace the traditional process management tools like BPM. They will continue to be used to support routine processes. ACM will simply augment the set of tools and will be used to facilitate knowledge work, for which traditional tools have never worked [44].

2.3. Innovation Processes

This chapter briefly describes what innovation is, presents a standard process for its management and explains why it is a hard task to successfully manage innovations.

2.3.1. Overview

Many attempts have been made by practitioners and researchers to define innovation. “Qualitatively new products or processes that differ significantly[...] from what existed before” [20] may be referred to as innovations. Alternatively, it is “the adoption of ideas that are new to the adopting organization” [41]. So novelty is a common characteristic. According to Porter [40] innovation may also be defined as “a new way of doing things that is commercialized”. Thus, not every invention or idea is an innovation. Only successful ones deserve this title. Another important point is that innovation is both an output and a process.

Innovation has a tremendous impact on firms and society. Surveys among managers show that the ability to innovate is considered as the most important growth driver and a key requirement to be competitive [32]. Rapid technology shifts and short product life-cycles necessitate continuous innovation, that is characterized by a high complexity. Mastering that growing complexity is a tough challenge, that many organizations struggle to

overcome [30]. Managing innovation is therefore a risky and difficult task. High expenses for research and development or application of sophisticated tools are no guarantee for success [25]. However, successful innovations need to be managed.

Innovation management is the discipline for managing processes that aims at creating and exploiting new things [26]. It is extremely knowledge-intensive. The new knowledge may be technological and market related. Technological knowledge include knowledge of components, their linkage, methods and processes that go into a product or service. Market knowledge is all about distribution channels, product applications, and customer needs. Innovation reflects the discovery of new technological or market knowledge [1].

A lot of organizations introduced formal innovation processes in order to standardize their development process. They are intended to facilitate the collaboration and communication in a distributed environment as well as split and parallelize the process steps [30].

2.3.2. Stage Gate Process

The literature and practice offer a variety of process models for innovation. Many of them are based on the stage-gate process developed by Cooper (cf. Figure 2.5). “A stage-gate system is both a conceptual and an operational model for moving a new product from idea to launch [8]”. It applies process-management methodologies to the innovation process, adds structure to it, and increases transparency.

First generation

The stage-gate model has its roots in the NASA’s PPP (phased project planing) developed in the 1960s. It is referred to as the first-generation scheme for product development and is often called *Phased Review Process* nowadays. NASA’s PPP represents a detailed scheme for working with contractors and suppliers on space objects. The approach was adopted by the U.S. military and was therefore quite wide-spread among its suppliers. The development proceeds to the next phase only after all tasks of the previous stage are completed. Concurrently, the design activities are isolated from the issues facing test, manufacturing, quality and service i.e. “over the wall” effect. Thus, the method was more about measurement and control and ensured that the project was completed according to plan. The shortcomings that lead to the development of the second-generation product development process i.e. the stage-gate process, include [9, 7]:

- Cumbersome due to ckeck-offs of a plenty of tasks at each review
- Slow due to hold-ups of projects for review
- Too narrow since it only focused on the actual development of the product
- Too functional as it solely dealt with technical risks but not with business risks

Second generation

The second generation of the stage-gate process addresses the drawbacks of its predecessor [9]:

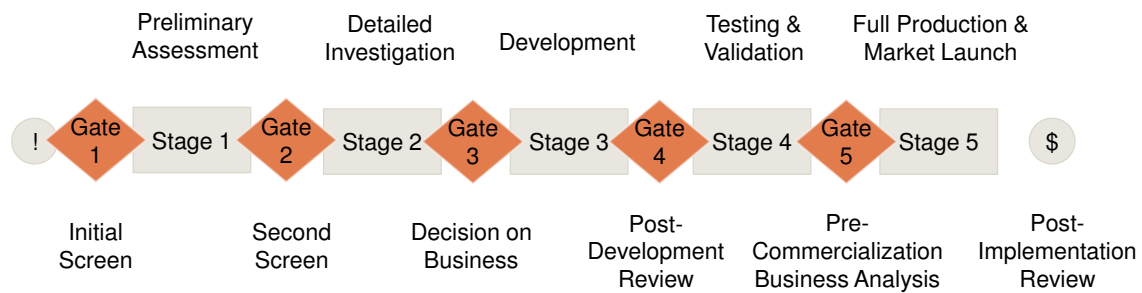


Figure 2.5.: Second generation of stage-gate process [8]

- It is cross-functional. Each stage involves activities from many departments. A much better cross-functional teamwork is encouraged by the process. Thus, also business risks are dealt with.
- It has a broader scope. In contrast to Phased Review Process, both marketing and manufacturing are integrated.
- More emphasis on pre-development work. Phase Review Process started directly with the development. This results in earlier detection of failures, reduction of re-work activities and therefore shorter elapsed time.
- Pre-development work results in a much stronger marketing orientation and a sharper product definition prior to development.
- Parallel processing is featured.
- Sharper decision points with rigorous criteria and metrics instead of a onerous control whether all tasks of the preceding stage are completed.

The stage-gate model divides the innovation process into a predetermined set of steps (Stages) that include the actual work and development of an idea. The stages are themselves composed of a group of prescribed activities. Each stage is usually more expensive than the previous ones. At the same time, the quality of information evolves as the process succeeds, thus managing the risk [8].

The entrance to each stage is represented by a gate. These gates control the process like quality control checkpoints. Each gate is characterized by a set of exit criteria that is used to assess the project. The criteria includes quantitative, financial but also qualitative measures of business issues (e.g. synergy, market attractiveness). They represent the hurdles that the project must pass to open the gate to the next stage. Additionally to the decision whether to continue the work on the project, the output of a gate contains the approval of an action plan for the next stage. Typically, multidisciplinary and multifunctional teams of senior managers act as “gatekeepers”. They must have enough authority to allocate the required resources for the project [8].

During the first stage called *Preliminary Assessment* a fast and cost-efficient analysis of market potential and technical feasibility is conducted. The second stage *Detailed Investigation* contains the creation of detailed technical development plans and concrete market

surveys. Moreover, a preparation of a business case including cash flow analysis as well as sensitivity analysis is usually required. The *Development* stage comprises the actual development of the product. The stages *Testing & Validation* as well as *Full Production & Market Launch* are self-explanatory. In the *Post-Implementation Review* the project and product performance are reviewed [45].

The stage-gate process involves organizational changes. One fundamental requirement is that a team with a leader must be assigned to a project and carry it through all stages and gates. Another change is the involvement of senior managers. It does not only guarantee the required resources, but also increases the commitment and awareness among the top managers [8].

Although stage-gate process was a great leap forward compared to the first-generation of product development models, it itself has some major weaknesses [45, 9]:

- One of the fundamental assumptions of stage-gate process is the ability to predict the success of an idea in early stages. History shows that this assumption is not always valid.
- The stage-gate process is based on the principles of scientific management. It assumes a repeatable process with deterministic results. This assumption contradicts with conditions required for successful innovation. They include freedom for creativity, no time schedule and uncontrolled input from outside the organization.
- Too many stages and gates result in a heavy-weight and bureaucratic process. Overlapping of stages that sometimes makes sense is discouraged by second-generation models.
- Inappropriate gate's criteria result either in an empty or an overfull process. A comparison across projects aiming at prioritization is hardly supported.

Third generation

In order to deal with these drawback the next generation of stage-gate process was developed (Figure 2.6). While the second-generation stage-gate process proved its effectiveness, the main focus of the third generation is on efficiency. It aims at speeding up the process and flexibility. The key characteristics of the third-generation stage-gate process are [9]:

- **Fluidity:** activities are not restricted to specific stages as in the previous generation. Instead, the process is more adaptable. It has overlapping and fluid stages that allow to begin activities before or after their regular stage or even move them between stages.
- **Fuzzy gates:** the new process provides conditional decisions which are dependent on the situation in contrast to absolute or black-and-white schemes. The decisions may be made on the basis of the partial information that is available. However, the remaining information or incomplete task must be completed. Thus the actual decision is postponed and the project may proceed without waiting.

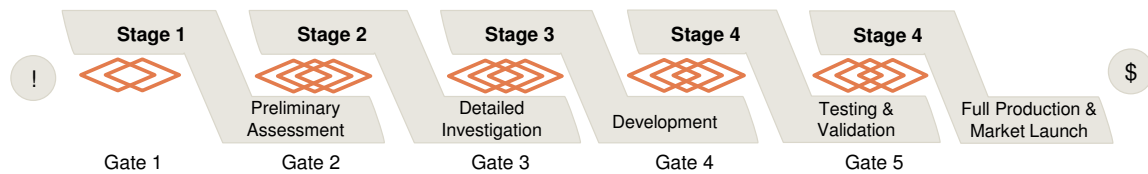


Figure 2.6.: Third generation of stage-gate process [9]

- **Focused:** prioritization methods that compare all projects in the pipe and consider limited resources of the organization are used. The results are better prioritization and sharper focus.
- **Flexible:** only the necessary gates and stages must be passed through. The specifics of the situation and project define what steps have to be done and which can be skipped.

2.3.3. Dealing with Uncertainty

Early stages of the innovation process are often referred to as *Front End Innovation*, *Fuzzy Front End* or *Pre-development*. They contain the activities of actual idea generation and pre-development and have a strong linkage to success of the entire project. “The seeds of success or failure are sown in the first few steps of the process” [8]. The early stages determine to a large extent the overall quality, costs and duration of the project. Small changes have great impact on further development.

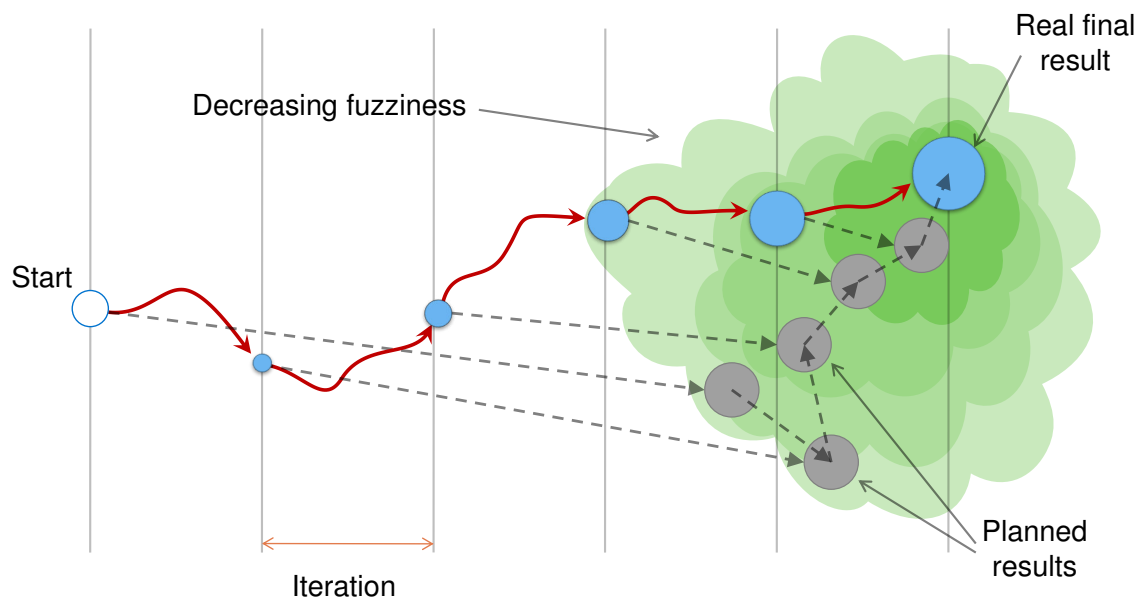


Figure 2.7.: Agility in the course of the project [36]

The innovation process is characterized by a high degree of uncertainty. Especially early stages are extremely knowledge intensive and therefore cannot be planned in advance, which explains the title *Fuzzy Front End*. One of the goals for development of the third-generation stage-gate process, that is described in section 2.3.2, was lack of flexibility provided by its predecessor. The resulted process tackles the problem to a certain degree. However, an extension to this solution comprising a combination of stage-gate process with agile methodology promises reasonable results. Currently, many companies are working in this direction [30]. Agile methods focus on adaptability instead of following a predefined plan. They assume a stepwise development of the project. The steps are represented by iterations that allow project to unfold as it proceeds, thus managing the uncertainty of the fuzzy front end. The uncertainty in the course of the project is demonstrated in Figure 2.7.

In the proposed approach the high-level innovation process with decisions and control checks is represented by the stage-gate process. The actual development process is harnessed by the means of an agile method, e.g. Design Thinking, and must be embedded into and synchronized with the overlying innovation process. That way, a combination of the stage-gate process allowing for clear structure, transparency and prioritization with adaptability of agile approach represents a feasible solution for innovation process [30, 45].

3. Innovation Process at DATEV

The main goal of this thesis is to develop a custom solution for DATEV's innovation process addressing the shortcomings of the currently deployed tools. The company has recognized the high importance of innovation quite early. Already in the first half of the 1990s an initiative aiming at collection of ideas for improvement was introduced. DATEV's employees were the target audience and major source for ideas. A lot of resources have been invested into innovation management since then. Today, the topic is driven by the department of the strategic company development that is, among others, responsible for providing appropriate tooling support. Currently, its core is constituted by two custom applications. They are described in the following.

3.1. INITIATIV

INITIATIV is a web-based application accessible from the organization's internal network. The main use case of the tool involves the submission of ideas for improvement by DATEV's employees as well as approval or rejection of these ideas by responsible users. Therefore, INITIATIV implements a rigid submission and evaluation process that resembles the early stages of the stage-gate process described in 2.3.2. The application is a direct descendant of the first tool for innovation management that was introduced by DATEV in the early 1990s. The current version was developed in 2004. To further demonstrate the application a screen shot of it is displayed in Figure 3.2.

