Tool Support for the Comprehensive Modeling of Quality Information within Business Process Models

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Abstract: Business process modeling is commonly used to document information about structure and behavior of a business process. However, current business process modeling notations do not support well the expression of quality information relating to business processes. Organizations are interested in the capturing of quality information for quality improvement of business processes and supporting IT systems. We are developing an approach to capture quality information comprehensively within business process models. In contrast to existing approaches, our notation allows the capturing of a broad range of quality characteristics as well as detailed attributes and measures. The approach is implemented as an extension of a CASE tool. Moreover, we discuss lessons learned from the application of the approach to a business process from practice.

1 Introduction

Business process modeling is widely used within organizations as a method to increase awareness and knowledge of business processes, and to deconstruct organizational complexity [BGR05]. Current business process modeling notations do not aim at expressing quality information (QI) such as information about maturity or security of a business process (cf. [Ko08], [PZ08], [SZS10]). Hence, quality requirements are often not considered at the process modeling stage, which results in increased costs and delays in the further development of business processes and involved IT systems. Annotating the process model with QI contributes to a model that provides a more complete representation of the overall business process [PZ08]. A (graphical) expression of QI together with information on structure and behavior within a single model would increase the modeler's focus on quality at the process modeling stage. Therefore, as stated in related work (cf. [SZS10], [PZ08]), it facilitates the capturing of quality requirements and results in a more complete set of requirements. Although the benefit of QI captured in a process model for early requirements elicitation has already been identified by other authors, current approaches only focus on single QI [HKP11]. Our research aims at capturing a comprehensive set of business and IT quality requirements

and the coordination of these requirements. A first step in this direction is the comprehensive modeling of QI within business process models, as business process models are a starting point of requirements elicitation [Ko08].

In contrast to software product quality, which for example is standardized in the ISO/IEC 9126 quality model [ISO01], there is no common quality standard for business processes. Therefore, we developed a comprehensive quality model for business processes that is based on software product quality standards [HP10a], [HP10b].

In this paper, we describe an approach to present the QI of our quality model within a business process model and provide prototypical tool support of our approach. The paper is structured as follows: In Section 2, as a background, we sketch our quality model. Section 3 describes our approach to model QI and the prototypical tool support. In Section 4 we present lessons learned from an exemplary application of the approach and tool. Section 5 concludes the paper and presents future work.

2 Background

In the quality initiative domain process quality is in the focus of research and practice for some decades and there are many high-level and expert-based techniques like TQM, Kaizen or Six Sigma. However, a comprehensive view on the – in particular non-financial – quality aspects of a business processes is still missing.

Therefore, we developed the comprehensive Business Process Quality Reference-Model (BPQRM) [HP10a], [HP10b] using characteristics we transferred from software product quality standards. To the characteristics we allocated a broad range of detailed quality aspects from business process management literature. We use a hierarchical structure of QI defined as follows. A *business process quality characteristic* is a category of business process quality attributes, for example the maturity of an activity. A *business process quality attribute* is an inherent property of a business process that can be distinguished quantitatively or qualitatively, for example the error density of an activity. A *business process quality measure* is a variable to which a value is assigned as the result of measurement. Measures can be defined as *base measures* or *derived measures*. A base measure is a measurement for which the value is directly applicable to the process, e.g. the number of errors or the number of (sub) activities. A derived measure is a measure that is defined as a function of two or more values of base measures, e.g. the number of errors per activity size. In the following, we use the term QI as a superset of characteristics, attributes and measures.

Business process quality refers to the components of a business process. Components are the activities of the process, the actors performing these activities, the objects handled and created by the process as well as the resources necessary for its execution. As an activity can be subdivided into sub activities, we consider a process itself as an activity. In the BPQRM we associated a set of quality characteristics adapted from software product quality standards to each component of a business process. Figure 1 shows the BPQRM. The nodes correspond to the components and the characteristics are listed

either within a node or on an edge between nodes. See [HP10b] for further information.

