User-centric Business Process Transformations: Challenges and First Solutions

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Abstract: The deployment of user-centered design methods such as contextual design in business process digitalizations is still at its beginning, in particular in conjunction with business process modeling techniques. Since their collaborative deployment is not a straightforward endeavor, this paper discusses challenges and first solutions in conducting contextual inquiry in combination with business process modeling. The challenges were acquired through observations in field studies and their validity is corroborated through a literature study of relevant and related works. This paper's main intention is to provide practical support and motivate the use of user-centered design methods in business process transformations.

1 INTRODUCTION

The continuously increasing global competition forces industrial companies to drive organizational changes and innovations forward (Richter et al., 2017). In this context, the digitalization of business processes along the value chain is taking on a significant role; it is an essential step in the digital transformation of companies (Binner, 2018) and requires both, an active participation of users in digitalization processes (Eller, 2009; Hanser et al., 2020) as well as an understanding of the end-to-end process and its steps through a formal specification (Fleischmann et al., 2018) to achieve a sustainable outcome.

To ensure the latter and avoid the risk of an incomplete understanding of the process, process modeling techniques and standards such as BPMN are often used (de la Vara and Sánchez, 2008). Business process modeling contributes to a coherent and clear visualization of the individual process steps, the resources involved as well as the data and information flows (Owen and Raj, 2003). It also facilitates the identification of weak points and establishes a communication basis between users[1] and developers (Staud, 2017), which makes it possible not only to digitize but also to optimize the process as part of the transformation (Indulska et al., 2009).

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[1]We denote these as *process stakeholders*

1.1 Motivation and Research Design

While business process modelling is an established approach in creating formal and executable specifications of business processes, it lacks user-centric aspects that are needed for a successful transformation. We introduced contextual design concepts such as *contextual inquiry* (Holtzblatt and Beyer, 1997) into the digitalization of business processes in order to find out whether we could ascertain an improvement in transformation quality and process usability (Zollweg and Zander, 2020). Contextual inquiry is a user research method in which a researcher conducts a combination of observation with semistructured interview techniques *in* the user's working environment to exploratively collect qualitative data (Holtzblatt and Beyer, 1997). Therefore, the use of contextual inquiry helps to analyze and understand processes within their environment, to identify the individual process steps and to realize the digitization according to user-centered design principles (Vilpola et al., 2006).

Our work is built on the *hypothesis* that a combination of contextual inquiry and business process modeling helps, on the one hand, to identify and consider individual and personal aspects and, on the other hand, to gain in-depth process knowledge that enables a holistic view of the process in the context of business process transformations. We tested our hypoth-

esis in a *field study* (described in Section 1.2) which revealed that the combination of contextual inquiry and process modeling using BPMN was proven to be successful for the digitalization of business processes (Zollweg, 2020). However, the field study also revealed that integrating contextual design methods in business process modelling is *not* a straightforward process and poses a number of *challenges*.

In this paper, we report on such challenges together with first solutions on how to address these. Our findings were corroborated with the relevant literature in order to ensure their validity. We argue that despite these challenges, a combination of contextual inquiry and business process modelling can make substantial contributions in successful and sustainable business process transformations since a user-centric approach not only promotes acceptance of the digital solution by employees, but also ensures that all individual perspectives are perceived and integrated into the digitized process (Eller, 2009; Hanser et al., 2020).

1.2 Field Study

The field study played a central part in our research design as it allowed us to test our hypothesis and evaluate our observations and findings. The study includes the transformation of an analog distribution process into a digitized and digitally integrated process within a large world-wide operating manufacturing company. In the course of this process digitization, a mobile application was implemented that enables employees to digitally complete a previously manually filled out data sheet via tablets.

Manually recored data was transferred in a further step to the SAP system, which serves as a common database and manages information, material, and value flows in the factory. This manual data recording lead to the situation that data had to be transferred twice, which created an immense source of errors and required a lot of time. It also led to a inconsistencies, which meant that information could not be distributed to all the involved departments in a timely manner.

The main goals of the transformation were to ensure traceability and transparency among material movements and states, minimize errors, save time by eliminating manual operations, and increase the overall process efficiency. To ensure that the mobile application contains all the functionalities relevant to the process and meets the requirements of the employees, several contextual inquiries were carried out as part of the requirements analysis. The contextual inquiry was conducted by two people, an employee from the IT department who was responsible for the implemen-

tation and the employee who initiated the transformation process. The total duration of the contextual inquiry was approximately one hour. During this time, the entire process was observed and the process steps that required further clarification were repeated.