The underlying process distinguishes following user roles: *submitters*, *innovation agents*, *experts* and *innovation agents committee*. Additionally, there exists the role of *coordinator* who controls the entire process and has access to any information. *Coordinator*, however, does not take part in the standard submission and evaluation process. The process steps with associated user roles are depicted in Figure 3.1. They are described in the following:

- *Submitter* (German: Ideeneinreicher) of the idea enters the required information including the identified problem and a corresponding solution as well as possible cost and benefits into the tool. The submitter has the possibility to stay anonymous. Furthermore, the responsible department must be specified, which leads to the notification of the associated innovation agent (cf. ❶ in Fig. 3.1)
- *Innovation agents* (German: Ideenbeauftragte) of the responsible department receive a notification email. They check the formal correctness of the submission and may directly reject the idea, e.g. if it is a duplicate, or request (cf. ❷ in Fig. 3.1) additional information from the submitter. Thereupon, innovation agents initiate the evaluation by assigning (cf. ❸ in Fig. 3.1) the relevant experts. Multiple experts may be selected.
- *Experts* (German: Gutachter) receive an email notification in case of assignment.

They may decline the assignment or create a report about the idea and notify the innovation agents (cf. ④ in Fig. 3.1).

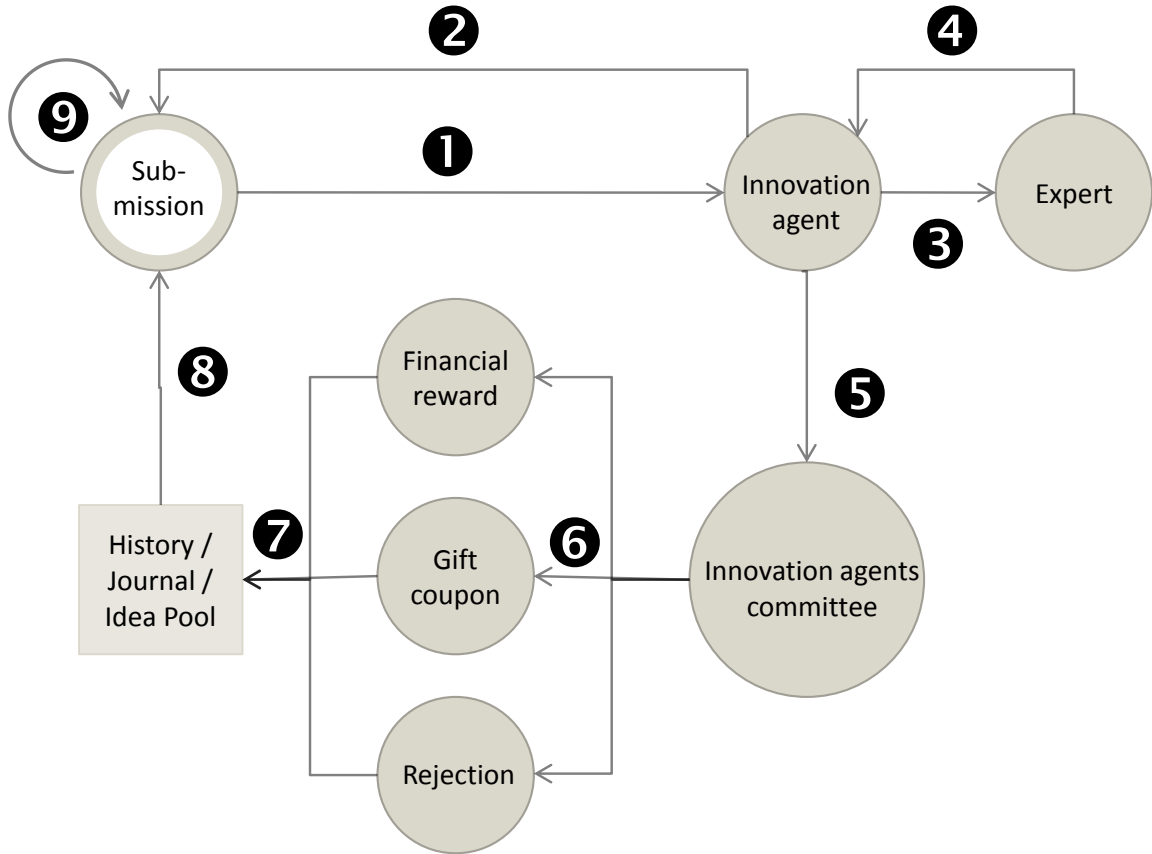


Figure 3.1.: INITIATIV Process

- After the expert reports have been created, the *innovation agents* have to check them. They may request additional information (cf. ③ in Fig. 3.1) if required, or forward them to the innovation agents committee (cf. ⑤ in Fig. 3.1).
- *Innovation agents committee* (German: Kommission der Ideenbeauftragten) makes the final decision about the approval or rejection of the idea based on the expert reports. If the profit of the idea may be calculated, the *submitter* will receive a financial reward. If the idea is useful, but no concrete figures can be identified, the *submitter* is usually rewarded with a gift coupon (cf. ⑥ in Fig. 3.1).
- Subsequently, the idea is archived (cf. ⑦ in Fig. 3.1) and its *submitter* is notified about the final decision and reward (cf. ⑧ in Fig. 3.1). The *submitter* has the possibility to appeal against the decision. In such cases the entire process is restarted (cf. ⑨ in Fig. 3.1). Furthermore, the *submitter* can cancel the submission anytime.

According to the German labour law, INITIATIV provides its users with different access rights depending on their role. The *submitters* may choose whether their personal informa-

tion is visible to other users or not. This option does not restrict the visibility of innovation agents, since they have to communicate with submitters.

The screenshot shows the INITIATIV V.1.3 web application. The browser title is "INITIATIV V.1.3 - Windows Internet Explorer bereitgestellt von DATEV". The page has a blue header with navigation buttons: "Startseite", "Drucken", "Speichern", "Versenden", "Ideenpool", "Gutachten", and "Beenden". Below the header is a "Zurück" button. On the left, there's a sidebar with "Meine Ideen [0 / 0]", "Info", and "Hilfe". The main content area contains a form with the following fields:

- Titel**: A text input field.
- Datum**: 2013-11-22 (09:53:14)
- Name**: Meyer
- Vorname**: Ralf
- KOE**: H122
- Personalnummer**: 1845
- Zuständigkeit**: A dropdown menu with the selected option "I - (Welcher Bereich soll diese Idee begutachten?)".
- Prämierung**: A section with the text "Sollte meine Idee prämiert werden, so wünsche ich" and two checkboxes: "eine Mitteilung an meinen Vorgesetzten" and "einen Vermerk in meiner Personalakte".
- Anonymität**: A checkbox labeled "Diese Idee soll anonym eingereicht werden, d.h. Ihr Name wird nur bei den zuständigen Ideenbeauftragten und der Kommission angezeigt."

Below the form is a large text area labeled "1. Ausgangssituation und Lösung". At the bottom left, there is a logo for "INITIATIV" featuring a stylized green and blue figure.

Figure 3.2.: INITIATIV screen shot: submitter's view

Ideas submitted via INITIATIV have an incremental nature i.e. they have a rather small impact on the organization. This is due to the fact that the final decision about approval or rejection is made by a small group of responsible individuals. Ideas with high impact require, in contrast, an organization-wide discussion since they may affect large sections of employees. Moreover, the ideas in INITIATIV must be fully developed and have a detailed description. Thus, the financial outcome and technical feasibility may be assessed. The high effort for a detailed description is rewarded in case of approval.

As described in 2.3.3, the early stages of innovation process are highly knowledge-intensive and non-deterministic. INITIATIV, however, implements a rigid process. Although it has branches, exceptions can be hardly handled. Therefore, the lack of flexibility is considered as a significant drawback of the tool. The current version of INITIATIV was introduced 10 years ago, which is a great age for a web application and dictates an insufficient usability. Furthermore, the application is not integrated with other tool in the innovation process. The outdated technology and the lack of integration forced DATEV to look for a replacement.

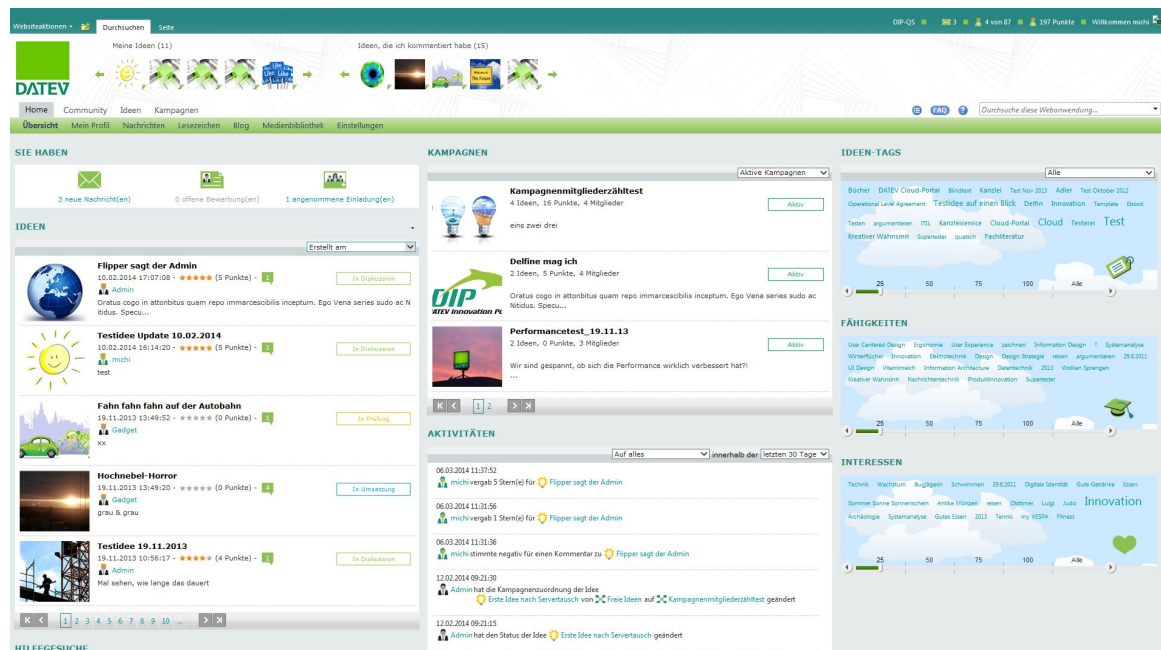


Figure 3.3.: Screen shot of dashboard in DIP

3.2. DATEV Idea Pool

In order to foster innovation and increase awareness among employees a new tool was introduced at DATEV in 2012. DATEV Idea Pool (DIP) is a discussion platform based on MS Sharepoint. The tool implements a collaborative idea generation which complements the submission process covered by INITIATIV. Currently there are 1800 users on the system. There is no process behind DIP. It only supports the discussion and rating of ideas. In contrast to INITIATIV, the submitters of ideas are not rewarded since the ideas emerge collaboratively. DIP, instead, relies on intrinsic motivation in the form of gamification. The most active users are listed in several rankings. An example screen shot of the dashboard in DIP is depicted in Figure 3.3.

The ideas are submitted and discussed in the course of so called innovation campaigns. The campaigns are initiated by the department of strategic company development in cooperation with an operating department. The campaigns have a topic and usually last for six weeks. Additionally to the temporary campaigns on specific topics, there exist continuous campaigns that are not restricted in terms of time and subject. The ideas and campaigns have a status e.g. in discussion or in implementation. They may have tags which simplifies the search for possible duplicates. The discussion of ideas is conducted by the means of user comments. Therefore, the campaign managers invite the relevant users to submit their ideas and participate in the discussion. Users have the possibility to apply as a co-author for an idea. After the discussion phase is over, the campaign managers forward the ideas to the responsible departments for further evaluation and realization. However, these activities are not supported in DIP.

In contrast to INITIATIV the ideas submitted via DIP do not have to be developed to the

finest detail. The submitters may simply suggest a high-level idea that will be collaboratively refined. Furthermore, the organization-wide discussion and collaboration enable the implementation of disruptive ideas, since the opinion of many employees is considered.

An essential drawback of DIP is the missing integration with INITIATIV. The submitter must decide where to submit an idea, which is not always simple. In fact, the application only supports the discussion and rating of ideas. The subsequent work takes place outside the tool which implies redundant data entries and compromised traceability. Another disadvantage of the tool is represented by the onerous entry of ideas in a similar vein to INITIATIV.

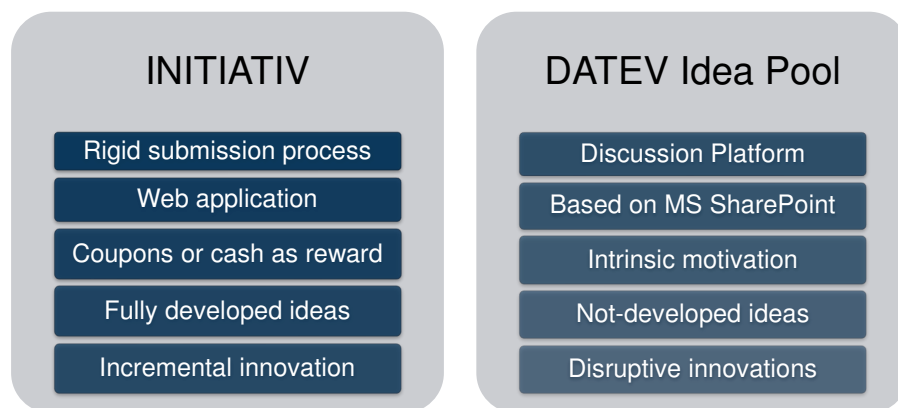


Figure 3.4.: Applications for innovation management at DATEV

3.3. Summary

The innovation process at DATEV is implemented by the means of two custom applications. They complement each other but have significant drawbacks, which encouraged DATEV to consider a new integrated solution for their replacement. An overview is given in Figure 3.4.

