



# Context-Aware Business Process Management

## Method Assessment and Selection

Jan vom Brocke · Marie-Sophie Baier · Theresa Schmiedel · Katharina Stelzl · Maximilian Röglinger · Charlotte Wehking

Received: 2 October 2019 / Accepted: 3 September 2020 / Published online: 2 March 2021  
© The Author(s) 2021

**Abstract** Context awareness is essential for successful business process management (BPM). So far, research has covered relevant BPM context factors and context-aware process design, but little is known about how to assess and select BPM methods in a context-aware manner. As BPM methods are involved in all stages of the BPM lifecycle, it is key to apply appropriate methods to efficiently use

organizational resources. Following the design science paradigm, the study at hand addresses this gap by developing and evaluating the Context-Aware BPM Method Assessment and Selection (CAMAS) Method. This method assists method engineers in assessing in which contexts their BPM methods can be applied and method users in selecting appropriate BPM methods for given contexts. The findings of this study call for more context awareness in BPM method design and for a stronger focus on explorative BPM. They also provide insights into the status quo of existing BPM methods.

Accepted after three revisions by Christof Weinhardt.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s12599-021-00685-0>.

J. vom Brocke (✉) · C. Wehking  
University of Liechtenstein, 9490 Vaduz, Liechtenstein  
e-mail: jan.vom.brocke@uni.li

C. Wehking  
e-mail: charlotte.wehking@uni.li

M.-S. Baier  
Project Group Business & Information Systems Engineering of the Fraunhofer FIT, Wittelsbacherring 10, 95444 Bayreuth, Germany  
e-mail: marie-sophie.denner@fit.fraunhofer.de

T. Schmiedel  
School of Business, University of Applied Sciences and Arts Northwestern Switzerland FHNW, Peter Merian-Strasse 86, 4002 Basel, Switzerland  
e-mail: theresa.schmiedel@fhnw.ch

K. Stelzl · M. Röglinger  
FIM Research Center, Project Group Business & Information Systems Engineering of the Fraunhofer FIT, University of Bayreuth, Wittelsbacherring 10, 95444 Bayreuth, Germany  
e-mail: katharina.stelzl@fim-rc.de

M. Röglinger  
e-mail: maximilian.roeglinger@fim-rc.de

**Keywords** Business process management · BPM methods · Context-aware BPM · BPM lifecycle · Method selection · Design science research

## 1 Introduction

Business process management (BPM) is an important discipline driving corporate success (vom Brocke and Mendling 2018). Today, organizations must seize opportunities and overcome challenges related to new technologies, customer expectations, and competitors, which makes the ability to respond to situational requirements increasingly important (Edvardsson et al. 2018; Oc 2018). That means, for example, that BPM in start-ups should differ from that in large multi-national organizations or that creativity-intensive processes have different requirements than low-creativity processes (vom Brocke et al. 2016). To better identify and structure such situational requirements, research has analyzed the overall BPM context of organizations, e.g., the nature of processes or the fit between business environment and processes (Dumas et al. 2013; Melão and Pidd 2000; vom Brocke et al. 2016). Hence,

scholars advocate that organizations must consider context when institutionalizing BPM (Harmon and Wolf 2018; Kerpedzhiev et al. 2020) and that a one-size-fits-all approach is likely to fail (vom Brocke et al. 2016). Moreover, context awareness has been recognized as an important principle of successful BPM (vom Brocke et al. 2014) and as a central theme covered by future BPM capabilities (Kerpedzhiev et al. 2020).

The notion of context is increasingly being covered in the BPM literature. Vom Brocke et al.'s (2016) BPM context framework, for example, considers the overall goal of BPM, the characteristics of business processes as well as organizational and environmental characteristics. Melão and Pidd's (2000) framework specifically focuses on the nature of processes, e.g., in terms of goals and activities. Moreover, defining process context in terms of time, location, legislation, culture, and performance requirements, Rosemann and Recker (2006) focus on context-aware process design. Other examples can be found in the area of context-aware process modeling (Ploesser and Recker 2011; Rosemann et al. 2008) and process mining (Günther et al. 2008). Nevertheless, prescriptive knowledge related to context-aware BPM is scarce (Denner et al. 2018b). This is especially true for BPM methods, i.e., tools and techniques that enable performing activities along the BPM lifecycle (Rosemann and vom Brocke 2015), which are key for successful BPM. In some cases, the use of general-purpose, i.e., context-independent, BPM methods such as Six Sigma or value-added analysis (Dumas et al. 2018) is sufficient. In other cases, however, the application of BPM methods that do not fit the context in which they are employed may cause an inefficient use of organizational resources (Dumas et al. 2018; Rosemann and vom Brocke 2015) or even the failure of BPM projects (Schmidt et al. 2001).