After the conduction of the contextual inquiry the collected data was structured and analyzed and a process model of the current process was created using BPMN. The process model was analyzed, functional and non-functional requirements were formulated and a business process model of the optimized process was created. Based on these requirements, a prototype was designed, tested, and implemented.

Usability tests were conducted by 10 users using a Post-Study System Usability Questionnaire (PSSUQ) (Lewis, 1992) to evaluate the digitized process. The questionnaire consisted of 16 questions, divided in the categories: *functionality, simplicity of use, learnability, effectiveness, user satisfaction* and *error handling*. With an overall PSSUQ score of 1.575, the result of the PSSUQ was rated as positive (cf. (Sauro and Lewis, 2012)).

The positive result confirms the hypothesis that an improvement in process usability can be achieved by combining contextual inquiry and business process modeling.

2 BACKGROUND

2.1 Business Processes Digitalization

Organizations face the challenge of designing their business processes in such a way that they can be adapted quickly and flexibly to the market situation (Christ, 2015). The digitalization or partial digitalization of business processes enables companies to increase process agility and thus react flexibly and quickly to changes in the operating environment. Another beneficial aspect of digitized business processes is the increase in efficiency, since digital processes contribute directly or supportively to value creation (Wolan, 2020). In addition, the reduction of manual data transfers in digitized business processes reduces errors (Appelfeller and Feldmann, 2018) and also leads to the elimination of time-consuming media discontinuities. Digital processes can standardize IT systems and ensure more performant and structured data capture and processing. In addition, not only vertical process transparency is increased, but also the horizontal overview of all business processes is improved and process standardization is simplified (Wolan, 2020; Appelfeller and Feldmann, 2018).

2.2 Usability Engineering, Usability and User Research

The variety of definitions of usability is extensive and the understanding of it can differ depending on the perspective (Eller, 2009). Consequently, an exact interpretation of the term usability always depends on the context of its use. The term user experience often appears in connection with usability. There is no universally valid definition for it either, but many different approaches to defining it. In some cases, user experience is used synonymously with the term usability (cf. (Richter and Flückiger, 2013)). Other definitions clearly distinguish between the two terms. According to the standard DIN EN ISO 9241 210, User Experience includes the perceptions, emotions, and physiological and psychological reactions of the user that occur before, after, and during the use of a software product. User experience is understood as a consequence of the design, functionality, and performance characteristics of a product. In addition, the user's knowledge, skills, and brand perception can play a role in the user experience of a software product (of Standardization, 1999).

The positive effects of usability have been proven in many studies, thus confirming its relevance as a success and quality feature of software products (Seffah and Metzker, 2009; Mao et al., 2005). If software products can demonstrate a high level of usability, users are encouraged to work more effectively and efficiently, which in turn has a positive effect on their productivity. According to the ISO standard, users, their tasks, and the work and application environment should be included in the development process as early as possible (ISO13407:1999,).

While the relevance of usability has been recognized, its integration into the software development process proves problematic for many companies (Fischer et al., 2011). Reasons for this were investigated many times, since they are however not topic of this work, they are not further addressed here.

In the context of usability engineering, it is important to explore the needs and the specific application contexts of the users (Seffah and Metzker, 2009). The goal of usability engineering is to reduce the functionality of a software product to an optimal minimum and to avoid unnecessary complexity (Burmester, 2008). To achieve this goal, different user research methods can be applied. As the elaborated challenges in this paper are based on the combination of the methods contextual inquiry and process modeling both methods are briefly described in the next section.

2.3 Contextual Inquiry

The method *contextual inquiry* is a part of the contextual design methodology, which includes various ethnographic methods (Holtzblatt and Beyer, 1997). Within the implementation process, the researcher conducts an observation and a semi-structured interview in the user's work environment to collect qualitative data (Savarit, 2020). The contextual inquiry method aims to analyze and understand the user and their needs before the development of a new product begins (Rosenbaum et al., 2000). Therefore, it is recommended to perform this method at the beginning of a project (cf. (Savarit, 2020; Holtzblatt and Beyer, 1997; Coble et al., 1995)).