The first tool titled INITIATIV implements the early stages of a rigid stage-gate process. Employees use it to submit their fully developed ideas and get a reward in case of approval. The ideas have rather small impact on the company. The tool has existed for many years and could prove its effectivity. However, INITIATIV have some essential shortcomings: it utilizes an outdated technology and does not provide flexibility which is considered as a key requirement for innovation process.

The second tool deployed by DATEV to support the innovation process is called DIP. It focuses on discussion and collaborative generation of ideas and allows operating departments to purposefully collect ideas on specific topics. The organization-wide discussion fosters disruptive ideas. They do not have to be fully developed for submission, since the tool enables collaborative refinement. The major drawbacks of DIP are represented by a time-consuming entry of ideas as well as the missing integration with other tools.

The lack of integration between INITIATIV and DIP poses a serious hindrance to the innovation management at DATEV, since there are several scenarios that involve the functionality of both tools. This leads to time-consuming redundant data entries and missing

traceability: e.g. an idea submitted and discussed in DIP must be reentered in INITIATIV in order to be approved and implemented. The insufficient flexibility of the stage-gate process realized in INITIATIV inhibits the innovation process itself. Therefore, a flexible integrated solution is required.

4. Related Work

In this chapter existing software tools that may be considered for implementation of the innovation process solution at DATEV are investigated. Two categories of tools were identified: those implementing the concept of Open Innovation and stage-gate process software.

4.1. Open Innovation

Open innovation approach assumes that valuable ideas can come from inside and outside the company and can go to market from inside or outside the company as well [6]. Innovation can easily move between an organization and its surrounding environment [5]. Among others it means that the end users are involved in the process. In case of DATEV, that widely leverages its innovation process for internal use, the end users are represented by its employees.

Consequently, the main use case for DATEV that can be implemented by the means of open innovation tools is defined as follows: an author publishes an idea that can be rated and discussed with other users in the company. The idea is constantly refined and updated collaboratively in the team. After the discussion and refinement of the idea, it is forwarded to the responsible organizational unit for approval and implementation. Thus, the front end (early stages) innovation process is supported.

A set of Enterprise 2.0 tools implementing the concept of open innovation is briefly described below [35].

- **Jive** is a collaboration and communication platform that provides a predefined content type for ideas. The available functions depend on the current state of an idea e.g. voting is not available in the state *coming soon*. Users can discuss the idea with nested replies and rate it with numerical values. The author is responsible for promoting the idea with a new status. Ideas can be referenced by a stable link that does not change even if e.g. the title does. Moreover, Jive offers a filter function to search for ideas.

The advantages of Jive are represented by the nested replies, a predefined rating functionality and actions depending on the stage as well as an extensive search. However, Jive does not allow for a concurrent editing of its content.

- **Confluence** is a collaboration and wiki software. Wiki sites and blogs offered by Confluence may be used to implement Open innovation, since they fulfill the same requirements. A new space for open innovation is created for both content types. Users can discuss the ideas using comments and rate them by the means of a rate button. Concurrent editing for the refinement of ideas is a valuable advantage of Confluence. Furthermore, it offers access control for wiki-pages and blogs and an

advanced search functionality in order to avoid duplicates. Rating of ideas by a simple rate button poses a disadvantage in terms of the expressive capability.

- **Sharepoint** is a web application framework and platform. It provides different content types, like status notes, blog, forum, and wiki that can be utilized to support open innovation. Blog with a default category for ideas or forum are considered as the main candidates most suitable for a desired solution. In both cases the default access rights settings must be modified to allow users to refine ideas. The discussion is enabled by the user comments. It is, however, not possible to reply to comments in the blog. Rating of ideas is realized by a simple like button, which represents a drawback. Sharepoint also provides a search mechanism with advanced operators and filters. Concurrent editing allows for a collaborative refinement of the content. Moreover, stable links are supported.

4.2. Stage-Gate Process

The solution for DATEV must support the early stages of the innovation process i.e. submission and approval of ideas as described in 3.1. A selected set of software tools that implement the stage-gate process is presented in the following. The selection is among others based on [23], [24] and [4].

- **Sopheon Accolade** is a product lifecycle management (PLM) solution that provides an integrated coverage for the entire innovation process and new product development. It is a business decision support system for making new product investment decisions. It integrates strategy, portfolio management and idea management. The tool follows and automates the stage-gate decision process. It acts as a central repository where all relevant information is stored in one single place during the process. The tool collects financial data to quantify the potential financial outcome as well as non-financial data about the strategic fit, market attractiveness, technical feasibility. This information is required for passing the related gates and for project prioritization. The tool allows to monitor and control the deadlines of actions and keep track of the responsible organizational units and individuals [10, 29].
- **CA Clarity PPM** is basically a project and portfolio management (PPM) solution that helps to optimize the strategic, financial, and operational impact of new product development plans. The goal is to balance processes, skills, and resources across all projects and phases of development to speed up decision making and time to market. The tool also provides idea management. The strengths of the tool are represented by its out-of-the-box features, processes, templates, reports and other starting points that can be immediately used without an extensive configuration. Configurability is also considered as a strength of the tool. It enables custom workflows, templates and business rules etc. Clarity's financial management is the most challenging feature that is rarely fully realized in the first stage of implementation [43].
- **PowerSteering** is a highly configurable software-as-a-service PPM solution. It pursues a top-down approach of driving projects from objectives and milestones. The

granularity of the project-level management may be defined by responsible organizational unit or user group [37]. To lower the entry barriers for new users, Power-Steering provides the ability to start with simple standard processes and features. The realization of the innovation process relies on the stage-gate process. The tool contains phase conditions for phase- or stage-gating. One of the areas for improvement is represented by the user interface and collaboration capabilities [42].

Part II.

Conceptual Solution

5. Use Cases and Scenarios

Use cases and scenarios belong to the standard arsenal of techniques applied for requirements engineering and conceptual design of information systems. They are utilized to capture functional requirements and different actors of the system [2]. This chapter contains use cases and scenarios illustrating the functional requirements for the integrated innovation process at DATEV. The functions are dictated by the need to provide the functionality of the existing tools applied at DATEV (see chapter 3).

Use cases for the integrated innovation process comprise the high-level functional requirements of both applications currently used by DATEV: DIP and INITIATIV. The combination of both functionalities enables new scenarios. The auxiliary functions like search or log-in are not part of the concept.

The actors of the use cases presented in this section resemble user roles implemented in INITIATIV (see chapter 3.1) and DIP (see chapter 3.2). Following actors were derived:

- **Regular users:** correspond to simple DIP users. They participate in discussions, rating and collaborative refinement of ideas.
- **Submitters:** are available in both DIP and INITIATIV. Regular users become submitters after the creation of an idea. The role of submitter only applies to user's own ideas.
- **Innovation agents:** additionally to the role with the same title in INITIATIV, innovation agent comprises the role of campaign manager implemented in DIP, since they have similar administrative responsibilities
- **Experts:** resemble the same role in INITIATIV. Experts evaluate ideas and create reports.
- **Innovation agents committee:** is adopted from INITIATIV. The committee makes the final decision about whether to approve or reject the idea.

Figure 5.1 illustrates the most common use cases representing single process steps that are considered in the integrated innovation process. The list is not complete, which however does not impede the process, since a high degree of adaptability and therefore the ability of adding new steps is assumed. The combination of several use cases constitutes a scenario. The most possible scenarios of the integrated innovation process are divided into two categories and described in the following sections.

Due to the adaptive nature of ACM, additional scenarios can be introduced as the result of the combination of the use cases displayed in Figure 5.1. Moreover, new use cases, i.e. process steps, may be defined. For that reason, the described scenarios represent a selection of the most possible cases, since it is not feasible to specify all possibilities (cf. chapter 2.1.2).

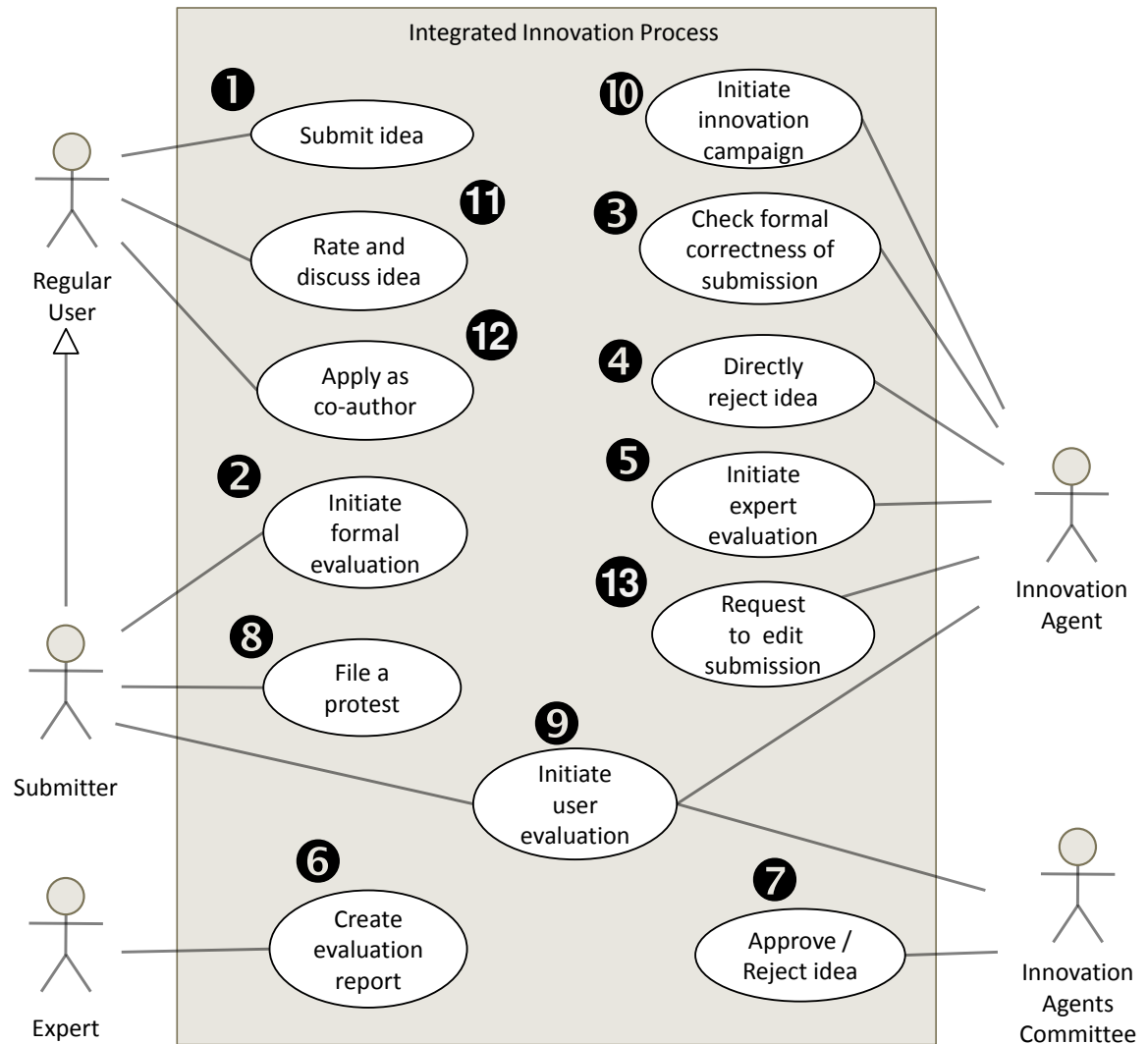


Figure 5.1.: Use cases of the integrated innovation process

5.1. Adopted Scenarios

This section presents scenarios that were directly adopted from the existing applications. The submission and evaluation process as it is realized in INITIATIV as well as the discussion and collaborative refinement of DIP constitute two separate scenarios that must be supported in the integrated solution.

Idea submission

The process starts with a submission of an idea by a *regular user* (cf. 1 in Fig. 5.1). The degree of the entered information depends on the objective of the submitter. In this scenario a precisely defined solution to a specific problem that intends to go directly through the formal evaluation process must be provided. The required information includes a detailed description of the identified problem, the corresponding solution as well as the associated costs and profits. Additionally, the privacy settings and the responsible organizational unit has to be provided.

In the next step, the submitter has to initiate the process (cf. 2 in Fig. 5.1). At this point the responsible *innovation agent*, determined during the submission, is notified. The *innovation agent* first checks the formal correctness of the idea and looks for duplicates (cf. 3 in Fig. 5.1). Subsequently, they can directly reject the idea (cf. 4 in Fig. 5.1) or select the relevant experts and request an evaluation (cf. 5 in Fig. 5.1). Another option would be to request the submitter to edit the description of the idea (cf. 13 in Fig. 5.1).

The *expert* creates a report (cf. 6 in Fig. 5.1) and notifies the *innovation agent*, who may request additional information in case the report is not sufficient (cf. 13 in Fig. 5.1).

The report serves as the basis for the final decision made by the *innovation agents committee* (cf. 7 in Fig. 5.1). In case of the approval, the *innovation agents committee* has to agree on a reward for submitter.

The *submitter* may disagree with this decision and file a protest (cf. 8 in Fig. 5.1). The protest results in the restart of the evaluation process (cf. 2 in Fig. 5.1).

Discussion and collaborative refinement

This scenario demonstrates the submission, discussion and collaborative refinement of ideas in the course of innovation campaigns. The scenario considers both types of campaigns: temporary and topic-specific as well as campaigns that are not restricted in terms of time and subject.

In the first step, *innovation agents* create an innovation campaign and invite the relevant *regular users* to participate in it (cf. 10 in Fig. 5.1).

The *regular users* may submit their own high-level ideas without a detailed description (cf. 1 in Fig. 5.1) as well as take part in the discussion and rating of the existing ones (cf. 11 in Fig. 5.1). Once the period of an innovation campaign expires, the *innovation agent* forwards the submitted ideas to the responsible operating departments for realization. *Regular users* may apply as co-author if their contribution was essential (cf. 12 in Fig. 5.1).