Although some researchers have already called for context-aware BPM methods (Kohlborn et al. 2014; Rosemann et al. 2008; van der Aalst 2013; vom Brocke et al. 2016), there has been little response so far, meaning that most BPM methods still assume a one-size-fits all approach (vom Brocke et al. 2016). Today, most BPM methods are not context-specific – or at least they do not state in which contexts they can or should be applied. Recent examples of BPM methods which account for specific contexts are Anastassiou et al. (2016), who proposed a method for identifying information that is most likely to influence the process goal, and Denner et al. (2018b), who developed a method for exploiting the digitalization potential of business processes. Despite these contributions, little is known about context-aware BPM methods (Rosemann et al. 2008; vom Brocke et al. 2016). Specifically, practitioners lack guidance on *assessing* the applicability of BPM methods currently being used and on

*selecting* appropriate BPM methods for given contexts. Hence, they do not know whether their BPM methods are fit for purpose (Zelt et al. 2018). Against this background, our research question is as follows: *How can BPM methods be assessed and selected in a context-aware manner?*

To answer this question, we propose an artifact called the Context-Aware BPM Method Assessment and Selection (CAMAS) Method, following the design science research (DSR) paradigm (Gregor and Hevner 2013). The CAMAS Method consists of three components: a Classification Framework, a Selection Process, and an Assessment Process. It supports organizations in addressing two fundamental use cases. First, BPM method engineers (e.g., BPM researchers, consultants) or users (e.g., BPM researchers, process managers) can use the CAMAS Method to assess BPM methods regarding their applicability to specific contexts (use case 1). Second, BPM method users can use the CAMAS Method to select BPM methods that fit their contexts at hand (use case 2).

Our study is structured according to the DSR reference process by Peffers et al. (2008). Having described the research problem in Sect. 1, we compile justificatory knowledge regarding BPM methods and context-aware BPM in Sect. 2. Section 3 outlines our research method and evaluation strategy, while Sect. 4 introduces the design specification of the CAMAS Method and Sect. 5 reports on its evaluation. We derive key findings, discuss theoretical and managerial implications, and address limitations and directions for future research in Sect. 6 and conclude in Sect. 7.

## 2 Theoretical Background

BPM is a principle-oriented and holistic management discipline, referring to the science and practice of improving and innovating business processes (Dumas et al. 2018; Schmiedel and vom Brocke 2015). Generally, BPM research can be structured according to two complementary perspectives: the *capability perspective* and the *lifecycle perspective* (Fig. 1).

From the *capability perspective*, BPM is decomposed into capabilities relevant for implementing process orientation in organizations (de Bruin and Rosemann 2005). Many researchers have used this perspective to develop BPM capability frameworks (Kerpedzhiev et al. 2020; Niehaves et al. 2013; Rosemann and vom Brocke 2015). Rosemann and vom Brocke's (2015) seminal framework includes thirty capability areas grouped according to the so-called core elements of BPM: strategic alignment, governance, methods, information technology (IT), people, and culture. In this framework, the capability areas related to the core elements methods and IT are structured along the BPM lifecycle (Fig. 1).

**Fig. 1** Integrated visualization of BPM capability areas and the BPM lifecycle

| BPM capability framework |   |   |  |  |                              |                                    |
|--------------------------|---|---|--|--|------------------------------|------------------------------------|
| Core element             | Strategic Alignment                     | Governance                              | Methods                                | Information Technology                 | People                       | Culture                            |
| Capability areas         | Process Improvement Planning            | Process Management Decision Making      | Process Design and Modelling           | Process Design and Modelling           | Process Skills and Expertise | Responsive-ness to Process Change  |
|                          | Strategy and Process Capability Linkage | Process Rules and Responsibilities      | Process Implementation and Execution   | Process Implementation and Execution   | Process Management Knowledge | Process Values and Beliefs         |
|                          | Enterprise Process Architecture         | Process Metrics and Performance Linkage | Process Monitoring and Control         | Process Monitoring and Control         | Process Education            | Process Attitudes Behavior         |
|                          | Process Measures                        | Process related Standards               | Process Improvement and Innovation     | Process Improvement and Innovation     | Process Collaboration        | Leadership Attention to Process    |
|                          | Process Customer and Stakeholders       | Process Management Compliance           | Process Program and Project Management | Process Program and Project Management | Process Management Leaders   | Process Management Social Networks |

The *lifecycle perspective* considers stages along the lifetime of a process (Dumas et al. 2018). Research has offered several BPM lifecycle models (de Bruin and Rosemann 2005; Dumas et al. 2018; van der Aalst 2013), including that of Rosemann and vom Brocke (2015), which covers the following stages: process design and modelling, implementation and execution, monitoring and control, improvement and innovation as well as project and program management.