The method takes an observational approach in which the researcher explores all aspects of the employee's environment as well as his or her activities. This allows the researcher to obtain personal information about the user (Savarit, 2020). In addition, this approach provides valuable insights that would be overlooked in a laboratory or unfamiliar environment, or would be difficult for users to communicate during an interview (cf. (Coble et al., 1995)). According to this, the completeness and correctness of the data collected is not dependent on how willing the employee being observed is to provide information. Another advantage of this method is that one has access to the real environment in which the product will later be used and can come to understand the user in his familiar environment, where he feels most comfortable. Moreover, the researcher is able to register unpredictable procedures and identify possible difficulties (cf. (Richter and Flückiger, 2013)).

By conducting a semi-structured interview alongside the observation, the observer can use specific questions to ensure that the observed phenomena are properly understood and interpreted. The interview questions serve as a guideline during the inquiry and allow participants to answer them freely with the aim to reach a so-called "story-telling mode". It allows the moderator to follow interesting leads and dig deeper in case something interesting or unexpected emerges during an interview situation.

Despite its many advantages, conducting the user research method contextual inquiry is challenging which will be further elaborated on in Section 3.

2.4 Process Modeling

The modeling of business processes is a prerequisite for their digitalization and automation. It is intended to formalize a company's business processes and to capture the context in which they are executed (Sharp

and McDermott, 2009). Business process modeling can also be applied to understand the process and verify that the understanding corresponds to that of the people who execute and participate in the process on a daily basis (Dumas et al., 2013).

Various modeling languages can be used for process modeling (Fleischmann et al., 2018). BPMN is the most widely used modeling notation for mapping business processes (Fleischmann et al., 2018). One objective of BPMN is simplicity, which nevertheless does not entail any restriction in the representation of complex business processes (OMG, 2011). Another objective and also an advantage of BPMN is that it is a standardization approach to the mapping of processes, which defines formats that are intended to enable an exchange across system boundaries (Bayer and Kühn, 2013). It is also used to establish a basis for communication between the project participants (Murzek et al., 2013). Due to the fact that the notation comprises a high number of language elements, its use is suitable for many different application areas (Fleischmann et al., 2018). The large number of elements also makes it possible to represent even complex dependencies in a compact manner. An advantage of BPMN that is particularly important for the digitalization of business processes is the possibility of representing communication processes between actors (Allweyer, 2020).

3 CHALLENGES

This section's intent is twofold:

(a) The first part introduces the *user-centered requirements specification process* – a workflow used to acquire, analyze, and document stakeholder requirements.

(b) The second part elaborates on the *main challenges* that need to be addressed when combining the user research method contextual inquiry with business process modeling for process digitalization.

Before a business process can be implementation, it needs to be formally specified and user-centric requirements need to be acquired, documented and analyzed. This workflow, which we denoted as user-centered requirements specification process, consists of four phases: (i) *preparation*, (ii) *inquiry and observation*, (iii) *data analysis*, and (iv) *requirements specification*. During the preparation phase, stakeholders are identified, the project scope is defined and the contextual inquiry is prepared. The inquiry and observation phase comprises the actual execution of the

contextual inquiry together with preceding observations. During the analysis phase, the collected observation and interview insights are analyzed and structured. The requirement specification phase transfers the insights into a business process model and thus integrates the results of the contextual inquiry into business process modeling.

We describe the challenges of each phase in separate subsections the order of which correspond to their chronological order in the user-centered requirements specification process.

They have been observed through field studies in a business process digitalization of a large world-wide operating manufacturing company and their validity was counterchecked with related and relevant works (see Section 4).

3.1 Preparation

The goal of the preparation phase is to identify the stakeholders, set the project scope, prepare the interview questions, and set the objectives of the contextual inquiry.

One challenge during the preparation phase is to identify all stakeholders that are directly or indirectly associated with a process and have an interest in the problem and its solution (Mitroff and Mason, 1983). A successful solution is only possible if all relevant stakeholders are identified and their opinions, expectations, and requirements are integrated and reflected in the business process transformation (Adelakun and Jennex, 2002). A stakeholder analysis helps in identifying relevant stakeholders but poses further challenges to the team (Jepsen and Eskerod, 2009).

Ascertaining the relevance and importance of process stakeholders is one of the main challenges, as their roles often become clearer as the project progresses.