5.2. Combined Scenarios

This section describes a selection of possible scenarios that are comprised by a combination of use cases from both tools INITIATIV and DIP. The ability to support any emerging scenarios constitutes the major advantage of the solution.

Submission of collaboratively generated ideas

After the discussion and collaborative refinement of ideas described in the scenario *Discussion and collaborative refinement* (cf. 5.1), the formal evaluation process may be initiated (cf. 2 in Fig. 5.1) and proceed as in the scenario *Idea submission* (cf. 5.1).

At this point of time, the idea must be defined to a high degree of detail. One important difference to the direct submission without prior discussion and collaborative refinement is the missing reward for the *submitter*.

Utilizing user feedback for the final decision

This scenario extends the *Idea submission* (cf. 5.1). The combination of the functionality of both tools allows the *innovation agents committee* to ask users for feedback (cf. 9 in Fig. 5.1), in case the expert reports are not sufficient for the final decision about whether to approve or reject the idea. This can be done seamlessly without redundant data entries.

Utilizing user feedback for protest against the final decision

The formal evaluation process described in the scenario *Idea submission* (cf. 5.1) may result in a rejection of an idea. In such cases the *submitter* can file a protest against this decision (cf. 8 in Fig. 5.1). Subsequently, the evaluation process is restarted. In order to increase the chances for a positive decision in the second process execution, the *submitter* may leverage user feedback (cf. 9 in Fig. 5.1).

6. Process Definition

Although knowledge-intensive processes like innovation process do not strictly follow a predefined sequence of actions, there are similarities between process instances that may be captured in process patterns in order to facilitate the execution. The use cases and scenarios presented in the previous chapter are incorporated in the process patterns. Users do not have to strictly follow them, they can rather reuse and adapt them to their needs instead of defining everything from the scratch.

This chapter presents an abstract process pattern for the integrated innovation process at DATEV. The process pattern is modeled by the means of the recently introduced Case Management Model and Notation (CMMN). This standard provides visual notation and semantics for modeling cases which are, in turn, used to support knowledge intensive processes. BPMN plays a similar role for traditional business processes [16].

The process modeled in the form of a case plan is demonstrated in Figure 6.1. It is defined on the level of ideas i.e. an idea represents the subject of a case. It is a focal point, around which all possible actions like generation and evaluation are taken. For this reason, the use case of creating an innovation campaign (cf. 10 in Fig. 5.1) that involves submission of multiple ideas is not covered in the case model.

The case model of the integrated innovation process in Figure 6.1 is divided into three stages: *idea generation*, *evaluation* and *decision making*. Stages may be defined as “clusters of activity intended to achieve milestones” [22]. Concurrently, they represent states or phases of the innovation process. Stages contain tasks that describe partial objectives and guide the user through the case.

The first stage *Idea generation* (cf. 1 in Fig. 6.1) contains three task required to initiate the formal evaluation. Apart from the actual description of the idea, user has to define the responsible organizational unit and decide whether to stay anonymous. In case the idea is submitted for discussion only, the last two tasks may be omitted.

The completion of the first stage results in the transition to the stage *Evaluation* (cf. 2 in Fig. 6.1). This stage comprises three tasks: the initial check for formal correctness (cf. 3 in Fig. 5.1), the user feedback (cf. 12 in Fig. 5.1) as well as the expert evaluation (cf. 6 in Fig. 5.1).

The link between two tasks *Perform initial check* and *Create expert's report* looks similar to the one between the first and the second stage. The difference represented by a solid diamond on the part of the task *Perform initial check* indicates that the second task *Create expert's report* depends on the output of the first one. In contrast, the link between the first two stages without a solid diamond represents a dependance on the completion of the stage and not on its output. Thus, the experts' reports are requested only if the formal criteria of the idea are fulfilled.

The link to the third stage *Decision making* (cf. 3 in Fig. 6.1) indicates the dependance on the output of the *Evaluation stage*, i.e. only if the experts' reports have been created, the final decision can be made. The stage comprises two tasks, with the reward depending on

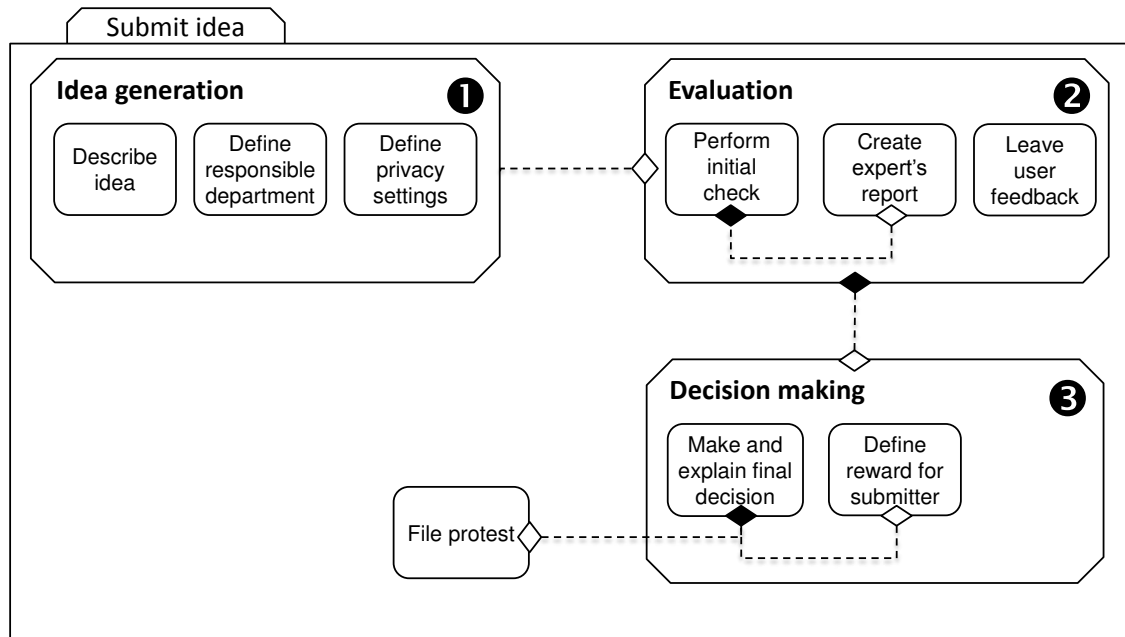


Figure 6.1.: Case model of the integrated innovation process

the final decision. Further, the submitter may file a protest in case of a rejection. This task is, however, not part of the stage.

Not all of the use cases from Figure 5.1 are covered by tasks in the case model. The missing ones can be realized by the means of the standard functionality of ACM. They rather corresponds to implementation requirements described in the next chapter.

As already mentioned before, case model is only a suggestion of how execution of cases may proceed. Case workers do not have to pursue this plan. Every case may be executed in an ad hoc manner. However, case model is expected to evolve over time as repeatable patterns and best practices emerge. For the case model of the integrated innovation process demonstrated in Figure 6.1, the repeatable patterns were extracted from the existing tools.

7. Requirements for Implementation

The previous two chapters presented high-level requirements for the integrated innovation process at DATEV. Additionally to the functionality of the applied tools that has to be preserved in the integrated solution, new requirements dictated by the need for flexibility were introduced. This chapter describes the rather low-level requirements to the implementation of the solution.

7.1. Derived Requirements

The requirements presented in the following were derived from the high-level requirements described above and are intended to provide an appropriate realization of the innovation process. An overview is given in Table 7.1.

R1 Process structure: the hierarchical structure of the integrated innovation process illustrated in Figure 6.1 has to be incorporated by the solution. The process is composed of stages, which in turn contain tasks while the dependencies between these elements indicate a logical sequence for execution.

R2 Task management: as demonstrated by the case model of the integrated innovation process in Figure 6.1 tasks represent sub-goals that, on par with stages, structure the entire case and are required to guide the user through the case process. Therefore the solution must provide users with the ability to handle, delegate, skip and repeat tasks.

- **Execution** of tasks is required to achieve the sub-goals they represent and therefore proceed in the case process.
- **Delegation** of tasks is required in case the current user is not qualified or authorized for the task (e.g. innovation agents delegate creation of reports to experts) or in order to share responsibility or effort (e.g. submitter asks regular users to rate and discuss an idea). User must receive a notification, if they are assigned to a task. An additional requirement suggested by DATEV is the possibility to set a deadline until the delegated task has to be completed.
- **Skipping** is necessary to omit task that users do not want to execute. It allows to complete a stage without achieving all its objectives i.e. finishing all its tasks. Users are free to decide which tasks they execute. Thus, for a simple discussion of an idea, the submitter may skip entering the responsible department and privacy settings in stage *Idea generation* (cf. 1 in Fig. 6.1).
- **Repeating a task** may represent an iteration, since the agility is one of goal for the integrated innovation process. Moreover, repeating a task is the only way

ID	Requirement
R1	Process structure
R2	Task management
R3	Integration of data
R4	Adaptability
R5	Evolution of innovation process
R6	User feedback
R7	Collaborative editing
R8	Visible process progress
R9	User and group management
R10	Access management
R11	Traceability
R12	Comprehensibility
R13	User communication
R14	Search mechanism

Table 7.1.: Requirements for the integrated innovation process

to interact with completed tasks and stages. It is useful for e.g. requesting the submitter or expert to provide additional information in case the description of an idea or a report are not sufficient, since the submission of an idea or a report usually results in transition to the consequent stage.

- R3 Integration of data:** the innovation process at DATEV is data driven. Submitters describe their ideas, experts create reports, regular users leave comments. Therefore, the solution has to serve as a system of record for all information relevant to the idea submission and evaluation process. Furthermore, a structured information model must be integrated with the above mentioned task management in order to assign specific data to tasks.
- R4 Adaptability:** The integrated solution relies on the third generation of the stage-gate process, with adaptability being its core feature. The solution must consequently provide functionality to adapt the process to the specifics of the situation as the work on an idea proceeds. The case model presented in Figure 6.1 contains stages and tasks. They comprise a process pattern that can be utilized at the discretion of case worker. Therefore, case workers must have the possibility to create, remove and edit the data model, tasks and stages suggested by the case model during the execution.
- R5 Evolution of innovation process:** the experience of users grows in submitting and evaluating similar ideas over time. Therefore, new common practices may emerge. The users must have the possibility to modify the process pattern and adapt it to their needs. Thus, the existing case model may undergo some changes that make it more suitable to the actual way people work. This would increase the acceptance of the case model among users. The modification of case model includes editing, adding and removing stages, tasks and the associated data model. An enhancement

of adaptability may be represented by user specific evolution of case models.

- R6 User feedback:** the functionality of DIP (cf. section 3.2) dictates the need for rating and discussion functionality. Therefore regular users must be able to participate in discussions, e.g. by means of comments, and rate the submitted ideas, e.g. by assigning a score.
- R7 Collaborative editing:** for collaborative refinement of ideas the solution must support collaborative editing of data. This may be achieved e.g. by a wiki system.
- R8 Visible process progress:** the solution must indicate the current state of the case which includes the stage and task in progress. The missing data necessary to complete a task must be communicated, too. Furthermore, the available tasks have to be suggested depending on the current stage and user role, guiding the user through the case process.
- R9 User and group management:** the integrated innovation process distinguishes several user roles. Therefore, the solution must allow for user and group management: a task must be assignable to a single user as well as to user group e.g. regular users.
- R10 Access management:** the integrated innovation process at DATEV utilizes confidential data, e.g. personal information about the submitter should be hidden from the experts or the reward is only visible to submitter and innovation agents. Furthermore, some data may be edited by certain users only, e.g. the submitter of the idea is not allowed to change the final decision. Similar constraints apply to tasks that are associated with specific user roles, e.g. a regular user should not be able to delegate or skip the task *Perform initial check* from the stage *Evaluation* (cf. 2 in Fig. 6.1). Therefore, the solution must support access management for both data and tasks. Access rights for data contain the read and write access whereas at the level of tasks it must be possible to specify the rights to handle, delegate, skip and repeat tasks.
- R11 Traceability:** in order to know who edited what data, which task has been finished and when or which information served as a basis for a decision, the solution must provide a log of actions accomplished within a case. This increases the transparency of the process.
- R12 Comprehensibility:** since every DATEV's employee is considered as a potential submitter of ideas, the functionality of the integrated innovation process including modification of cases during the execution must be understandable to business users without process modeling knowledge or programming skills.
- R13 User communication:** the solution must provide functionality for communication between users, e.g. innovation agent cannot request the submitter to edit the description of an idea without explaining the reason for this request.
- R14 Search mechanism:** in order to avoid duplicates there must be a possibility to search for existing ideas.

7.2. Conformity with ACM

This section briefly demonstrates how the implementation requirements for the integrated innovation process described in the previous chapter are covered by the requirements for ACM (cf. section 2.1).

- The requirements for the integrated solution *Process structure* (R1) and *Task management* (R2) are covered by the ACM requirements *Hierarchical structure of tasks* (A7) and *Definition of case objectives* (A6). The required process structure of R1 is restricted to stages and tasks only, whereas A1 does not restrict the number of hierarchical levels. Concurrently, since task and stages represent sub-objectives of the case, both R1 and R2 are also related to A6.
- The requirement *Integration of data* (R3) specifying the integration of structured as well as unstructured data in the integrated solution is supported by the ACM requirement *Integration of data in the case* (A8).
- *Adaptability* (R4) of the integrated solution aiming at managing the uncertainty is contained in the requirement *Flexibility at run-time* (A1) that allows to handle unpredictable situations and adapt to changes during the execution of the process.
- The requirements *Evolution of innovation process* (R5), *Visible process progress* (R8) and *Comprehensibility* (R12) have direct counterparts among the ACM requirements that serve the same purpose. The corresponding ACM requirements are represented by *Evolving cases and templates* (A2), *Visible progress of the case* (A4) and *Understandable and adaptable for business users* (A10).
- *Access management* (R10) as well as *User and group management* (R9) are partially supported by the requirements *Flexible assignment of roles* (A5) and *Transparent responsibilities* (A3). A5 covers the user roles for tasks, whereas access rights for the data model are not specified.
- *Traceability* (R11) of the integrated solution is not directly required for ACM. However, it is, to a certain extent, supported by *Transparent responsibilities* (A3) and *Visible progress of the case* (A4).
- The requirements for the integrated solution including *User Feedback* (R6), *Collaborative Editing* (R) as well as *User communication* (R13) and *Search mechanism* (R14) are not covered by the ACM requirements.

