A Tool for Assisted Business Process Redesign

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Abstract

The continuous optimization of business processes remains a critical success factor for companies. The assisted business process redesign (aBPR) concept guides users in improving business processes based on redesign patterns. Depending on the process data at hand, it generates four types of recommendations that differ in their level of automation. This paper presents a tool implementation of the aBPR concept as a stand-alone desktop application that has been successfully used in several case studies. The aBPR tool uses BPMN diagrams, redesign best practices, and simulation experiments to guide the user to improved process designs in a modeling application.

Keywords

Business Process Redesign, User Guidance, Simulation

1. Introduction

Transforming business processes at an accelerating pace is essential for companies to meet increasing competition and customer needs [1]. Business process redesign (BPR) is concerned with improving business processes [2]. It is considered an essential phase in the business process management (BPM) lifecycle since it entails significant economic value by introducing innovation, reducing costs, as well as improving quality, productivity, and customer experience [3, 4]. Despite its importance, BPR lacks clear guidance and often "happens in a black box" ([5, p. 217]). Often, organizations conduct workshops with consultants and stakeholders to analyze process challenges as well as opportunities and manually generate options for process improvements [5]. Even when supported by data-driven approaches such as process mining, the quality and the effectiveness of BPR depend on the creativity and the expertise of the project team to find valuable solutions, which is both time-consuming and costly. Automation of process redesign could thus hold great potential for long-term organizational success, as it could be more efficient with less dependence on human creativity. Several approaches have already dealt

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with how partial aspects of process improvement can be automated. However, to the best of our knowledge, there is no holistic approach that provides end-to-end support and integrates the user into the decision-making process where necessary.

The assisted business process redesign (ABPR) tool was developed as a stand-alone desktop application that guides users in improving process models using an assisted approach and redesign recommendations. Focusing on *incremental process improvement*, it facilitates the popular method of process redesign patterns and a four-step procedure to generate redesign options: step 1) *select* suitable redesign patterns, step 2) *identify* suitable process parts, step 3) *create* alternative models, and step 4) *evaluate* the performance of these alternative models. Executing these four steps leads to redesign options that, after thorough evaluation, may be suitable for improving the process under investigation. The presented ABPR tool integrates this four-step procedure. The literature shows that individual steps and combinations of these steps can be (partially) automated, leaving the finalization of the redesign options with the human user [6]. This is by no means a weakness of related work in this area, but often because the approaches work with assumptions for which data may be missing in the execution. From the possible combinations of automatable and manual steps, four types can be defined with an increasing automation level (AL). The ABPR tool supports this typology so that increasingly specific recommendations for process improvement are proposed to the user, who can adopt them whole or finalize them manually, depending on their type.

In the remainder of this manuscript, we present the ABPR tool with its innovation and characteristics in Section 2, discuss its maturity by describing the measures and outcomes used to evaluate the tool (in Section 3), and conclude in Section 4.

2. Innovation and characteristics

In the ABPR tool, a blank canvas can be used as a starting point to model a process or an existing business process modeling and notation (BPMN) diagram can be imported. The process model is the central starting point for process improvement and can therefore be enriched with far-reaching information that provides a comprehensive picture of the *as-is* state. The ABPR tool provides support for interactively editing the process model and integrates improvement recommendations for the generation of redesign options. A four-step procedure is repeated until satisfaction with the process is achieved and the improved process model is exported. Because of its good usability, we used the Camunda Modeler[1], which is widely used in research and practice, as a starting point for tool development. Figure 1 shows the tool's GUI.

Modeling and simulation In addition to traditional control flow descriptions and considering events, documents, organizations, and lanes, a custom extension of the BPMN metamodel captures simulation configuration, performance data, and ABPR-specific annotations. This allows information to be stored consistently in the model and imported and exported as a . simubpmn file. When importing a basic BPMN diagram, event arrival rates, resources with their costs and timetables, activity durations, routing probabilities, resource timetables, and further properties are initialized with a default configuration to ensure valid models and a convenient

[1] https://github.com/camunda/camunda-modeler

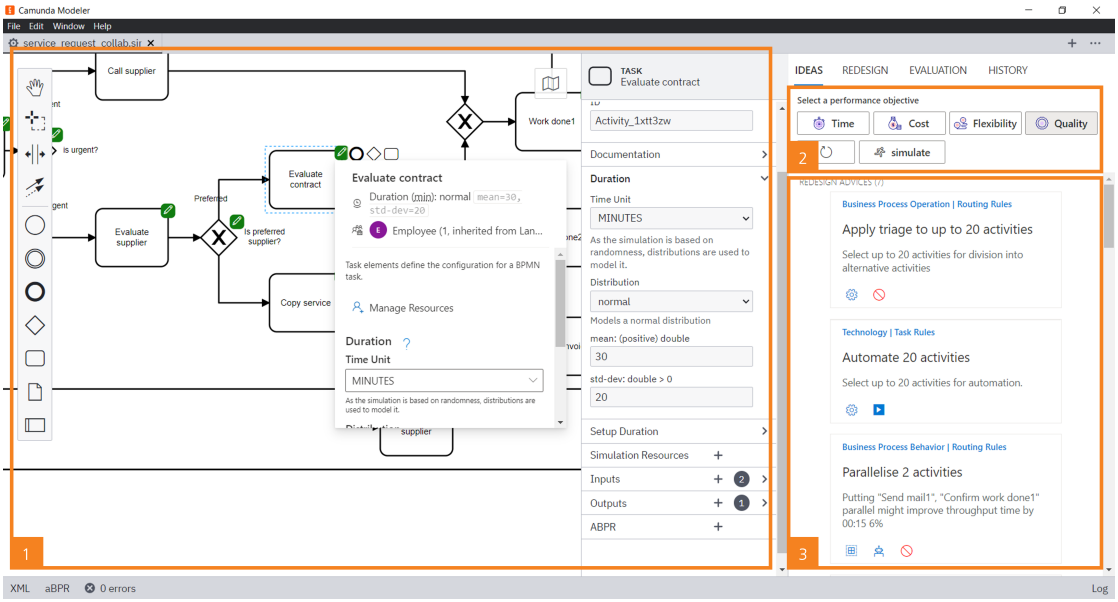
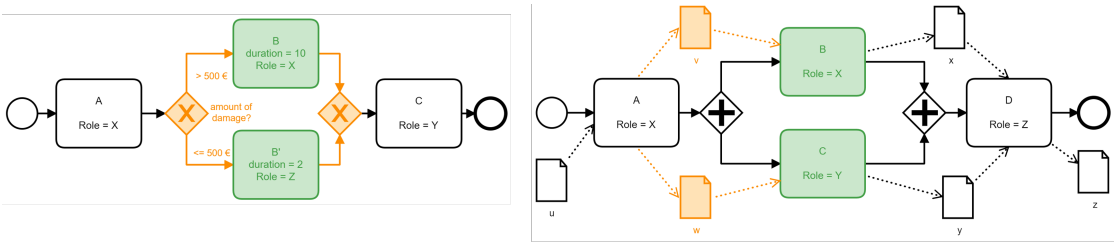