A detailed stakeholder analysis is a crucial but time- and resource consuming task. Therefore, it can be challenging to decide whether to make a thorough analysis or to keep the costs small (cf. (Jepsen and Eskerod, 2009)).

Since stakeholders are usually employed in different departments, a lack of common understanding and knowledge can lead to team dysfunctionality and thus an incomplete or inaccurate capture of user requirements (Nelson and Cooprider, 1996). A terminological reconciliation is thus both essential and challenging as the semantics of relevant terms is determined by the working contexts of the participants.

A frequent situation an inquiry team is often confronted with is the necessity to prepare and formulate concrete but open interview questions without having

detailed knowledge about the business case in which a business process is embedded in. This in turn makes it difficult to determine the usefulness of specific interview points beforehand and prioritize them appropriately. However, in order to conduct a successful and insightful interview, it is crucial to define the interview objectives as well as the stereotypes that serve as the primary personas; first solutions to this challenge such as formulating hypothesis that reflect research objectives will be introduced in Section 4.

Another challenge identified during our field study is to prepare for how to approach the employees as their attitude towards the business process transformation is unpredictable. The moderator must remain neutral in any case, no matter what attitude of the participants she encounters.

3.2 Interview and Observation

This phase comprises the execution of the contextual inquiry, which includes the observation and the semi-structured interview. In this phase, the data for the business process analysis including the different operands and artifacts as well as details regarding the process environment are collected.

As outlined in the previous section, it is often impossible to predict the participants' reactions during a contextual inquiry correctly. Therefore, the moderator should expect that views, objectives, and expectations may differ significantly among the different stereotypes. In addition, the moderator has to show a neutral, constructive, and professional behavior during the interview conduction. The importance of social and soft skills in moderation situations has been addressed sufficiently in the related literature, which will be further elaborated in the discussion section.

People sometimes have difficulties in explaining their tasks verbally accurate since they use their own (technical or specialized) wording, which differs from the terminology used in another department, or they disregard allegedly trivial things, which are important for a process formalization. A multitude of the daily routines are done habitually and often unconsciously (Holtzblatt and Beyer, 1997). Hence, it requires thorough preparation and observational tasks before conducting the interview. Moreover, tasks, initially considered simple or straightforward often reveal to be more complex when going into detail and require a substantial amount of time in order to reach a common understanding and shared agreement. This in turn makes it necessary to plan sufficiently.

It is recommended to record the interview and complement audio and video recordings with important aspects of the environment in the form of digital photos (Holtzblatt et al., 2005). In addition, participants may feel disturbed by the camera and behave differently (Holtzblatt et al., 2005). If possible, a second person should monitor the interview simultaneously and specifically focus on emotional reactions and body language of the participants. This observing person could also support the moderator in case an interesting lead or follow-up questions emerge.

In order to obtain a complete and thorough specification of the requirements, the investigation team must focus on detailed documentation of the interviews, because even with comparatively small business processes, the amount of data can grow enormously.

3.3 Data Analysis

The data analysis phase aims to structure and analyze the data collected during the contextual inquiry in order to identify important aspects for the business process digitization. The outcome and success of the data analysis highly depends on the quality, consistency, and completeness of acquired interview data. It is therefore important to plan data acquisition means beforehand and as thorough as possible.

One of the challenges during the data analysis is that not only data from the interview but also from the observation where collected during the inquiry conduction phase. People do not talk about "obvious" or trivial things, as in most cases these are routine tasks that require little to no cognitive stimulus. People often neglect to communicate those information but they are elementary in the data analysis and the requirements specification phase. The challenge thereby is to combine observational with articulated interview data in a consistent and coherent manner wherefore it is necessary to record them in a structured and systematic manner together with meta data (provenance, confidence, trustworthiness etc). Also, conclusions drawn from the acquired data should be reflected with stereotypes to validate their correctness and appropriateness. It is sometimes observable, in particular if the inquiry team has little detailed knowledge about the business process, that relevant questions or issues arise during the data analysis phase. As a consequence, parts of the interview need to be retaken since things that seemed trivial or obvious were initially not documented in detail. This leads to a high expenditure of time and resources (cf. (Viitanen, 2011)).