The presented requirements for the implementation of the integrated innovation process at DATEV bear high similarity to general requirements for ACM systems described in section 2.2.2. Most of the requirements for the integrated solution are at least partially covered by the requirements for ACM.

Part III.

Implementation

8. Realization of Requirements

This chapter illustrates the implementation of the solution for the integrated innovation process at DATEV. In particular, the description addresses the realization of requirements presented in the previous part. The implementation of the tool is based on a research prototype that follows the ACM approach. The research prototype called *Darwin* is developed at the chair for Software Engineering for Business Information Systems of the Technical University of Munich in close cooperation with several industry partners. The research project aims at empowering users to collaboratively structure knowledge-intensive processes such as the innovation process at DATEV.

The research prototype Darwin is a web application based on the Play Framework. The server side is written in Scala whereas the client side is implemented by the means of the AngularJS framework. Furthermore, several other JavaScript libraries are used in Darwin for different purposes.

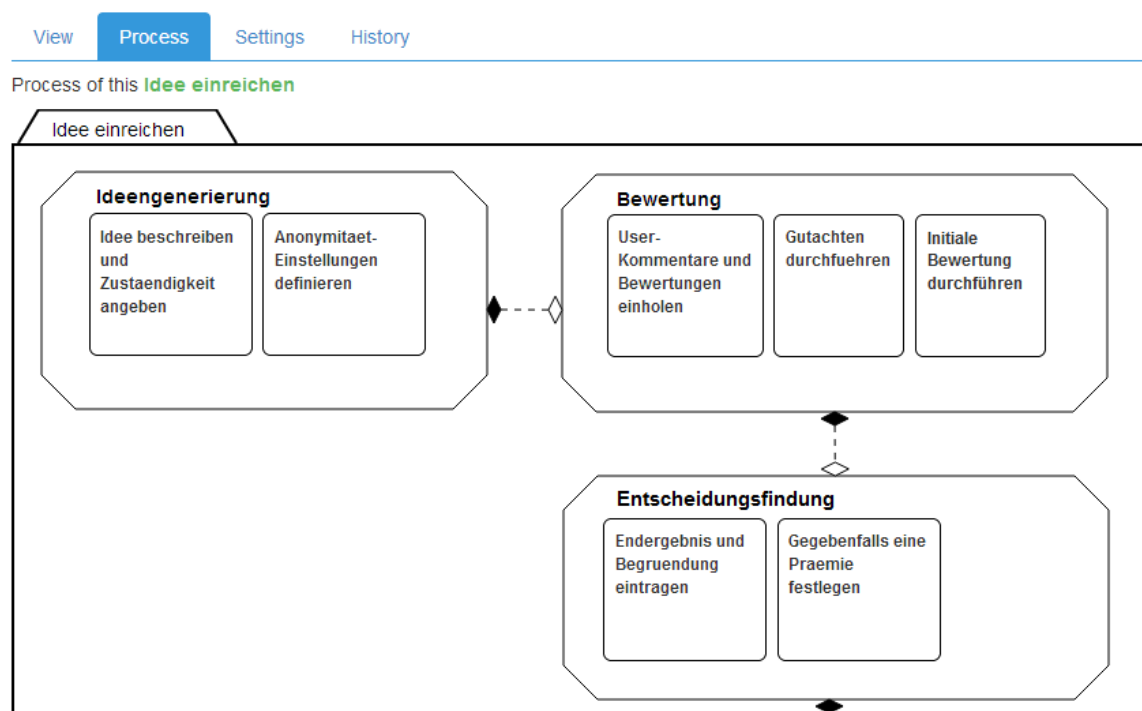


Figure 8.1.: Implementation of process structure

Darwin represents a wiki system that was extended to provide basic ACM functionality. Every wiki page is associated with a case type that describes a case model. Therefore, wiki pages incorporate cases of certain types. The system supports creation of any case

types with corresponding case models, while the integrated innovation process utilizes its own case type. As part of this thesis the specifics of the integrated innovation process, according to the requirements defined in section 7, has been added to the prototype as well as considered in the corresponding case type. Implementation of these requirements is presented in the following. The number given in parenthesis corresponds to the ID of requirement in section 7.

Process structure (R1): the implementation of the hierarchical process structure is illustrated in Figure 8.1. It shows the process tab of a wiki page. This process tab contains an interactive diagram that utilizes the Case Management Model and Notation (CMMN) [16] for case modeling. The process is defined by the means of consecutive stages that, in turn, comprise tasks. The case model demonstrated in Figure 8.1 represents the integrated innovation process and corresponds to the model described in chapter 6.

Integration of data (R3): Figure 8.2 demonstrates the view tab of a case. The case data may be captured in the structured as well as unstructured form. Attributes displayed in the bottom part of the image represent structured data. They may be defined at the level of the case type as well as for single cases. A text editor shown on the top of the Figure 8.2 is used to handle unstructured information.

The screenshot displays a web application interface with a top navigation bar containing four tabs: 'View' (selected), 'Process', 'Settings', and 'History'. Below the tabs is a rich text editor toolbar with various icons for text formatting (bold, italic, underline, link, unlink, list, indent, outdent, quote, unquote), alignment, and other functions. The editor area contains the text 'Hello World!'. Below the editor is a status bar showing 'body p b'. At the bottom of the editor are 'Save' and 'Cancel' buttons.

Below the editor, a heading states: 'This page of type **Idee einreichen** has 11 attributes'. This is followed by a list of attributes, each with a label and an 'Add' button:

- Anonyme Einreichung** (Add Anonyme Einreichung ...)
- Begründung**
- Mitteilung an Vorgesetzten** (Add Mitteilung an Vorgesetzten ...)

Figure 8.2.: Implementation of data model

Task management (R2): every stage is associated with several tasks. Depending on the current stage and user role the available tasks are suggested to the user as displayed in ❶ of Figure 8.3. Case worker has the possibility to execute, skip or delegate task. In order to complete a task, user has to provide the associated data that can be defined as shown in ❷ of Figure 8.3. Whenever a task is activated, only the associated attributes are displayed to the user. Skipping a task corresponds to completing it without providing any data.

Delegation of tasks involves a notification of relevant users. The number of delegated tasks is displayed in the left top corner as demonstrated in Figure 8.4. Case worker can see all delegated tasks and the corresponding wiki page. The delegations are divided into personal and group delegations (cf. Figure 8.4). Whenever a task is completed, it disappears from the user's task list. Deadline for completion of delegated tasks as well as explanatory message for delegee were not implemented in the prototype.

First idea **Ideengenerierung**

Last edited 37 minutes ago by [demo1](#) ☆☆☆☆☆

» Idee beschreiben und Zuständigkeit angeben ❶ Delegate Skip

» Anonymität-Einstellungen definieren

[View](#) [Process](#) [Settings](#) [History](#)

Process of this **Idee einreichen**

Idee einreichen

Ideengenerierung

Idee beschreiben und Zuständigkeit angeben

Anonymität-Einstellungen definieren

Bewertung

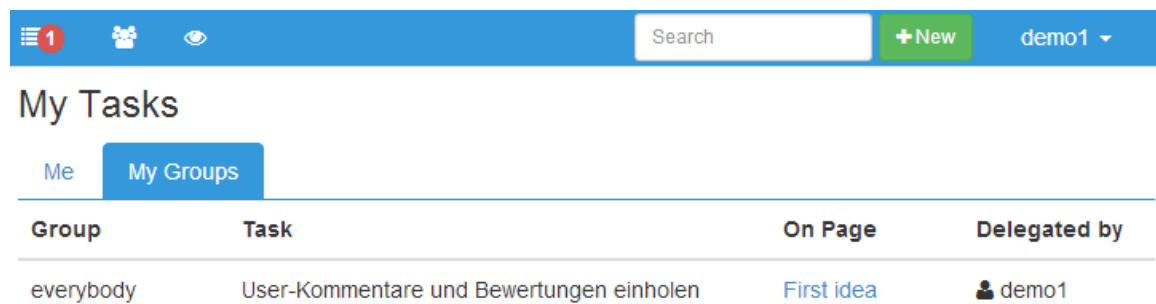
User-Kommentare und Bewertungen einholen

Gutachten durchführen

Initiale Bewertung durchführen

Action Name	Mandatory attributes	Roles
Idee beschreiben und Zuständigkeit angeben	• Titel • Zuständigkeit +	❺ Execute Delegate Skip Ideeeinreicher Search for users and groups...

Figure 8.3.: Task management



The screenshot shows a web interface titled "My Tasks". At the top, there is a blue header bar with a menu icon, a search bar, a "+ New" button, and a "demo1" dropdown. Below the header, there are two tabs: "Me" and "My Groups", with "My Groups" being the active tab. The main content is a table with the following structure:

Group	Task	On Page	Delegated by
everybody	User-Kommentare und Bewertungen einholen	First idea	demo1

Figure 8.4.: Task delegation

Adaptability (R4) and **evolution of innovation process (R5)**: both requirements are fulfilled by the means of the same mechanism. Case workers have the ability to add, remove and connect stages in order to change the logical order of the process (cf. ④ in Fig. 8.3), remove and add new tasks to these stages (cf. ③ in Fig. 8.3), and modify the associated attributes of tasks (cf. ② in Fig. 8.3). These changes can be introduced during the execution-time of the case. They not only affect the current execution of the case, but also apply to the case model of the associated case type. Furthermore, case workers can decide whether to apply the changes globally or locally. Global changes affect the case model at the level of case type, i.e. for all cases of a type whereas local changes only modify the case model of the current case. The idea of user specific case models was not implemented in the prototype.

User feedback (R6) and **collaborative editing (R7)**: collaborative editing is a core functionality of wiki systems. Therefore the text editor in the view tab displayed in the top part of Figure 8.2 may be utilized for collaborative refinement of ideas. Despite being a common feature of wiki systems [28], version control for unstructured information is not implemented in the prototype. Rating of ideas is implemented by assigning a score between 1 and 5 (cf. ① in Fig. 8.5), while the number of stars indicates the average score.

Visible process progress (R8): the current stage of the case that is displayed on the right of the case title (cf. ② in Fig. 8.5) as well as the currently executed task that is color-highlighted (cf. ③ in Fig. 8.5) indicate the current progress of the case. Moreover, the attributes associated with the current task are displayed in the view tab in order to communicate what data has to be provided for finishing the task.

Traceability (R11): the history tab of a case displayed in Figure 8.5 demonstrates the chronological development of a case. The protocol shows modifications of attributes, activations and completions of tasks and stage transitions. Furthermore, case worker may restart a task in the history tab, which is crucial for interaction with completed tasks and stages.

First idea

Bewertung

2

1

★★★★☆

Last edited 3 hours ago by demo1

» User-Kommentare und Bewertungen einholen

3

Delegate

Skip

» Initiale Bewertung durchführen

» Gutachten durchführen

View

Process

Settings

History

Time	User	Changes
2014/05/09 15:20		Page's state changed to Bewertung
2014/05/09 15:20	demo1	finished task Anonymität-Einstellungen definieren
2014/05/09 15:20	demo1	added value of attribute Vermerk in Personalakte
2014/05/09 15:20	demo1	added value of attribute Mitteilung an Vorgesetzten
2014/05/09 15:20	demo1	added value of attribute Anonyme Einreichung
2014/05/09 15:20	demo1	added value of attribute Zuständigkeit
2014/05/09 15:20	demo1	finished task Idee beschreiben und Zuständigkeit angeben
2014/05/09 15:20	demo1	added value of attribute Titel

Figure 8.5.: History tab

User and group management (R9): a simplified user and group management was implemented to support user roles for the integrated innovation process. Case worker has the possibility to create new user groups, join and leave them. Figure 8.6 shows a screen shot of the group management. What is not implemented in the prototype, are the case-related roles: e.g. a regular user that submits an idea is not automatically recognized as the submitter of this idea. The roles are represented by global user groups which is, however, sufficient for demonstration purposes.

User groups

everybody ✓	Leave
Gutachter	Join
Ideeneinreicher ✓	Leave
Ideenbeauftragte	Join

+ Create group

Figure 8.6.: Group management

Idee einreichen

[All pages](#)[Type Attributes](#)

The type Idee einreichen has 9 attributes 	Editor	Reader
Anonyme Einreichung	 Ideeeneinreicher	 Ideeeneinreicher  Ideenbeauftragte
Begründung	 Ideenbeauftragte	 everybody
Entscheidung	 Ideenbeauftragte	 everybody
Ergebnis Gutachten	 Gutachter	 Gutachter  Ideenbeauftragte
Mitteilung an Vorgesetzten	 Ideeeneinreicher	 Ideeeneinreicher  Ideenbeauftragte
Praemierung	 Ideenbeauftragte	 everybody
Titel	 Ideeeneinreicher	 everybody
Vermerk in Personalakte	 Ideeeneinreicher	 Ideeeneinreicher  Ideenbeauftragte
Zuständigkeit	 Ideeeneinreicher	 everybody

Figure 8.7.: Data model with access rights

Access management (R10): access management is required for both data and tasks. Access rights for attributes are defined at the level of case type. For every attribute defined for a case type multiple editors and readers can be assigned as demonstrated in Figure 8.7. The implementation does not fulfill the privacy requirements of the integrated innovation process, e.g. the submitter of an idea cannot be hidden from other users, since access rights only apply to defined attributes. Access rights specifying who is allowed to execute, delegate and skip tasks are defined in the process tab as illustrated in cf. ⑤ on Figure 8.3. Skip and delegate roles automatically include the execution role

User communication (R13): this feature was not directly implemented in the prototype. However, case workers may communicate utilizing attributes or tasks that are only visible to both parties. Delegation of tasks can be used for notifications.