Generally, a *method* is a collection of problem-solving approaches and a specific way of thinking, consisting of directions and rules, structured in a systematic way (Avison 1996; Brinkkemper 1996). Following Braun et al. (2005), we refer to a method as an approach offering a systematic structure to perform work steps to achieve defined goals. Methods feature attributes and elements (Denner et al. 2018b; Vanwersch et al. 2016), which are summarized in Table 1. In BPM, methods are defined as sets of tools and techniques that support and enable consistent activities along the BPM lifecycle (Rosemann and vom Brocke 2015). For our purposes, we define a ‘BPM method’ as a method that can be used in at least one stage of the BPM lifecycle.

When institutionalizing BPM or applying BPM methods, organizations must consider the context(s) in which

they are operating (vom Brocke et al. 2014). Generally, context awareness evolved from contingency theory (Donaldson 2001), considering information that characterizes an entity’s situation (Dey 2001). *Context-aware BPM*, which is often used as umbrella term covering related discussions in the literature, challenges organizations to consider their contexts and to respond to situational requirements in BPM activities (Harmon and Wolf 2018; Kerpedzhiev et al. 2020). To help organizations identify their context, researchers have analyzed the organizational context, the nature of processes as well as the fit between the business environment and business processes, and have proposed various frameworks (Dumas et al. 2013; Melão and Pidd 2000). One well-established example is vom Brocke et al.’s (2016) BPM context framework, which provides an overview of contextual dimensions, factors, and characteristics relevant for BPM (Fig. 2). As there is – to the best of our knowledge – no other work that structures BPM context dimensions more comprehensively, we used this framework in the course of our research. For further details on the BPM context framework, please see vom Brocke et al. (2016).

**Table 1** Frequently mentioned method components

|            | Name                   | Description  |
|------------|------------------------|--|
| Attributes | Goal orientation       | Methods must strive for achieving specific goals                   |
|            | Systematic approach    | Methods must include a systematic procedure model                  |
|            | Principles orientation | Methods must follow general design guidelines and strategies       |
|            | Repeatability          | Methods must be repeatable in different contexts                   |
| Elements   | Meta model             | Model that specifies the conceptual data model of the results      |
|            | Activity               | Task that creates a distinct (intermediate) output                 |
|            | Technique              | Detailed instruction that supports the execution of an activity    |
|            | Tool                   | Tool (e.g., software) that supports the execution of an activity   |
|            | Role                   | Actor that executes or is involved in the execution of an activity |
|            | Defined output         | Defined outcome per activity (e.g., documents)                     |

**Fig. 2** BPM context framework (vom Brocke et al. 2016)

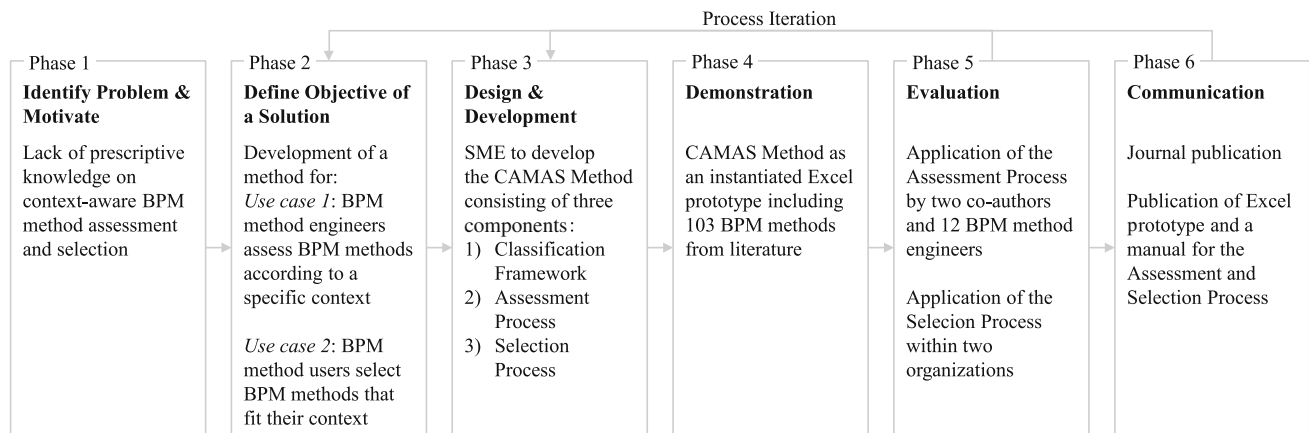
| Context factor         | Example characteristics        |                                  |                                |
|------------------------|--------------------------------|----------------------------------|--------------------------------|
| Goal dimension         |                                |                                  |                                |
| Focus                  | Exploitation                   |                                  | Exploration                    |
| Process dimension      |                                |                                  |                                |
| Value contribution     | Core process                   | Management process               | Support process                |
| Repetitiveness         | Repetitive                     |                                  | Non-repetitive                 |
| Knowledge - intensity  | Low knowledge - intensity      | Medium knowledge - intensity     | High knowledge - intensity     |
| Creativity             | Low creativity                 | Medium creativity                | High creativity                |
| Interdependence        | Low interdependence            | Medium interdependence           | High interdependence           |
| Variability            | Low variability                | Medium variability               | High variability               |
| Organization dimension |                                |                                  |                                |
| Scope                  | Intra-organizational processes |                                  | Inter-organizational processes |
| Industry               | Process industry               | Product industry                 | Product & service industry     |
| Size                   | Start-up                       | Small and medium enterprise      | Large organization             |
| Culture                | Culture supportive for BPM     |                                  | Culture non-supportive for BPM |
| Resources              | Low organizational resources   | Medium organizational resources  | High organizational resources  |
| Environment dimension  |                                |                                  |                                |
| Competitiveness        | Low competitive environment    | Medium competitive environment   | Highly competitive environment |
| Uncertainty            | Low environmental uncertainty  | Medium environmental uncertainty | High environmental uncertainty |