Since the amount of acquired data increases with the complexity and scope of the observed process, difficulties in structuring and analyzing the data are likely to emerge (Kujala, 2003). In addition to that,

the contextual design guidelines do not provide any recommendations regarding supplemental or substitutional tools, which leads to the team having to organize itself (Kujala, 2003).

Another challenge is to extract and reconstruct problems from the acquired data (Zollweg, 2020). It was observable that participants were not aware about problems before talking about them or analyzing the data. However, there are no guidelines or recommendations regarding the selection and usage of data analysis tools and methodologies. This is one of the most critical aspects in this phase and requires both technological and methodological knowledge by the inquiry team (Holtzblatt and Beyer, 1997; Kujala, 2003).

3.4 Requirements Specification

The requirements specification phase aims to create a business process model from the data collected and analysed during the contextual inquiry and the data analysis. The business process model helps to reflect the business environment in which the process takes place as well as the process itself and therefore is of high importance for the requirements specification (cf. (de la Vara and Sánchez, 2008)). The business process model using BPMN serves as a basis for further discussions regarding the process transformation(cf. (Murzek et al., 2013)).

An interesting observation in our study was that the process modeling revealed details that were not "visible" when conducting contextual inquiry alone. Business process modeling has also helped in other studies to provide a large amount of detail that could not be identified with the use of another requirements engineering approach (cf. (Cardoso et al., 2009)).

Although process modeling with BPMN in the requirement specification phase has many advantages (see Section 2.4), full-fledged knowledge about the modeling primitives of the BPMN notation and its associated rules and semantic is required among the team (OMG, 2011). Consequently, project members need to be familiar with this kind of modeling language in addition to their technical and professional skills. While the flexibility of BPMN provides the ability to model many different processes, it also leads to a level of complexity that can be challenging for users (Fleischmann et al., 2018). The interpretation of models becomes more complex due to the variety of different ways in which similar processes can be modeled (Aagesen and Krogstie, 2015).

Like any modeling language, BPMN has its limitations, which might impact result depending on the business process being modeled (cf. (Recker et al., 2006)). Due to those limitations the modeling of case-

based business processes, which are highly variable from case to case and thus difficult to predict, become very complex and difficult to understand using BPMN (cf. (Recker et al., 2006)). Additionally, the lack of a representation of states using BPMN, leads to difficulties in the representation of control flow patterns (Wohed et al., 2005). The flexible semantics of lanes and pools in BPMN leads to them being used to represent different real-world constructs and thus becoming ambiguous (cf. (Recker et al., 2006; Recker, 2008)). This in turn can lead to problems in the common understanding of the model. Another deficiency of BPMN is that the ability to represent business-oriented aspects such as business rules and business data is very limited (Börger, 2012)).

4 DISCUSSION

In the Discussion section, we present first solutions on how to address the challenges outlined in the previous section. These solutions were discovered from a field study in real-world business process transformations (see Section 1.2). Empirical evidence for the stated solutions is derived from the related literature, i.e., the observations are validated through a literature study. This section also discusses related works and incorporates their findings in the respective paragraphs of each phase.

An important task in the preparation phase is to set priorities and *focal points* for conducting the Contextual Inquiry in order to obtain a clear understanding of the process to be digitized (McDonald et al., 2006). There are difficulties in preparing for interviews, as it is sometimes not possible to determine and prioritize the expedience of certain aspects in advance. Various published *guidelines* and *templates* (cf. (Courage and Baxter, 2005; Wilson, 2013; Kallio et al., 2016)) provide support in formulating specific interview questions and setting realistic objectives. Another technique that is considered helpful is that of using *meta concepts* or *categories* for formulating interview questions (cf. (Richter and Flückiger, 2013)). Examples of such categories are roles distribution, responsibilities and communication, while others could refer to strategies, artifacts, social and cultural effects and working environments. An up front system context analysis (Pohl and Rupp, 2011) would also be helpful in getting a knowledge base for the formulation of interview questions.

Another important task is to conduct a *stakeholder analysis* beforehand in order to identify all relevant stakeholders and to evaluate and understand them and their importance to the project (Brugha and

Varvasovszky, 2000). A stakeholder analysis also helps to gain an understanding about the extrinsic and intrinsic motivation of the relevant people and their attitude towards the business process transformation (Schmeer, 1999).