Search mechanism (R14): this feature was not implemented, since the solution is intended for demonstration purposes only.

Comprehensibility (R12): fulfillment of this requirement is subject to the evaluation of the solution described in the last part of the thesis. However, the main focus of the evaluation is the compliance with functional requirements for the integrated innovation process.

9. Case Type Definition

Case types are assigned to wiki-pages that represent cases. They are utilized to define process and data model that underlie the case instances. For the integrated innovation process an own case type entitled *Idea submission* (German: Idee einreichen) has been created. Its process model fully corresponds to the one described in chapter 6. The process comprises three stages with associated tasks: *Idea generation*, *Evaluation* and *Decision making*. The process contains one auxiliary stage that does not contain any tasks and represents the completed state of the case. Figure 8.1 show the process model of the case type *Idea submission*. The data model of the case type was adopted from INITIATIV and is depicted in Figure 8.7. A detailed description of stages and tasks with corresponding attributes and access rights is explained in the following.

Ideengenerierung					
Task Name	Mandatory attributes	Roles	Execute	Delegate	Skip
Idee beschreiben	• Titel	 Ideeneinreicher	☒	☐	☐
		 Ideenbeauftragte	☒	☒	☐
Zuständigkeit angeben	• Zuständigkeit	 Ideeneinreicher	☒	☐	☒
		 Ideenbeauftragte	☒	☒	☐
Anonymität-Einstellungen definieren	• Vermerk in Personalakte	 Ideeneinreicher	☒	☐	☒
	• Mitteilung an Vorgesetzten	 Ideenbeauftragte	☒	☒	☐
	• Anonyme Einreichung				

Figure 9.1.: Idea generation stage

The stage *Idea generation* displayed in Figure 9.1 serves as the starting point of the innovation process and comprises three tasks:

- **Describe idea** (German: Idee beschreiben): this task is associated with the attribute *Title* (German: Titel) that is visible to all users and can be edited by the submitter only. In addition to the title, the submitter and regular users (in case of collaborative refinement) has to provide a description in the form of a wiki text.
- **Define responsibility** (German: Zuständigkeit definieren): the submitter defines an organizational unit responsible for the idea. This task is associated with attribute *Responsibility* (German: Zuständigkeit). Everybody can see it, whereas submitter has write access. The task can be skipped if the idea is intended for discussion and collaborative refinement.

- **Define privacy setting** (German: Anonymität-Einstellungen definieren): this task is associated with three attributes that can be modified by the submitter and are additionally visible to the innovation agents. The privacy settings include: *Anonymous submission* (German: Anonyme Einreichung), *Notify supervisor* (German: Mitteilung an Vorgesetzten) and *Note in personnel file* (German: Vermerk in Personalakte). This task can be skipped by the submitter. All three tasks of the stage *Idea generation* can be delegated by the innovation agents to the submitter, in case the were skipped or if additional information is required.

The stage *Evaluation* follows the stage *Idea generation*. It is depicted in Figure 9.2 and contains three tasks:

- **Perform initial evaluation** (German: Initiale Bewertung durchführen): this task comes after the idea generation in the INITIATIV process (cf. section 3.1). The submitter delegates it to an innovation agent in order to initiate the formal evaluation process. The task has no attributes, so that skipping it is the only way for completion. Only innovation agents have the ability to execute the task.
- **User comments and rating** (German: User-Kommentare und Bewertungen einholen): this task can be executed, delegated and skipped by the submitters and innovation agents. Skipping is required since this task is used for user feedback, which is not involved in the INITIATIV process and can therefore be omitted. But even if user feedback is retrieved by delegating the task to the relevant users, skipping is the only way to complete the tasks since it has no associated attributes. Regular users can discuss the idea using the embedded text editor. Rating is implemented by assigning a score to the wiki page.
- **Create expert's report** (German: Gutachten erstellen): innovation agents delegate this task to experts which can execute it by editing the associated attribute *Outcome of report* (German: Ergebnis Gutachten). The attribute is only visible to innovation agents and experts. This task was adopted from the INITIATIV process.

Bewertung					
Task Name	Mandatory attributes	Roles	Execute	Delegate	Skip
User-Kommentare und Bewertungen einholen		 Ideeneinreicher	☒	☒	☒
		 Ideenbeauftragte	☒	☒	☒
Initiale Bewertung durchfuehren		 Ideeneinreicher	☒	☒	☐
		 Ideenbeauftragte	☒	☐	☒
Gutachten durchfuehren	• Ergebnis Gutachten	 Gutachter	☒	☐	☐
		 Ideenbeauftragte	☒	☒	☐

Figure 9.2.: Evaluation stage

Entscheidungsfindung					
Task Name	Mandatory attributes	Roles	Execute	Delegate	Skip
Endergebnis und Begründung eintragen	- Entscheidung - Begründung	 Ideenbeauftragte	☒	☒	☐
Gegebenfalls eine Prämie festlegen	Prämierung	 Ideenbeauftragte	☒	☐	☒

Figure 9.3.: Decision making stage

The innovation process is completed by the stage *Decision making*. It is displayed in Figure 9.3 and comprises two tasks:

- **Make and explain final decision** (German: Endergebnis und Begründung eintragen): this task can be executed and delegated by the innovation agents committee. For simplicity reasons the task's roles are assigned to innovation agents since they are members of that committee. The task is associated with two attributes: *Decision* (German: Entscheidung) and *Motivation* (German: Begründung) that can be edited by innovation agents and are visible to all users.
- **Define reward for submitter** (German: Gegebenfalls Prämie festlegen): this task depends on the final decision about whether to accept or decline the idea. The task can be executed or skipped (in case of rejection) by innovation agents. It is associated with the attribute *Reward* (German: Prämierung) that can be modified by the innovation agents committee, whereas the submitter of the idea has read access.

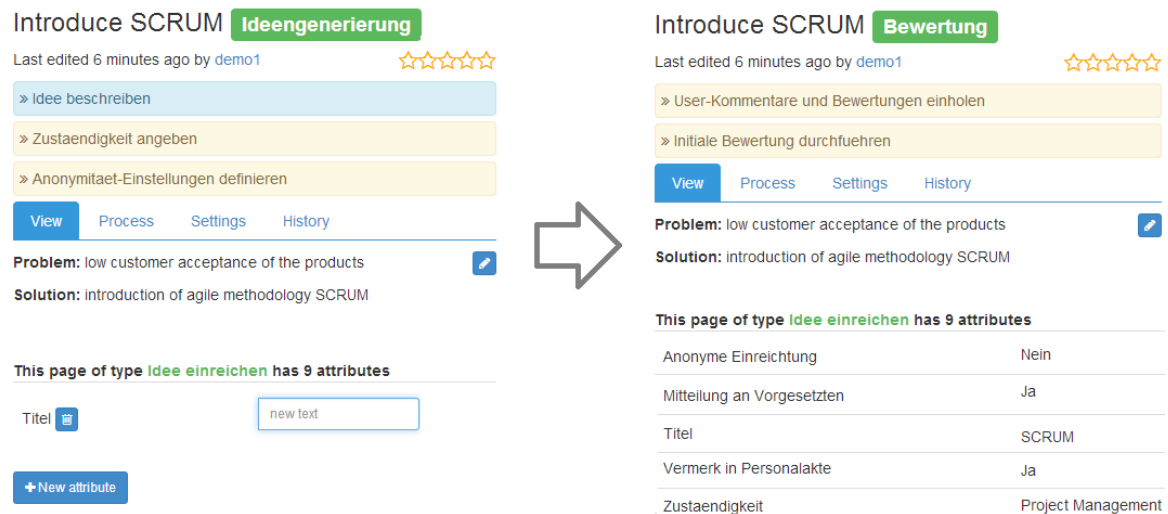
The described elements constitute the planned case model. It can be used to execute the process instances that resemble the scenarios described in chapter 5. Furthermore, due to the run-time flexibility of the tool, the case model can be adapted to the specifics of situation and therefore support any scenario not considered during the modeling phase. The execution of known scenarios is presented in the next chapter.

10. Demonstration of Scenarios

This chapter illustrates an exemplary execution of scenarios presented in section 5. First, the execution of the INITIATIV submission process (cf. chapter 3.1) is demonstrated. Second, a collaborative discussion and rating of ideas resembling the DIP functionality (cf. section 3.2) is shown. Finally, this chapter presents how the combined scenarios are supported in the prototype.

10.1. Idea Submission

This sections describes how the implemented prototype supports the INITIATIV-like submission of ideas. This scenario involves the participation of four user groups: submitter, innovation agents, innovation agents committee and experts. All attributes defined for the case type are utilized. The case model does not have to be modified for the execution.



Introduce SCRUM **Ideengenerierung**

Last edited 6 minutes ago by demo1 ☆☆☆☆☆

» Idee beschreiben

» Zustandigkeit angeben

» Anonymitaet-Einstellungen definieren

View Process Settings History

Problem: low customer acceptance of the products

Solution: introduction of agile methodology SCRUM

This page of type **Idee einreichen** has 9 attributes

Titel

+ New attribute

Introduce SCRUM **Bewertung**

Last edited 6 minutes ago by demo1 ☆☆☆☆☆

» User-Kommentare und Bewertungen einholen

» Initiale Bewertung durchfuehren

View Process Settings History

Problem: low customer acceptance of the products

Solution: introduction of agile methodology SCRUM

This page of type **Idee einreichen** has 9 attributes

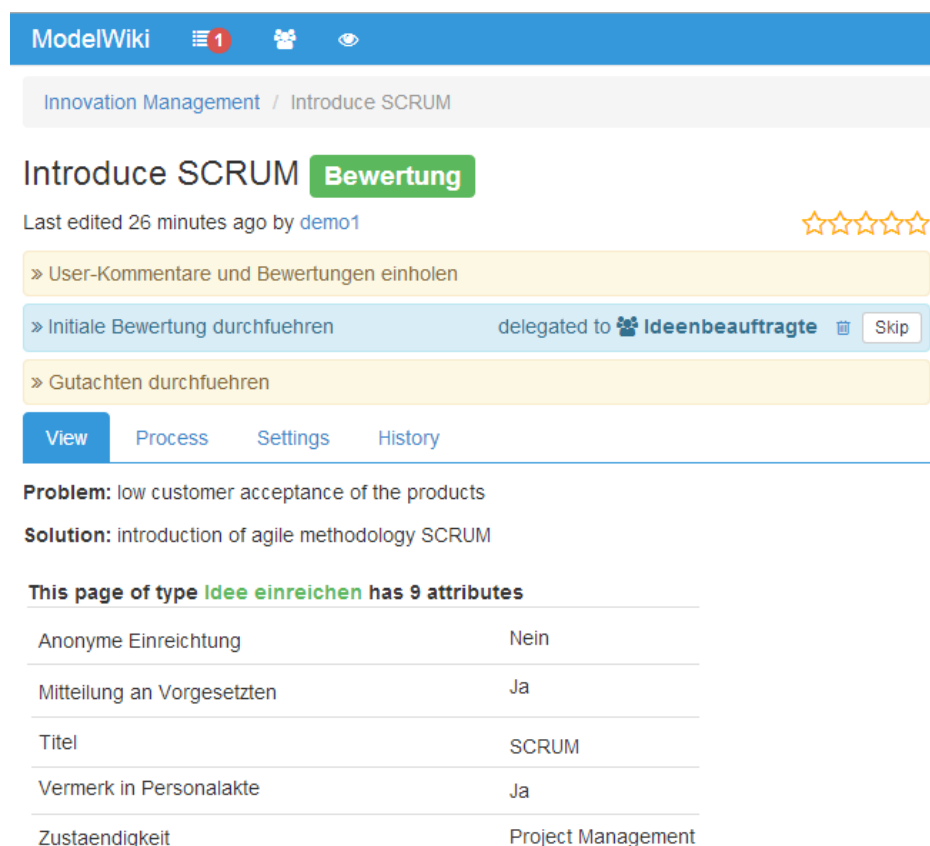
Anonyme Einreichung	Nein
Mitteilung an Vorgesetzten	Ja
Titel	SCRUM
Vermerk in Personalakte	Ja
Zustandigkeit	Project Management

Figure 10.1.: Submitter's view of transition from idea generation to evaluation

1. The submitter creates a new wiki-page and assigns the case type *Idea submission* (German: Idee einreichen) to it. As consequence, the data model of the case type is applied to the wiki-page i.e. it acquires all the attributes defined for the case type (cf. Figure 8.7). The case's initial stage is *Idea generation*.

2. The submitter executes the tasks available in the stage *Idea generation*. They enter the description and title of the idea as well as the privacy settings and the responsible organizational unit. After all three tasks are completed, the case proceeds to stage *Evaluation* (German: Bewertung) as displayed in Figure 10.1.
3. In this step the submitter has to execute the task *Perform initial evaluation* (German: Initiale Bewertung durchführen) and delegate it to an innovation agent, that subsequently receives a notification. Automatic notification of the responsible innovation agents, as it is realized in INITIATIV, was not implemented. The submitter has to know the responsible innovation agent in order to delegate a task.

Figure 10.2 shows the innovation agent's view of the evaluation stage. The available tasks differ from the ones of the submitter's view (cf. right part of Figure 10.1).