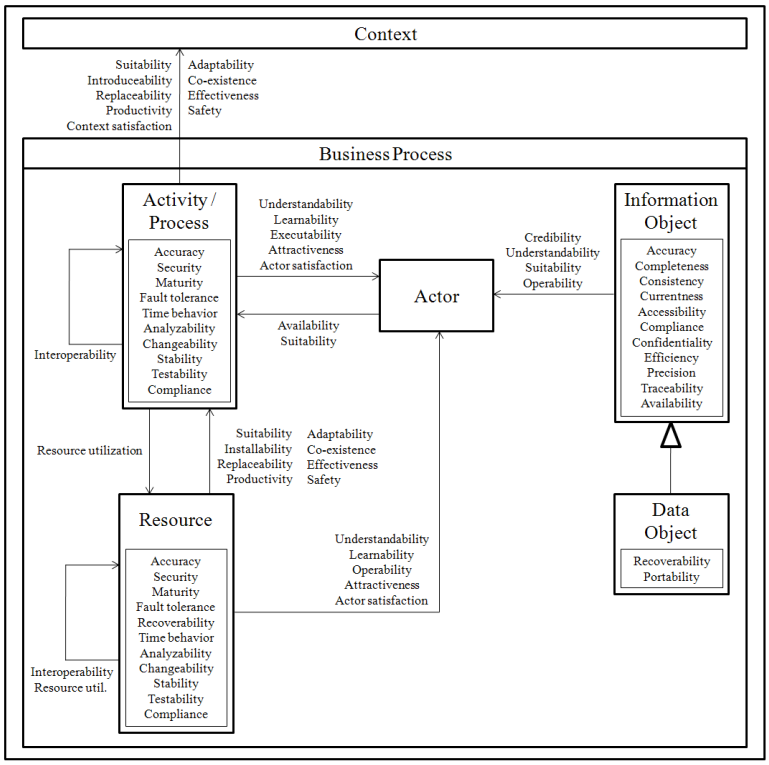

Fig. 1: Business Process Quality Reference-Model

3 Approach and Tool Support

We conducted an extensive literature and tool survey [HKP11] on research approaches and tools from practice for modeling QI within business process models. As shown in the survey, neither of them was able to express QI covered by more than 9 characteristics of the BPQRM. Moreover, in most cases the surveyed tools were not able to express QI in the process modeling view. The deficiencies identified in the survey motivated us to develop an approach to model QI comprehensively within business process models and to provide a new tool support. The research question thereby is how to enable the modeling of a large set of different QI without a major increase of complexity of the modeling notation. We decided to add small graphical symbols to already existing model elements. To each characteristic in the BPQRM we associate a graphical symbol. A detailed allocation of the symbols to the characteristics can be found in [Ka11]. To each symbol we associate attributes, derived measures, base measures and the related values in tabular form. The approach is implemented prototypically as an extension of the Eclipse-based CASE tool UNICASE (http://unicase.org/).

Figure 2 shows a screenshot of our tool. The process model is presented in a split screen view together with the corresponding tables of attributes and measures. Therefore, – in contrast to the surveyed tools – information on structure and behavior as well as information on quality can be presented in a single view. In the process modeling view (Business Process Model) the modeler can capture information on structure and behavior of the business process as a BPMN [OMG11] model and can additionally capture the quality characteristics of the BPQRM. The modeler can add quality characteristics to a process model element by dragging and dropping the characteristic icons from the toolbar beside the process model to the corresponding process model element. By clicking a characteristic icon in the process model, the table of attributes and measures related to the selected characteristic appears in the QI Details view below. Here the modeler can capture the attributes, measures and their values. Thus, it is possible to model a large set of different QI (in the form of characteristics) as well as to capture detailed QI (in the form of attributes and measures) without a major increase of complexity of the process model.

