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FlexIA - A toolkit for the participatory information analysis in small and medium-sized companies

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Abstract. In times of industry 4.0 work processes are getting more and more complex. Thus, new technologies and digital tools are needed to assist small and medium-sized companies. The FlexDeMo project focuses on this challenge. One main project goal is to develop a toolkit consisting of different digital assistants to support companies in participatory assembly planning and simulation. In this paper one of these tools, the FlexIA (flexible information analysis) toolkit, is presented and first practical experiences are discussed.

Introduction

In times of industry 4.0 small and medium-sized companies (SMC) have to cope with multiple aspects of digitization. The increasing complexity of work processes necessitates the use of advanced technologies. Hence, the work context of employees changes rapidly and substantial technological knowledge is needed to manage the daily work routines. How to deal with this challenge is a central

question within the 3-year project FlexDeMo¹. One main project goal is to develop a toolkit consisting of digital assistants to support companies in participatory assembly planning and simulation. One of these tools is FlexIA, that may be used for analyzing the flow of information as well as knowledge sources of SMC's. Incorporating ideas of the participatory design approach by Bjögvínsson et al. (2012) and the framework of design case study presented in Wulf et al. (2011) this paper describes the motivation and the functionality of the FlexIA toolkit. In addition, preliminary practical experiences and possible future improvements are discussed.

The FlexIA toolkit - idea and methodology

The basic motivation of performing a comprehensive information analysis with FlexIA is to provide the user with relevant information, at the correct time and place while spending as little effort as possible. This requires the development of a digital assistant that is able to analyze and satisfy the information needs from the users' perspective referring to cross-functional business processes rather than just isolated information units. On the other hand, it should be possible to intuitively use the tool by different users without much training. Thus, the FlexIA toolkit has been developed following a user-centered design as e.g. presented in Schwab and Wack (2019). Furthermore, the approach is based on the idea of the participatory design of work systems (Latos et al., 2017). Accordingly, employee participation is a key concept when performing an information analysis with FlexIA.

The toolkit developed consists of five core components including a self assessment survey, an information supply matrix and a customized flow diagram. Depending on the goal and work environment of the planned analysis these may be flexibly used and extended by further methods such as semi-structured interviews. Typically, an information analysis with FlexIA is performed in four steps: acquisition of general data, detailed examination, analysis and validation. In the next section these are discussed in more detail.

Using the FlexIA toolkit - first practical experiences

To get an impression of the functionality and possible restrictions of the toolkit it has been prototypically tested in one medium-sized company in the domain of mechanical engineering, thereby performing the above mentioned four steps.

First, value stream mapping (Erlach, 2010) has been used to identify five company processes that need to be analyzed on a micro-level. In parallel, the current digital state of the company was analyzed with the help of a self

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assessment survey. However, the data gained from the survey has been too abstract to derive specific recommendations on an operation level.

In the second step, moderated workshops with affiliated employees were conducted to examine the five identified processes in more detail. The discussion was guided by the moderators and quickly revealed critical points due to the fact that the participants were actively involved in the analysis. The participatory approach also led the employees to reflect the current state of the processes as well as their work spaces.

During these workshops the moderators documented information objects and resources as well as knowledge sources of the processes within a matrix, which was created by adapting elements of the Japanese Makigami (Wagner and Lindner, 2013) methodology. Additionally, the general information flow was sketched graphically in a flow diagram. According to O'Shea et al. (2013) this can be done using e.g. UML. The authors designed a simplified approach based upon BPMN 2.0 (Rücker and Freund, 2019) and UML (Oestereich, 2014) because the flow diagram is supposed to be used by experts as well as novice users and it should consider loops and events. Besides some difficulties regarding the clearness of the flow diagram, this worked quite well.

In the next step the data collected was analyzed both quantitatively and qualitatively. Special emphasis was paid to interfaces, process abnormalities and waste, particularly in the form of unnecessary editing of information. Sometimes, this proved to be difficult because of missing comparative data.

Finally, the results were presented in workshops and discussed with the company's staff to validate the correctness and consistency of the issues found. Nearly all of the problems identified proved to be correct and could be validated. The feedback to this workshop has been very positive and the participatory development of ideas and solutions has been very effective. As stated by Meyer et al. (2018) we also experienced, that information aware users show a higher degree of information literacy and behaviour and also use information more creatively.

Summary and outlook

This paper presented FlexIA, a prototypical tool for the participatory analysis of SMC's information processes developed within the FlexDeMo project. One of the main tasks within the FlexDeMo research project is to offer a digital toolkit to SMCs to optimize their production and assembly planning. A special characteristic of this project is the inherently user-centered approach, which means that the focus is set on the users, who are actively involved in each relevant step. This strategy has already been proved to be very effective during the first tests with FlexIA.

A revision of single methodological components was necessary to resolve encountered problems. Concretely, the information supply matrix and flow diagram were simplified and the self assessment survey was overhauled. Each

component still needs to be transferred into a digital version to allow a more comfortable usage and testing by an extended user community.

Until now, information analysis with the help of FlexIA has only been performed within one medium-sized company in the domain of mechanical engineering. Hence, it is not possible for the authors to draw any conclusions towards the general use of the tool. Further investigations will be necessary in the future to ensure that it can also be used in the context of other domains as well as smaller companies. In this context, the authors already started the evaluation of further tools and methods including work shadowing, as this may provide additional and different analysis data than conventional qualitative research approaches (McDonald, 2005).

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