ModelWiki

Innovation Management / Introduce SCRUM

Introduce SCRUM **Bewertung**

Last edited 26 minutes ago by demo1

» User-Kommentare und Bewertungen einholen

» Initiale Bewertung durchfuehren delegated to Ideenbeauftragte Skip

» Gutachten durchfuehren

View Process Settings History

Problem: low customer acceptance of the products

Solution: introduction of agile methodology SCRUM

This page of type **Idee einreichen** has 9 attributes

Anonyme Einreichung	Nein
Mitteilung an Vorgesetzten	Ja
Titel	SCRUM
Vermerk in Personalakte	Ja
Zustaendigkeit	Project Management

Figure 10.2.: Innovation agent's view of evaluation stage

4. Innovation agent checks the formal correctness of the submitted idea. If the description is sufficient, innovation agent may complete the task *Perform initial evaluation* by skipping it and delegate the task *Create expert's report* to an expert. In case the description is not sufficient, the innovation agent may repeat one or more tasks of the stage *Idea generation* (depending on the required information) and delegate it to the submitter with the purpose of notification. In this case the wiki-page transitions back to the stage *Idea generation*, with the submitter having to complete the requested task and delegate the initial evaluation to the innovation agent again. Either innovation agents or submitter skip the task *User comments and rating* (German: User-Kommentare und Bewertungen einholen) since it is not required in this scenario. The innovation agent has an option of directly rejecting the idea. Therefore, the task *Create expert's report* is skipped and the case subsequently proceeds to the next stage.
5. The expert receives a notification with the delegated task on the corresponding page. Only one task is available to the expert in the evaluation stage. Visible attributes differ too: the privacy settings are not displayed. The expert creates a report and edits the attribute *Outcome of report* (German: Ergebnis Gutachten). As consequence, the case transitions to stage *Decision making*.

Introduce SCRUM

Entscheidungsfindung

Last edited an hour ago by [demo1](#) ☆☆☆☆☆

[» Endergebnis und Begründung eintragen](#)
Delegate

[» Gegebenfalls eine Praemie festlegen](#)

[View](#)
[Process](#)
[Settings](#)
[History](#)

Problem: low customer acceptance of the products 🔗

Solution: introduction of agile methodology SCRUM

This page of type **Idee einreichen** has 9 attributes

Begründung	Add Begründung ...
Entscheidung 🗑️	+ Idee annehmen Idee ablehnen

Figure 10.3.: Innovation agent's view of decision-making stage

6. After the reports are created, innovation agents have to check whether the provided information is enough. They may request experts to revise their reports by repeating the task *Create expert's report* and delegating it to the experts again. If the report is sufficient, the innovation agents committee has to make the final decision whether to accept or reject the idea and add a motivation for this decision. Depending on the final decision, the innovation agents must either enter the reward for the submitter or skip the task *Define reward for submitter*. The completion of both tasks results in transition of the case to stage *Completed* which represents the completion of the process. Figure 10.3 shows the innovation agent's view of the stage *Decision making* exposing two available tasks.

7. After the completion of the entire process, the submitter may file a protest against the final decision, which is not directly implemented in the prototype, and re-initiate the evaluation process from the beginning. Therefore, the submitter has to repeat the task *Perform initial evaluation* and delegate it to an innovation agent. Figure 10.4 shows the submitter's view of the completed case. There are no available tasks. The visible attributes do not include the expert's report according to the attribute access rights (cf. Figure 8.7).

Introduce SCRUM

Abgeschlossen

Last edited 2 hours ago by demo1
☆☆☆☆☆

View Process Settings History

Problem: low customer acceptance of the products

Solution: introduction of agile methodology SCRUM

This page of type **Idee einreichen** has 9 attributes

Anonyme Einreichung	Nein
Begründung	positive expert's report
Entscheidung	Idee annehmen
Mitteilung an Vorgesetzten	Ja
Praemierung	Financial reward
Titel	SCRUM
Vermerk in Personalakte	Ja
Zuständigkeit	Project Management

Figure 10.4.: Submitter's view of the completed stage

10.2. Discussion and Collaborative Refinement

This section demonstrates how discussion and collaborative refinement are supported in the prototype. The scenario presented below was adopted from DIP (cf. chapter 3.2). It involves the participation of regular users and the submitter of an idea. The data model of the case type is hardly utilized in this scenario: only one attribute must be entered.

1. In the first step the submitter has to create a new wiki-page of case type *Idea submission*. Consequently, the data model and the process pattern including stages and tasks is applied to the created wiki page.
2. *Idea generation* is the starting stage of the created case. The suggested available tasks include the description of idea, privacy settings and the definition of responsible organizational unit. Only the first task must be executed for this scenario. Therefore the tasks *Define responsibility* and *Define privacy settings* must be skipped by submitter in order to complete the first stage.
3. In the consequent stage *Evaluation* the submitter has to execute and delegate the task *User comments and rating* to regular users. The remaining available tasks of the stage can be ignored in this scenario.

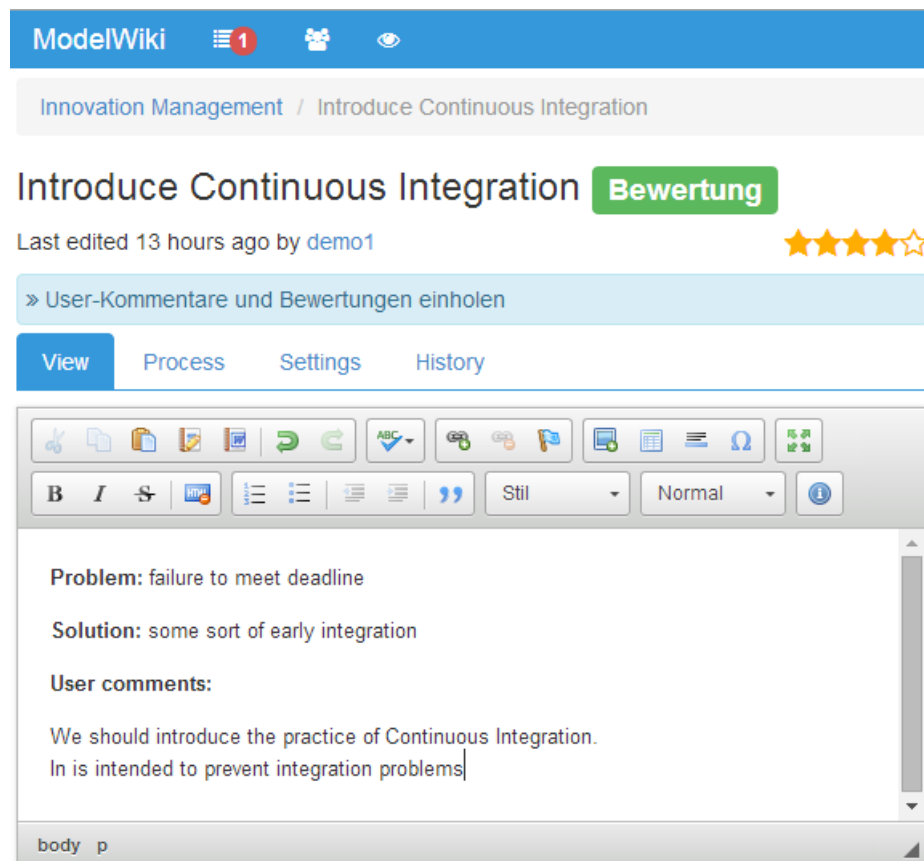


Figure 10.5.: Regular user's view of evaluation stage

4. In this step the actual discussion and rating of the submitted idea takes place. Figure 10.5 shows the regular user's view of the *Evaluation* stage. Only one task is available to them. The delegated task results in a notification of all users. They may utilize the embedded text editor to refine the idea and leave their comments. Additionally, they may assign a score to the page that is displayed in the top right corner of Figure 10.5.
5. In order to finish the discussion and rating of an idea, submitter has to skip the delegated task *User comments and rating*, thereupon the notifications of regular users disappear from their task lists. However, in contrast to DIP the idea may still be discussed and rated after the completion of the task.

10.3. Combined Scenarios

In addition to the support of scenarios that are currently implemented by INITIATIV and DIP, the prototype covers new ones that emerged from the combination of both functionalities. This section describes how such scenarios are supported by the solution. An exemplary execution of three combined scenarios described in chapter 5.2 is presented in the following.

Submission of collaboratively generated ideas represents a continuation of the scenario presented in the previous chapter. The execution stopped in the stage *Evaluation* after skipping the task *User comments and rating*.

1. Before initiating the formal evaluation process, the submitter has to provide information that was omitted in the stage *Idea generation*. The tasks of defining the responsible organizational unit and privacy settings were skipped. So the submitter either has to directly enter the corresponding attributes or repeat the skipped task which will transition the case to the stage *Idea generation*. After the previously skipped tasks are completed, the case will again proceed to the stage *Evaluation*.
2. The only task available to the submitter in this stage is *Perform initial evaluation*. In order to initiate a formal evaluation the submitter has to execute and delegate this task to an innovation agent.
3. The innovation agent subsequently receives a notification about the delegated tasks and continues the submission process according to the description in section 10.1 from the fourth step on.

Utilizing user feedback for the final decision extends the process of direct submission described in the in section 10.1. In the sixth step the innovation agent checks the expert's report. In case it is not sufficient, additional information may be requested by repeating and delegating the task *Create expert's report*. This scenario adds a new option to the arsenal of the innovation agents.

1. Innovation agents repeat the previously skipped task *User comments and rating* of the stage *Evaluation* and delegate it to the relevant users. The stage of the case changes to *Evaluation*.

2. After enough ratings and comments are submitted, the innovation agent may complete the task *User comments and ratings* which will result in the transition to stage *Decision making*.
3. In the next step, the innovation agents committee makes the final decision on the basis of both expert's report and user feedback. The completion of the process is described in section 10.1 from the sixth step on.

Utilizing user feedback for protest against the final decision extends the submission process described in section 10.1. The last step of the process involves a protest against the final decision and restart of the entire process. Utilizing user feedback at this point may improve the chances for the acceptance of the idea or, instead, prevent the submitter from re-initiating the entire process.

1. The scenario starts when the current stage of the case is *Completed*. Before restarting the formal evaluation process, the submitter has to repeat the task *User comments and ratings* and delegate it to regular users. Consequently, the stage of the case will change from *Completed* to *Evaluation*.
2. This step involves a discussion and rating of the idea as described in section 10.2. The task is finished once the submitter skips it.
3. After the user feedback is retrieved, the submitter decides whether to initiate the formal evaluation process or not. In order to proceed with the process, they have to repeat the task *Perform initial evaluation* and delegate it to an innovation agent.
4. Further process execution evolves as described in section 10.1 from the fourth step on.

Part IV.

Evaluation and Conclusion

11. Evaluation

Evaluation of the implemented solution constitutes the last objective of the thesis. The resulted prototype is evaluated through a group discussion with DATEV employees that are, to one extent or another, involved in the integrated innovation process. The participants included two representatives of the department of strategic company development that in general coordinates the innovation management at DATEV. On the other hand, three workflow specialists, that are currently working on a replacement for the outdated INITIATIV application, took part in the discussion.

The evaluation started with a demonstration of the implemented prototype. After a short introduction, different scenarios were executed as described in chapter 10. First, the support of the INITIATIV-like submission process was demonstrated. The second step included the presentation of the DIP functionality realized in the prototype. Finally, the support for combined scenarios representing the actual advantage of the integrated innovation process was demonstrated to the participants.

Following questions formed the agenda for discussion:

1. **INITIATIV:** Does the implemented solution support the functionality of INITIATIV? What are the pros and cons of the solution compared to INITIATIV?
2. **DIP:** Does the implemented solution support the functionality of DIP? What are the pros and cons of the solution compared to DIP?
3. **Combined application:** What are the new application possibilities/scenarios of the integration innovation process?
4. **Usability:** Are the business users able to execute the defined case model? Are they able to adapt the model?
5. **General feedback:** Do you have any general ideas for improvement of the implemented prototype?

The group discussion produced following findings (numeration corresponds to the questions):

1. The demonstrated prototype in general implements the functionality of INITIATIV and supports the associated submission process. However, several functions that are critical for enterprise applications were not realized in the prototype:
 - The role of *Coordinator* who controls the entire submission process and has access to any data and tasks is not directly implemented, since it is not involved in the standard execution of the submission process. However, the role can be easily added by providing full access to every task and attribute of the case model.

- In every stage all visible attributes of the case are displayed. INITIATIV, instead, shows attributes that are relevant in the current stage. This functionality was not implemented due to the nature of the underlying wiki-system. The process execution is data driven, so that the implemented ACM functionality is intended for assistance of data entry, not for restriction.
- The communication between users is not directly implemented. However, it can be realized by a workaround explained in chapter 8.
- The notification of users does not implement a reminder mechanism.

For the standardized submission process no advantages of the implemented solution were identified, since its adaptability is not utilized in that case.

The disadvantages of the prototype compared to INITIATIV have their roots in the generic nature of the solution. Its user interface represents an area for improvement and may be adapted to the specifics of the innovation process. Another disadvantage is represented by a relatively high learning barrier. The streamlined workflow of INITIATIV that is enabled by a rigid underlying process is less error-prone and provides a better guidance.

2. The functionality of DIP is supported by the prototype with the exception of following aspects:
 - The user-to-user communication is not provided.
 - Usage of pseudonyms for nicknames is currently not supported. At the moment of the evaluation the prototype did not implement a registration mechanism. Therefore all existing users were hard-coded.
 - The phase of discussion and rating of ideas cannot be stopped like it is implemented in DIP. Even in the consequent stages regular users may edit the description and rate the idea.

The advantage of the implemented solution compared to DIP is the visible progress of the process: it is clear what happened to the case before and what is expected in the next step.

3. Two of three presented combined scenarios, i.e. *submission of collaboratively generated ideas* and *utilizing user feedback for the final decision*, received high acceptance among participants. *Utilizing user feedback for protest against the final decision* was considered improbable to occur. The participants came up with a new combined scenario that involves experts who utilize user feedback for creating reports. The suggested case model only considered submitters and innovation agents for asking regular users.

The combined functionality raised a question of how to reward the submitters of collaboratively generated ideas. Usually, ideas that are collaboratively developed in DIP are rewarded. However, this is rather an organizational question.