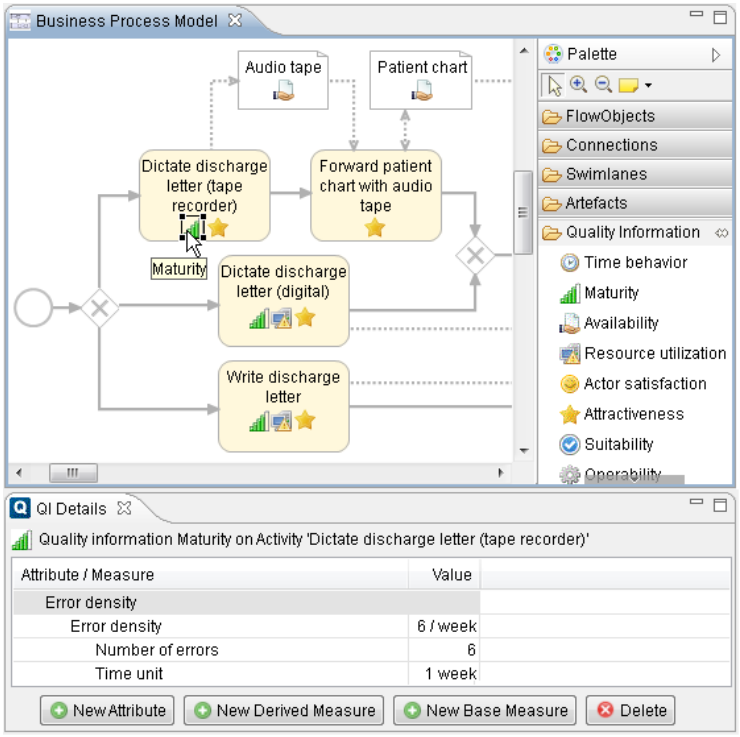

Fig. 2: Screenshot of the Process Modeling Editor

Note that in our view it is important to model QI simultaneously with information on structure and behavior because QI is often elicited together with information on structure and behavior. We think it is not sufficient to enter QI ex post into the model as QI may influence the structure and behavior of a business process. Our approach is applicable to an arbitrary graphical modeling notation. We utilize the BPMN as an example as it is an

up-to-date and wide-spread modeling notation for business processes. Moreover, the BPMN is well suited to be extended.

4 Exemplary Application

In the previous section, we described our approach and the prototypical tool support. In the following, we discuss lessons learned by the application of the tool in a first evaluation. We wanted to get first feedback whether our approach is an adequate means to model the QI of a business process from practice. As an example we choose the process of writing discharge letters in a hospital, because all the components of the BPQRM are contained in the process and there is a large number of QI to be captured. A discharge letter is a summary of the performed patient treatment and is used for the communication between physicians for follow-up treatments. The modeled process consists of 15 activities and handles 5 information objects. 4 actors and 1 IT system are involved in the process. Altogether, we captured 12 different characteristics of the BPQRM and related attributes and measures. For activities we captured the characteristics maturity, time behavior, interoperability, attractiveness and resource utilization. For resources we captured the characteristics maturity, attractiveness and learnability and for information objects we captured currentness, compliance, availability and operability. We did not capture QI related to actors as this QI was excluded on request of the hospital. In Figure 2, as an example, a part of the process is modeled in the process modeling editor. The diagram shows 4 activities and 2 data objects annotated with characteristic icons which are relevant in the process. Further information on the exemplary application can be found in [Ka11]. Next, we discuss lessons learned by applying our approach in practice.

The example showed that our approach is a valid and practically applicable means to model the 12 different characteristics that are relevant in the process. In general, annotating a large set of characteristics to a single model element (the worst case is 26 characteristics per model element for the process components activity and resource) very likely will reduce the clarity of a model developed using our approach. It turned out, however, that in the example the number of modeled characteristics per model element was much lower (typically 1 to 5 characteristics per model element) because not all of the characteristics were relevant to every model element in the specific process.

In the process model we only visualize the quality characteristics. One characteristic icon can represent several attributes and measures. The limitation to characteristics is a useful means to allow a compact overview of the QI. However, the modeler cannot access a specific attribute or measure directly. Instead s/he has to click on the corresponding characteristic icon. For example, if the modeler wants to view the value of the measure *number of errors*, s/he first has to click on the *maturity* icon (see Figure 2). In the future the tool support may provide functionality for the direct retrieval of a specific attribute or measure, e.g. by searching for its name.

The split screen view is a useful means to show details of a single characteristic together with the process model element the characteristic is annotated to. Moreover, the tool

allows the switching between characteristics quickly. However, selecting single characteristic icons may be cumbersome, if the modeler wants to view QI aggregated over different characteristics or model elements. Future work on the tool is required.

5 Conclusion and Future Work

In this paper, we presented an approach to model QI comprehensively within a business process model and provide prototypical tool support as an extension of the Eclipse-based CASE tool UNICASE. The approach puts quality in the focus of business process modelers and therefore helps to capture relevant QI early at the modeling stage. It is built on the results of an extensive literature and tool survey. To the best of our knowledge this approach is the first one which allows the modeling of a comprehensive set of QI within a business process model and provides guidance on the QI to be modeled.
As a next step we plan to conduct further evaluations of the approach. We want to compare our approach to goal-oriented approaches that model quality requirements separately in a goal hierarchy and link them to processes. Moreover, the usability of the prototypical tool support has to be revised. Extending the tool support by additional functionality for automatic QI calculation, analysis or simulation is also desirable.

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