Since it is difficult to predict the participants' reactions or feelings before conducting the interview, a *pilot test* should always be conducted beforehand (Turner III, 2010). A pilot test also helps in discovering discrepancies and inconsistencies as well as structural and logical flaws. It is also possible to find out whether the prepared interview questions and objectives are sufficient or need to be enhanced (cf. (Van Teijlingen et al., 2010)).

The participants' reactions and feelings towards the process digitalization can never be fully anticipated wherefore the moderator should respond neutrally and empathically to all reactions and attitudes (cf. (Preim and Dachselt, 2015)). Moreover, the researchers' appearance must be neutral, constructive and sympathetic in any case to ensure that the participants do not feel uncomfortable by her or the interview situation, which would bias the result (cf. (Chlebek, 2011)). Our observations confirmed the experiences reported in the relevant literature, that it is important that moderator and participants are on par with each other and that a substantial amount of understanding towards the participants and their working environments is needed for the successful execution of user research (cf. (Batinic, 2008; Heimsoeth, 2015; Weber, 2017; Wright and McCarthy, 2008)).

Sufficiently scheduled *time slots* for conducting the interviews proved to be very important, as tasks initially classified as simple turned out to be more complex and difficult to understand. Furthermore, time constraints may affect the quality of the survey and can lead to incomplete results (Neumeier, 2017). This in return has a negative impact of the success of the data analysis, which highly depends on the quality and completeness of the acquired interview data (Holtzblatt and Beyer, 1997). A *detailed documentation* of the contextual inquiry is therefore necessary in order to reconstruct the process retrospectively as best as possible and to have a complete and thorough specification of the user-centric requirements.

In order to avoid increased time and costs due to the repetition of interview sequences, a focus group interview can be conducted in addition to the contextual inquiry, in which as many different aspects as possible are collected (cf.(Schulz, 2012)). Furthermore, it should be checked whether all relevant stakeholders have been identified correctly and the system context analysis has been accomplished completely.

After completing the data analysis phase it is rec-ommendable to reflect and discuss extracted problems with the responsible persons and to validate pre-taken assumptions. If that validation is relinquished, data analysis results and requirements might be compromised or inaccurate, rendering the process digitalization unsuccessful. These validating iterations are therefore an integral part in the contextual design specification but makes its conduction time- and cost-intensive (cf. (Holtzblatt and Beyer, 1997)).

Since BPMN has become a standard and established itself in industrial practice, a profound knowledge of BPMN within the project team is a fundamental prerequisite for being able to use the modeling language during a business process transformation. To counteract the complexity and the associated difficulty in understanding the model-theoretic semantics, a reduced language scope is used in practice (Recker, 2008). Sometimes, the pragmatic understanding of a model is given more importance than the syntactic correctness, which leads to the fact that syntactically incorrect models are designed knowingly (cf. (Wesenberg, 2011)). Since business process modeling in the digitalization of business processes is used to establish a common understanding of the process, a less complex process model that may not be entirely syntactically correct serves the purpose far better than a highly complex model that is, in consequence, difficult to understand. The question in this case is whether self-designed workarounds to overcome the weaknesses of BPMN are a real problem or whether this approach is better suited than trying to design an all-encompassing language (cf. (Aagesen and Krogstie, 2015)).

Another way to bridge the gap between what should be modeled and what is possible with BPMN is to combine BPMN with other approaches to eliminate the identified weaknesses depending on the use case; Aagsen and Krogsite present various possible extensions and recommended solutions for this purpose (cf. (Aagesen and Krogstie, 2015)).

5 CONCLUSION

Successful business process digitalizations require user involvement as well as a thorough, detailed, and formalized specification of process constituents. The latter is usually done using BPMN while for the involvement of users, we introduced the user-research method contextual design. Although both methods cover different aspects in business process digitalizations, their combination and interplay is not a straightforward task. This paper therefore presented challenges that need to be addressed when combining

both methods for successful business process transformations. The challenges together with recommendations on how to address them were acquired through a field study conducted in a large, world-wide operating manufacturing company and validated by a study of the related literature.

Since our study covers a comparably low-volume business process digitalization, future work should validated the challenges explored during a largescaled process. The variety of available modeling languages as well as a combination of BPMN with other methods and their integration into the software development process, especially into requirements analysis, also offers many future research topics. More work also needs to be done in supporting organizations to adopt such a user-centered methodology by providing additional guidelines and case studies.

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