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RUPERT: A modelling tool for supporting business process improvement initiatives

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Abstract. Business process improvement (BPI) will be a high priority topic for CEOs in the near future. Currently available BPI approaches, however, lack means for adequately codifying, documenting and processing knowledge created in a BPI project. Therefore we developed RUPERT (**R**egensburg **U**niversity **P**rocess **E**xcellence and **R**eengineering **T**oolkit), which is a tool for managing knowledge in a BPI project, covering all stages of the knowledge lifecycle. In this paper, we describe the design and implementation of RUPERT.

1 Introduction

Developments in information technology (e.g. Web 2.0) have brought about high market transparency leading to rapidly changing consumer requirements in recent years [1, 2]. At the same time, increasing market pressure forces companies to reduce costs and to reengineer resp. optimize business processes to be more efficient [3, 4]. To face these challenges, business process improvement (BPI) has been a key subject for CEOs in the recent past and will remain a high priority area to achieve process excellence [4, 5]. A major success factor for BPI projects is the participation of employees engaged in a business process under consideration (see [6]). In a BPI project, the project participants' tacit process knowledge (e.g. of process weaknesses, etc.) is transformed into explicit knowledge which needs to be codified, communicated and processed adequately. However, the management of process knowledge is a topic so far strongly neglected in current BPI approaches (e.g. [2, 7, 8]). Knowledge management tools (KM tools) provide a solution for this shortcoming since they do not only enable to store knowledge suitably but also facilitate the knowledge transfer within a company or across enterprise boundaries [9, 10].

In practice, KM tools are used for supporting all stages of the knowledge lifecycle [10]. Whereas the benefits of KM tools are commonly known (e.g. for innovative product development [9]), their potential for supporting BPI projects has not been investigated in detail yet. A possible explanation might be the lack of KM tools adapted to the specific needs of BPI practitioners. We thus contribute to the effective management of knowledge created in a BPI project, by the prototypical development of the tool "RUPERT" (Regensburg University Process Excellence and Reengineering Toolkit). RUPERT builds on the so-called "BPI roadmap" which we developed during an earlier stage of our research (see [20]). The BPI roadmap is a manageable set of well-established BPI techniques covering all mandatory stages of a BPI project (see e.g. [11]) and has been evaluated in different BPI project settings. Several challenges were associated with the implementation of RUPERT. First, all techniques of the BPI roadmap were supposed to be considered by the tool. Second, the tool needed to be intuitively operable in terms of the handling of the tool and the application of the techniques. The realization of the techniques in the form of an IT-based modelling tool was thus promising for effectively codifying, communicating as well as processing knowledge in practice (see [12]). Third, the tool was meant to support all phases of the knowledge lifecycle [10] in the context of a BPI project. Besides knowledge generation and sharing this also included the automatic creation of reports enabling the analysis of knowledge captured. In the following, we introduce the tool "RUPERT" and emphasize key aspects of its implementation. The remainder of the paper is structured as follows: In section 2, we provide information on the design of the prototype and justify its implementation using a metamodelling platform. Afterwards, we highlight the contribution of the prototype. Section 4 describes the evaluation results gained in a pre-test. The paper concludes with a summary and an outlook.

2 Design of the artifact

Recent studies (see [4]) have shown that process improvement initiatives increasingly abandon holistic BPI approaches, which are often perceived as over dimensioned or inefficient. Instead a manageable set of BPI techniques is preferred (see [4]). Therefore, we have developed a BPI roadmap in a long-term cooperation with an automotive bank, which builds on eleven well-established BPI techniques (see [20]).

The BPI roadmap starts with the *SIPOC Diagram*, visualizing the business process. Afterwards, the *CTQ-/CTB-Matrix* is used to identify customer requirements and *Performance Indicators* are defined for measuring the process performance. By means of the *Measurement Matrix* and the *Data Collection Plan*, the Performance Indicators are prioritized and operationalized. As soon as the process data has been collected, the current process performance is analyzed via *Histograms* resp. *Scatterplots*. Then, problem causes are identified via *Ishikawa Diagrams* and corresponding solutions are developed with *Affinity Diagrams*. After implementing these, means for mitigating unexpected process variances are formulated (*Reaction Plan*) and the process performance is continuously controlled (*Control Charts*). These BPI techniques were transformed into conceptual model types. The *conceptualization* as model types and metamodels is described in an earlier work [20]. We chose this approach because conceptual models have proven as a very effective means for organizing, creating, distributing and preserving knowledge in practice [12]. The model types of the BPI roadmap are interrelated with one another. Results that are produced once can be referenced by other model types. The integrated metamodel of the BPI roadmap linking the technique-specific metamodels by common key concepts (e.g. "critical-to-quality-factors") was the main result of the **design phase**. Each metamodel was formalized (**formalization phase**) using the FDMM formalism, which enabled their mathematical description [13]. This is an important step, since it allows the user to formally define, analyze and evaluate the syntax of the modelling language to be implemented [14]. The formal specification served as input for the implementation of the metamodels via the ADOxx metamodelling platform [13, 15] (**development phase**). An example for the formalization of the metamodel for the *Measurement Matrix Model* as FDMM code is given in Fig. 1. This figure also shows screenshots of the *CTQ-/CTB-Model* and the *Performance Indicator Model*. Further, an excerpt of the ADOxx Library Language (ALL) is shown, which is used for describing user-defined metamodels that are derived from the ADOxx meta[2]model [15].

