



# Analysis of process model reuse: Where are we now, where should we go from here?



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## ABSTRACT

Business process model reuse means building up new business process models by assembling already designed ones. Significant effort has been made by researchers so far to promote reuse (e.g. via reference models or workflow patterns) and plenty of benefits are assumed (e.g., time and error reduction, quality improvement and productivity gain (Fellmann, 2014)). Contrary to this, the observation is that business process model reuse does not seem to be a common technique in order to design a business process model. To provide reasons for the lack of enthusiasm for business process model reuse, this paper presents the results of a profound analysis of business process model reuse from different perspectives: First, the state of research is unveiled in a comprehensive structured literature review of 143 papers. Second, the engagement of tool vendors to promote reuse is identified in an analysis of 32 Business Process Management systems (BPMS). Third, users' opinions concerning business process model reuse is assessed in two surveys. The integration of the results provides a holistic view on the current state of business process model reuse as well as on future research directions and implications for researchers, practitioners and tool vendors.

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## 1. Introduction

Enterprises struggle with large collections of business process models gathered from numerous projects [2]. Process model reuse might solve the challenges accompanied with managing these collections since it is a common technique in order to build up new process models by assembling already designed ones. Process model reuse means acquiring model assets (e.g., fragment, pattern or architecture) from another context instead of creating the assets from scratch [3].

Therefore, it is argued that process model reuse generates time savings, increases productivity and model quality [1]. Reuse techniques are common in Software Engineering where they date back from the early beginning of programming. Hence, a plethora of research results are available for software reuse and its techniques are well understood in

contrast to process model reuse.<sup>1</sup> Even though process model reuse has been identified as one of the main practitioner's challenges [4], it is still quite neglected. There are some streams of research providing concepts relevant for process model reuse such as business process reference models [5] or distributed systems with a special emphasis on the Service Oriented Architecture (SOA) paradigm. Regarding the former, process model reuse provides a promising alternative to reference process model customization since no reference model is required.

However, the advantages of reusing assets instead of newly creating them by the user herself might be widely acknowledged if a balance between research on process model reuse and commercial interests exists.

<sup>1</sup> An indication of this might be the amount of publications that can be retrieved from well-known paper hosts such as ISI Web of Knowledge (WoK) or Science Direct (SD). Using the term "business process management" AND "reuse" in the topic field, eight publications can be retrieved from WoK and two from SD using the fields abstract, title and keywords. In contrast to that, for "software engineering" AND "reuse", the numbers are 417 and 121. Besides the absolute number of publications on reuse, also the relative importance of reuse is higher in SE than in BPM. Using the same fields as before, 1.8% of the articles retrieved from WoK that contain "business process management" also contain "reuse" (SD: 1.21%). In contrast to that, the percentage of SE articles also focusing on reuse is more than three times higher with 6.6% (WoK) and 5.3% (SD).

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The intention of this paper is a profound analysis of business process model reuse. The paper is guided by the following research questions:

- RQ 1: What kind of assets of business process model reuse have already been tackled by academia/research, i.e. what is the progress of research in business process model reuse?
- RQ 2: What kind of features of business process model reuse are implemented in common BPM systems?
- RQ 3: What kind of features are in demand by users to support business process model reuse?

The analysis presented in this paper should contribute to the understanding of business process model reuse and allow us to derive future directions for researchers and BPMS vendors in order to contribute to a widespread application of business process model reuse. To achieve the objective of this paper the following structure is used. Initially, the term process model reuse is discussed (Section 2) in order to achieve agreement on this concept. Section 3 sketches a preliminary survey that should elicit the status of process model reuse from a user's perspective. One result of the survey indicates a clear dissatisfaction with commercial implementation of features for process model reuse. This result of the survey motivated us to spend further research effort on process model reuse. To unveil the state of reuse in research, a comprehensive literature review on process model reuse was conducted based on a defined taxonomy. The review is presented in Section 4 and indicates that researchers continuously develop ideas supporting process model reuse. While there are numerous contributions suggesting solutions related to abstraction mechanisms, a lack of empirical work is diagnosed, which might affect the popularity of process model reuse. To unveil the state in industry, an analysis of 32 commercial BPM systems (based upon the "Magic Quadrant for Business Process Management" from Gartner [6]) has been carried out, which is summarized in Section 5. The tool analysis shows a poor dissemination of process model reuse features, which means that research results are rarely leveraged from industry. To question the poor commercial exploitation, a second survey has been conducted that addressed BPMS vendors (Section 6). In this survey a consentaneous high importance of process model reuse has been diagnosed with a slight advantage for more established reuse methods. Consequently, the dissatisfaction might be explained due to the low commercial support of process model reuse and researchers should advocate their propositions. We consider our findings as an opening to raise vendors' interest for process model reuse and to motivate researchers to empirically validate their concepts. These findings of the different perspectives are integrated and discussed in Section 7. Finally, a summary of our findings and an outlook will conclude the paper (Section 8).