Figure 1: General tool overview with the major GUI components (1) the diagram editor and lint tab, (2) the performance objective selection, and (3) the list of recommendations.

experience for the user. The available element shapes in the process modeler are restricted to a set supported by the redesign handlers. Via static model analysis, the tool identifies modeling errors, detects misconfigurations or missing properties, and provides visual feedback to fix the model. The simulation package Scylla [7] is embedded in the ABPR tool and facilitates the simulation of the *as-is* process model and redesign options. The results of the simulation experiments can be compared side by side to estimate the effects.

Redesign recommendations After modeling the initial process model and validating its real-world fidelity with initial simulation studies, a redesign performance objective, such as time, cost, flexibility, or quality, is selected. Using the process model and the performance objective as an input, the tool then generates redesign recommendations by invoking *recommendation providers* that contain the logic to execute (parts of) the four-step procedure for applying redesign patterns. A recommendation provider may return more than one recommendation and several recommendation providers might provide recommendations for the same redesign pattern. In the graphical user interface (GUI), each recommendation is characterized with its corresponding process aspect, the pattern category, a distinct name, a description, and, optionally, the expected impact and affected process elements. How a recommendation can be applied varies per AL. The ABPR tool supports all patterns from Reijers and Mansar [8] in varying automation levels (AL). The *triage* and *activity automation* patterns are implemented on AL3, the *parallelism*, and *extra resources* patterns are implemented on AL4, whereas the remaining are implemented as AL1 and AL2 recommendations. In case of full automation (AL4), the ABPR tool generates process models in the background with feasible implemented redesign options, such as parallelized task: The developed heuristic checks whether sequential



a) Triage b) Parallelization

Figure 2: Implementation of two redesign patterns

activities can be parallelized or are interdependent (see Figure 2 b). The different models are then simulated simultaneously to reveal effects on performance. The result of this simulation is then integrated into the recommendation and shown to the user. In contrast, at the lowest level, only a general recommendation is made that a redesign pattern can help achieve a performance goal. In the intermediate levels (AL2&3), user input is requested in addition to the automated checks to determine, for example, the applicability of the triage pattern (see Figure 2 a): After selecting activities that are potentially suitable for triage, the user models the new process manually or is guided by a wizard.

To diversify good recommendations in terms of their estimated impact and place them on top of the list of recommendations a $A*$ heuristic is implemented. Users can accept or reject recommendations and evaluate their impact via simulation experiments and own judgment.

3. Tool maturity & evaluation

The stand-alone ABPR tool can be downloaded[2] for Windows PCs and tried, e.g., with a sample process provided in a tutorial[3]. The ABPR tool is the result of a design science research (DSR) project [6] and has been evaluated in terms of operationality, feasibility, and applicability in artificial and naturalistic settings. During the development phase, the tool was interactively demonstrated in eight expert interviews to evaluate the ABPR's feasibility and operationality, based on an artificial service request process that is also demonstrated in a screencast of the tool's functionality[4]. In a second evaluation, we conducted two case studies with professionals engaged in real-world BPR projects in an artificial setting. In the first case, we involved three consultants from a process consulting firm. For the second case, we involved a consultant and a process owner. In a real-world case study with Germany-based industrial automation solutions provider KUKA, the ABPR tool was tested in a workshop where the prototype was utilized to develop process improvement ideas that reduce cycle time by 30 %. Further details on the case studies and the evaluation of the ABPR tool can be found in Fehrer et al. [6].

[2]download: https://dtdi.github.io/assisted-bpr-modeler/
[3]tutorial: https://github.com/dtdi/assisted-bpr-modeler/blob/gh-pages/aBPR%20Tutorial.pdf
[4]screencast: https://www.youtube.com/watch?v=HwXtz2mDHLw

4. Conclusion

In this paper, we introduced the ABPR tool that supports practitioners in improving business processes by guiding them to creating process redesign options and simulating the impact of process changes. The tool is available for download and can be extended with additional redesign heuristics. In future research, we plan to enhance the tool by (a) implementing further redesign heuristics in advanced levels of automation, (b) improving the guidance through the act of process redesign, and (c) integrating additional sources for developing an understanding of the *as-is* business process, such as event logs.

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