In general, metamodelling platforms provide great benefits when implementing metamodels, since classes and their relations can be implemented without programming effort (see [15]). Further, an environment for the storage, user interaction and the creation of models, as well as the creation of an installation package for the resulting modelling tool is provided automatically [16]. The ADOxx metamodelling platform (www.adoxx.org) has been successfully applied in various research and industrial projects for more than 15 years and has constantly been developed further [15].

The architecture of ADOxx builds on a database-driven client-server repository providing a multi-user environment with several components to realize modelling methods [15]. The platform proved well-suited for implementing “RUPERT” considering the challenges as stated in section 1. In particular, the querying functionality of ADOxx [15], in the form of the ADOxx query language (AQL), allows to automatically generate user-defined reports and to analyze the knowledge captured.

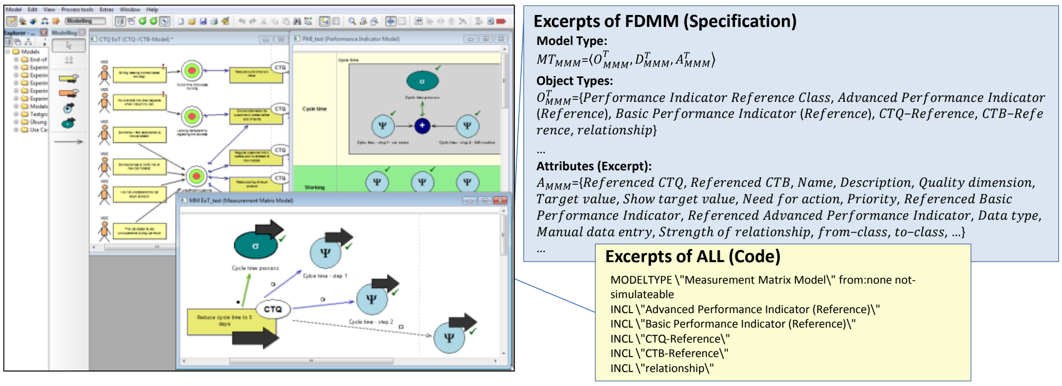

Fig. 1: Examples for model types, FDMM and ALL code

3 Significance of the research

RUPERT contributes to the appropriate documentation, communication and processing of knowledge in BPI projects, supporting all stages of the knowledge lifecycle from capitalizing, sharing, retrieving, to the creation of knowledge concerning the business process to be improved (see [10, 21]). In doing so, a solution for the goal-oriented management of knowledge in BPI projects is proposed. Potential users of the tool are all members of a project team involved in a BPI project. Since the models are stored in a repository and the BPI roadmap covers all stages of a BPI project, process knowledge once captured can be retrieved and reused at any time. Therefore the *capi-*

talization of knowledge (see [10]) is supported. The tool enables to share process knowledge (*knowledge sharing*) (see [10]), since ADOxx builds on a client-server approach, allowing all project members to access the models and results. By the querying functionality of ADOxx, process knowledge can be systematically retrieved from the models e.g. in the form of user-adapted reports (*knowledge retrieval and querying*) (see [10]). These reports support decision making, since the insights gained can be used for deriving problem-specific solutions. Finally, *knowledge creation* (see [10]) is supported, as the model types of the BPI roadmap guide the systematic transformation of employees' implicit knowledge to explicit process knowledge.

4 Pre-test for a usability study

RUPERT represents a proof-of-concept (see [17]) for the previously developed BPI roadmap. The FDMM formalism was used to analyze the soundness and correctness of the created metamodels. In a next step, the usability of RUPERT is to be evaluated in an extensive laboratory experiment with a target sample size between 60 to 100 participants. For that purpose, a pre-test with seven master students (business informatics) of a German university was conducted to evaluate the material developed for the usability study of RUPERT. The material was based on a case study from a real life BPI project at an automotive bank. Based on a given problem statement, the participants were asked to systematically derive solutions for process improvement using the tool "RUPERT". To assess usability, the dimensions efficiency, effectiveness and subjective usability (SUMI) were referred to (see [18]). Effectiveness was judged by the quantity and quality of solutions developed, whereas the "temporal efficiency" was measured by the relation of effectiveness and task time (see [18]). The subjective usability was determined based on the SUMI questionnaire [19]. The results received from the pre-test confirmed the suitability of the material for a larger usability study. The students did well in developing solutions using RUPERT, even though they did not have domain specific knowledge on automotive banks. It took the participants between 58 and 62.5 minutes to complete the case study. The review of participants' solutions (to assess effectiveness) was done by two researchers to reduce subjectivity. Participants perceived the SUMI questions as well-formulated and unambiguous. The download and installation of RUPERT in a computer lab took about 20 minutes. In addition to master degree students, we plan to evaluate RUPERT with practitioners.

5 Conclusion

In this paper, we describe the prototypical implementation of RUPERT. The tool supports the management of emerging knowledge in BPI projects and thus contributes to current BPI research. RUPERT serves as a proof-of-concept for the so-called "BPI roadmap" that was developed and evaluated at a prior stage of this research. In that context, the formalization of the metamodels of the BPI roadmap (via FDMM) proved to be a mandatory step for assessing their correctness prior to implementation. Whereas the BPI roadmap was already evaluated in practice, an extensive evaluation of RUPERT has not been done yet. In future work, RUPERT will thus be evaluated in larger settings in both academia and practice. Further information on RUPERT (screenshots, use case, etc.) as well as the prototype (as an MS Windows installation package) is available at: http://www.omilab.org/web/rupert/home

6 Literature

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