## 2. Preliminaries: Defining the term and concept of process model reuse

The concept of reuse has been discussed for a long time as key to competitiveness of enterprises [7,8]. Traditionally, concepts of reuse have been studied and applied successfully in Software Engineering [9]. Recently, reuse is also studied in business process modeling as an emerging topic [3]. Much like in Software Engineering where reuse is differentiated in unplanned (or ad-hoc) and planned (or systematic) reuse [10, 11], this distinction can also be applied to process model reuse. Whereas unplanned reuse does not require any special preparation of a model to enable its later reuse, planned reuse can only be achieved by first preparing the model (e.g., documenting the model, creating metadata). A disadvantage of the unplanned reuse is that the costs of the adaptation of a comprehensive model often outweigh the benefits of reuse [12]. Hence, approaches to reuse smaller units such as labels, elements, rules or fragments [13] emerge to create new models out of existing ones. Categorizing business process model reuse in "unplanned reuse" and "planned reuse" also allows one to differentiate between the *act of reuse* and *reusability*. While the former supports the act of reuse (without preparation of what is being reused), the latter concentrates on features that

require preparation. The preparation is the storage of e.g. definitions, patterns or sub-processes for their later reuse.

Independent of the reuse approach, the definition of reuse may be difficult when it is based on the result of reuse, i.e. the newly constructed model. If a model  $x$  coincidentally includes elements, which are present in another model  $y$ , is  $x$  reusing  $y$ ? In order to avoid such difficulties, reuse might be defined emphasizing the process of reuse, analogous to reuse in Software Engineering where it is defined as "...the process whereby an organization defines a set of systematic operating procedures to specify, produce, classify, retrieve and adopt software artifacts for the purpose of using them in its development activities" [14]. We transfer that definition to process model reuse and define it analogously: *Process model reuse is the process to specify, produce, classify, retrieve and adopt process assets such as semi-formal process models or executable process specifications or fragments thereof for the purpose of using them in the construction activity of process assets.*

## 3. Process model reuse from the user's perspective – Results of a survey

Although process model reuse has been identified as an emerging topic, it does not seem to be widely acknowledged by process modelers for the business process model design phase. To analyze the status of process model reuse from a user's perspective, a survey has been conducted.

### 3.1. Interview design

The intention of the survey was threefold:

- to identify if modelers are aware of process model reuse and if they indeed reuse process models,
- to reveal satisfaction with current commercial support for process model reuse in general and
- to ask what kind of features are missing.

The survey was run in May 2011. The foundation of the survey was a structured and standardized online questionnaire. To attract interviewees we spread the link of the online questionnaire to a popular German BPM network, forum and a widely-used mailing list of business informatics ([www.bpm-netzwerk.de](http://www.bpm-netzwerk.de), [www.bpm-forum.net](http://www.bpm-forum.net)). The addressees of the questionnaire were experts with long-standing process modeling experience. The questionnaire consisted of 17 questions (0–16). In the first part of the questionnaire (questions 0–8) we asked about professional skills and business process modeling experience. The second part of the questionnaire (9–16) addressed the perception of process model reuse in general.

### 3.2. Results

Overall, the questionnaire was answered by 47 people among whom 48.9% were researchers (23 persons), 40.4% were practitioners (19 persons) and 10.6% were others (5 persons, e.g., people in education). The researchers had on average around 5.8 years of modeling experience.<sup>2</sup> 36.2% of the interviewees indicated a sole modeling background in practice, 23.4% had only a modeling background in research and 40.4% had modeling experience in both areas. The respondents have used the following tools for process modeling (multiple selection was possible): ARIS platform (40.4%), MS Visio (31.9%), Signavio (14.9%), Adonis (8.5%), MS PowerPoint (6.4%), MS Excel (6.4%) and BizAgi (4.3%). 26 other tools were indicated only once, which are not mentioned one by one. With respect to the process modeling notation, the following have been used: EPC (78.7%), BPMN (65.9%), UML (44.7%), BPEL

<sup>2</sup> This is an average number of all participants that is calculated from a range of less than 1 year of modeling experience to more than 10 years. 74% of practitioners indicated long modeling experience (10 years) and researchers mostly had 3 to 5 years of experience.

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