-
4. The complexity of the implemented prototype was considered too high for regular users, since the innovation tools are not used frequently. This does not allow for effective learning. Moreover, rare usage of the tools decreases the need for adaptability. Moreover, the generic nature of the prototype further increases complexity and therefore decreases usability.
 5. General ideas for improvement of the prototype included realization of complex business rules, functionality for reporting and analysis of submitted ideas, and the ability to define rigid process sections that cannot be skipped or modified.

The evaluation revealed that the implemented solution not only supports the existing scenarios but also allows for execution of new, emerging ones e.g. utilizing user feedback for expert's report. Therefore, the solution can be applied to support the highly uncertain innovation processes. Comments from the participants of the evaluation regarding the missing functionality were expected, since the prototype was not intended for productive use. Furthermore, the evaluation revealed a high complexity of the solution.

12. Summary

Apart from the implementation of a prototypical solution for the innovation process at DATEV, the overall purpose of this thesis was to analyze how ACM can be leveraged to support adaptive innovation processes. ACM is considered as the new promising concept for managing knowledge-intensive processes that are highly uncertain, unpredictable and non-repeatable. Further, innovation process is considered as one of the prominent examples of such processes.

The research was performed in cooperation with DATEV eG that provided insights into the tools and processes it deploys for innovation. The tooling support at DATEV in general comprises two applications with different purposes: INTIATIV implementing a rigid submission workflow and DIP (DATEV Idea Pool) for discussion and collaborative generation of ideas. The main shortcoming of both tools is the lack of integration with each other. Therefore, the main objective for this thesis was the development of a prototypical solution for the support of the integrated innovation process at DATEV. Apart from the integration of both functionalities, providing adaptability that plays a crucial role for innovation, was another key requirement for the thesis.

In the first step, the existing innovation process and both the tools deployed at DATEV were thoroughly analyzed. Subsequently, a conceptual solution for the integrated innovation process comprising the use cases, scenarios, formal process description as well as implementation requirements were created. The identified requirements for the agile integrated innovation process to a large extent correspond to the requirements for ACM systems that were derived from the current literature.

The implementation of the solution is based on a research prototype developed at the sebis chair of the Technical University of Munich. The research prototype represents a wiki system that was extended to provide the basic ACM functionality. In the course of the implementation, new features were added to the prototype to comply with the requirements for the innovation process at DATEV.

The resulted solution was evaluated together with DATEV employees responsible for the innovation process. Apart from several specific features which were not realized in the prototype, the solution supports scenarios that are currently implemented by INTIATIV and DIP as well as new ones that emerged from the combination of both functionalities. In conclusion, the results of this thesis show that ACM is able to support highly uncertain innovation processes through its adaptive nature.

13. Discussion

Both the tools INITIATIV and DIP remain in usage at DATEV. However, due to its outdated technology INITIATIV is currently being reimplemented. As its predecessor, the new implementation will follow a rigid predefined process. In order to support more variations, the underlying submission process has been extended by several branches and loops. A lot of resources have been invested into the definition of the new process, making it quite complicated, although only the early stages of the innovation process are supported. This leads to the assumption, that the definition of the entire innovation process, from the idea generation stage to the introduction of the resulted product, which includes all possible deviations and execution scenarios, is too complex to be completed within reasonable time and budget. This substantiates the shortcomings of defining knowledge-intensive processes by the means of traditional workflow management tools.

There may be several reasons why organizations still utilize rigid processes. In case of the innovation process at DATEV, such reasons include the simplicity for users and legal restrictions that enterprise applications have to fulfill. The high simplicity represented by rigid guidance, however, inhibits creativity. At DATEV this problem is mitigated by the fact that the idea generation and submission process is separated from the actual implementation. However, this leads to other problems like lacking traceability and redundancies.

In fact, high complexity of the implemented prototype was mentioned during the evaluation. It has a negative effect on usability and may overwhelm the users, especially because they make use of the innovation tools quite rarely. The main complexity driver of the prototype is its generality, since it is supposed to support any knowledge-intensive processes.

As the example of DATEV demonstrates, simplicity provided by rigid predefined processes was eventually preferred over adaptability. ACM, however, allows to achieve both goals (at least it is required to). Therefore, the decision of DATEV has been rather dictated by the lack of appropriate tools on the market. Thus, the results of the thesis may have an impact on the vendors of solutions for innovation processes, making them recognize the feasibility of ACM for innovation processes, so that there is no need to choose between adaptability and simplicity anymore.

14. Outlook

The results of the thesis allow to make first reasonable assumptions about the suitability of ACM for the implementation of innovation processes. However, in order to produce more concrete and valuable results about the feasibility and user acceptance, the solution must be better tailored to the specific innovation process and the evaluation must involve a significant number of potential users of the application.

As mentioned in the previous chapter, DATEV sticks to the existing tools that follow a rigid process. A further development of the prototype may potentially result in an acceptance of the solution or, at least, its underlying principles. In order to be ready for a productive application the implemented solution must undergo severe modifications that could be subject to the future work. The required functionality can be adopted from the results of the evaluation described in chapter 11. Therefore, the candidates for the extension of the prototype would include the support of complex business rules. Further, for improved interoperability the solution should be implemented in conformance with the Case Management Model and Notation (CMMN). The rules should allow for the definition of rigid process parts that cannot be skipped or modified. The application of the solution in an enterprise environment requires the solution to implement an analysis and reporting functionality. Another important feature mentioned during the evaluation is represented by the user-to-user communication.

“Design for people” and “build for change” are the main principles that will shape software applications in the future [38]. The latter is per se supported by the implemented solution due to the adaptive nature of ACM. The former represents an area for improvement, which was revealed in the evaluation. Consequently, in order to increase the usability and therefore user acceptance, the solution should also follow the principle “design for people”. Therefore, the business users must be able adapt the tool, e.g. its user interface, to the way they want to work.

Appendix

Bibliography

- [1] Allan Afuah. Innovation management: strategies, implementation and profits. 2003.
- [2] Ian Alexander and Neil Maiden. *Scenarios, stories, use cases: through the systems development life-cycle*. John Wiley & Sons, 2005.
- [3] N Aschenbrenner. Wissensgesellschaft-trends: Vom info-bit zum wissen. *Pictures of the Future (Siemens) Frühjahr*, pages 64–67, 2004.
- [4] Bethany M Byron and Steven B Shooter. A review of software solutions for the management of new product development and product family planning. In *ASME 2005 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*, pages 947–957. American Society of Mechanical Engineers, 2005.
- [5] Henry W Chesbrough. The era of open innovation. *Managing innovation and change*, 127(3):34–41, 2006.
- [6] Henry William Chesbrough. *Open innovation: The new imperative for creating and profiting from technology*. Harvard Business Press, 2003.
- [7] Rachel Cooper, Ghassan Aouad, Angela Lee, Song Wu, Andrew Fleming, and Mike Kagioglou. *Process management in design and construction*. John Wiley & Sons, 2008.
- [8] Robert G Cooper. Stage-gate systems: a new tool for managing new products. *Business horizons*, 33(3):44–54, 1990.
- [9] Robert G Cooper. Perspective third-generation new product processes. *Journal of Product Innovation Management*, 11(1):3–14, 1994.
- [10] Robert G Cooper. Winning at new products: pathways to profitable innovation. In *Proceedings Project Management Research Conference, Montreal, Canada*. MPM, 2006.
- [11] James W Cortada. *Rise of the knowledge worker*. Routledge, 1998.
- [12] Thomas H Davenport. *Thinking for a living: how to get better performances and results from knowledge workers*. Harvard Business Press, 2005.
- [13] Peter F. Drucker. *The age of discontinuity: Guidelines to our changing society*. Harper and Row, 1969.
- [14] Peter F. Drucker. *Management Challenges for the 21th Century*. HarperCollins, 1999.
- [15] Claude R Duguay, Sylvain Landry, and Federico Pasin. From mass production to flexible/agile production. *International Journal of Operations & Production Management*, 17(12):1183–1195, 1997.

- [16] Object Management Group. *Case Management Model and Notation (CMMN)*. formal/2014-05-05.
- [17] Object Management Group. *Case Management Process Modeling (CMPM) Request For Proposal*. Bmi/2009-09-23.
- [18] Matheus Hauder, Dominik Münch, Felix Michel, Alexej Utz, and Florian Matthes. Examining adaptive case handling for enterprise architecture management. In *9th Trends in Enterprise Architecture Research Workshop (TEAR), 2014 18th IEEE International*, 2014.
- [19] Matheus Hauder, Simon Pigat, and Florian Matthes. Research challenges in adaptive case management - a literature review. In *3rd International Workshop on Adaptive Case Management and other non-workflow approaches to BPM (AdaptiveCM)*, Ulm, Germany, 2014.
- [20] Jürgen Hauschildt and Sören Salomo. *Innovationsmanagement*. Vahlen, 2011.
- [21] Christian Herrmann and Matthias Kurz. Adaptive case management: Supporting knowledge intensive processes with it systems. In *S-BPM ONE-Learning by Doing-Doing by Learning*, pages 80–97. Springer, 2011.
- [22] Richard Hull, Elio Damaggio, Riccardo De Masellis, Fabiana Fournier, Manmohan Gupta, Fenno Terry Heath, Stacy Hobson, Mark H. Linehan, Sridhar Maradugu, Anil Nigam, Piyawadee Noi Sukaviriya, and Roman Vaculan. Business artifacts with guard-stage-milestone lifecycles: managing artifact interactions with conditions and events. In *DEBS’11*, pages 51–62, 2011.
- [23] Stefan Hüsigg and Stefan Kohn. Computer aided innovation – stat of the art from a new product development perspective. *Computers in Industry*, 60(8):551–562, 2009.
- [24] Stefan Hüsigg and Stefan Kohn. Open cai 2.0—computer aided innovation in the era of open innovation and web 2.0. *Computers in Industry*, 62(4):407–413, 2011.
- [25] Barry Jaruzelski and Kevin Dehoff. Beyond borders: the global innovation 1000. *strategy+ business*, 53(Winter):52–69, 2008.
- [26] Patrick Kelly and Melvin Kranzberg. *Technological innovation: A critical review of current knowledge*. San Francisco Press San Francisco, 1978.
- [27] Craig Le Clair and Connie Moore. Dynamic case management—an old idea catches new fire. *Forrester Research*, 2009.
- [28] Ilaria Liccardi, Hugh C Davis, and Su White. Caws: a wiki system to improve workspace awareness to advance effectiveness of co-authoring activities. In *CHI’07 Extended Abstracts on Human Factors in Computing Systems*, pages 2555–2560. ACM, 2007.
- [29] Angela Liew and Chris Akroyd. Executing management control through decision technology. In *PACIS*, page 79, 2010.

- [30] Patrick Link. Agile methoden im produkt-lifecycle-prozess–mit agilen methoden die komplexität im innovationsprozess handhaben. In *Komplexitätsmanagement in Unternehmen*, pages 65–92. Springer, 2014.
- [31] James Manyika, Michael Chui, Jacques Bughin, Richard Dobbs, Peter Bisson, and Alex Marrs. *Disruptive technologies: Advances that will transform life, business, and the global economy*. McKinsey Global Institute, 2013.
- [32] Sam Marwaha, Parul Seth, and David W Tanner. What global executives think about technology and innovation. *McKinsey on IT*, (5):18–21, 2005.
- [33] Hamid Motahari Nezhad, Susan Spence, Claudio Bartolini, Sven Graupner, Charles Bess, Marianne Hickey, P Joshi, Roberto Mirizzi, Kivanc Ozonat, and Maher Rahmouni. Casebook: A cloud-based system of engagement for case management. 2013.
- [34] Hamid R Motahari-Nezhad and Keith D Swenson. Adaptive case management: Overview and research challenges. In *Business Informatics (CBI), 2013 IEEE 15th Conference on*, pages 264–269. IEEE, 2013.
- [35] Stephan Münter. Evaluation of enterprise 2.0 tools based on usage patterns. Master’s thesis, Fakultät für Informatik, Technische Universität München, 2014.
- [36] Bernd Oestereich and Christian Weiss. Apm–agiles projektmanagement. *Erfolgreiches Timeboxing für IT-Projekte*. dpunkt. verlag, Heidelberg, 2008.
- [37] Mark Price Perry. *Business Driven Project Portfolio Management: Conquering the Top 10 Risks that Threaten Success*. J. Ross Publishing, 2011.
- [38] T Pohlmann and C Moore. The new it imperative: Design for people, build for change. *Forrester Research*, 2007.
- [39] Karl Popper. *The logic of scientific discovery*. Routledge, 2005.
- [40] Michael E Porter. The competitive advantage of notions. *Harvard business review*, 1990.
- [41] Everett M Rogers. *Diffusion of innovations*. Simon and Schuster, 2010.
- [42] Daniel B Stang and Robert A Handler. Magic quadrant for cloud-based it project and portfolio management services. 2013.
- [43] Daniel B Stang and Michael Hanford. Magic quadrant for it project and portfolio management. *Gartner RAS Core Research Note, Gartner Research*, 2010.
- [44] Keith D. Swenson. *Mastering the Unpredictable: How Adaptive Case Management Will Revolutionize the Way That Knowledge Workers Get Things Done*. Meghan Kiffer Press, 2010.
- [45] Andreas Szinovatz and Christian Müller. Management der komplexität im innovationsprozess vom stage-gate-modell zum survival-of-the-fittest-modell. In *Komplexitätsmanagement in Unternehmen*, pages 93–112. Springer, 2014.

- [46] Hanna Timonen and Kaija-Stiina Paloheimo. The emergence and diffusion of the concept of knowledge work. *Electronic Journal of Knowledge Management*, 6(2), 2008.
- [47] Keith D. wenson. Designing for an innovative learning organization. In *17th IEEE International Enterprise Distributed Object Computing Conference*, pages 209–213, Vancouver, Canada, 2013.