### 3 Research Design

Our study follows the DSR paradigm (Gregor and Hevner 2013) and adopts the DSR methodology by Peffers et al. (2008), with the CAMAS Method being our central artifact.

An overview of our research process is shown in Fig. 3. The first two phases have already been presented in Sect. 1.

The CAMAS Method is specified in the *design and development* phase. As research method, we rely on situational method engineering (SME), which assists in the



**Fig. 3** DSR methodology to propose our CAMAS method

development of methods suitable for specific situations (Brinkkemper 1996; Henderson-Sellers and Ralyte 2010). In general, SME distinguishes between method configuration and method composition (Bucher et al. 2017). While method configuration refers to the adaptation of a generic method for specific situations, method composition compiles fragments from existing methods with situational needs (Ralyté et al. 2003). In line with the two use cases addressed by the CAMAS Method (Sect. 1), it consists of a Classification Framework that serves as a joint meta model for the Assessment and a Selection Process. The Classification Framework extends an existing assessment scheme (Denner et al. 2018a) and builds on the BPM lifecycle (Rosemann and vom Brocke 2015) as well as the BPM context framework (vom Brocke et al. 2016). When defining the Assessment and the Selection Process, we did not create an entirely new end-to-end method, but composed existing fragments against the background of context awareness in BPM. The Assessment Process uses classification techniques, whereas the Selection Process leverages techniques from multi-criteria decision analysis as justificatory knowledge. Hence, we follow the method composition mode abided by related guidance in the literature. Moreover, the Assessment and the Selection Process account for the method components identified in Sect. 2 (Table 1). We report on details in Sect. 4.

To *demonstrate and evaluate* the CAMAS Method, we chose an evaluation strategy using well-known evaluation criteria for methods as artifacts, namely ease of use, real-world fidelity, effectiveness, and efficiency (March and Smith 1995; Sonnenberg and vom Brocke 2012). The overall objective was to determine whether the CAMAS Method contributes to the knowledge of context-aware BPM. Hence, the evaluation covered both the demonstration and evaluation of all components of the CAMAS Method (Pries-Heje et al. 2008; Sonnenberg and vom Brocke 2012; Venable et al. 2012). To that end, we prepared an Excel

prototype with a sample of 103 BPM methods retrieved from the literature, which supports the execution of the Assessment and the Selection Process. Please find details and design decisions regarding the structured literature review (e.g., coverage, search term, timeframe, and selection criteria) in online Appendix 1 (available online via <http://link.springer.com>). To evaluate the Assessment Process and the Classification Framework, we applied it in two phases. First two co-authors – both being researchers and BPM method engineers – independently assessed the identified BPM methods (including the CAMAS Method) and added them to the Excel prototype (use case 1). Second, to obtain first-hand classifications and get insights into the ease of use of the Assessment Process, we asked 20 original BPM method engineers to assess around 20% of the methods per lifecycle stage from our sample (30 in total). We received an assessment for 20 methods by 12 BPM method engineers. To evaluate the Selection Process, BPM method users from two organizations selected BPM methods for six real-world processes against individual context requirements (use case 2). We report on details and results of our evaluation activities in Sect. 5.

Finally, to *communicate* our results, we intend to publish the study in an information systems (IS) journal. Moreover, the Excel prototype for the Assessment and Selection Process including the 103 BPM methods is provided as electronic supplementary material (available online via <http://link.springer.com>).

## 4 Design Specification

### 4.1 Overview

The CAMAS Method consists of a Classification Framework, an Assessment Process, and a Selection Process. Linking the CAMAS Method to the method attributes from



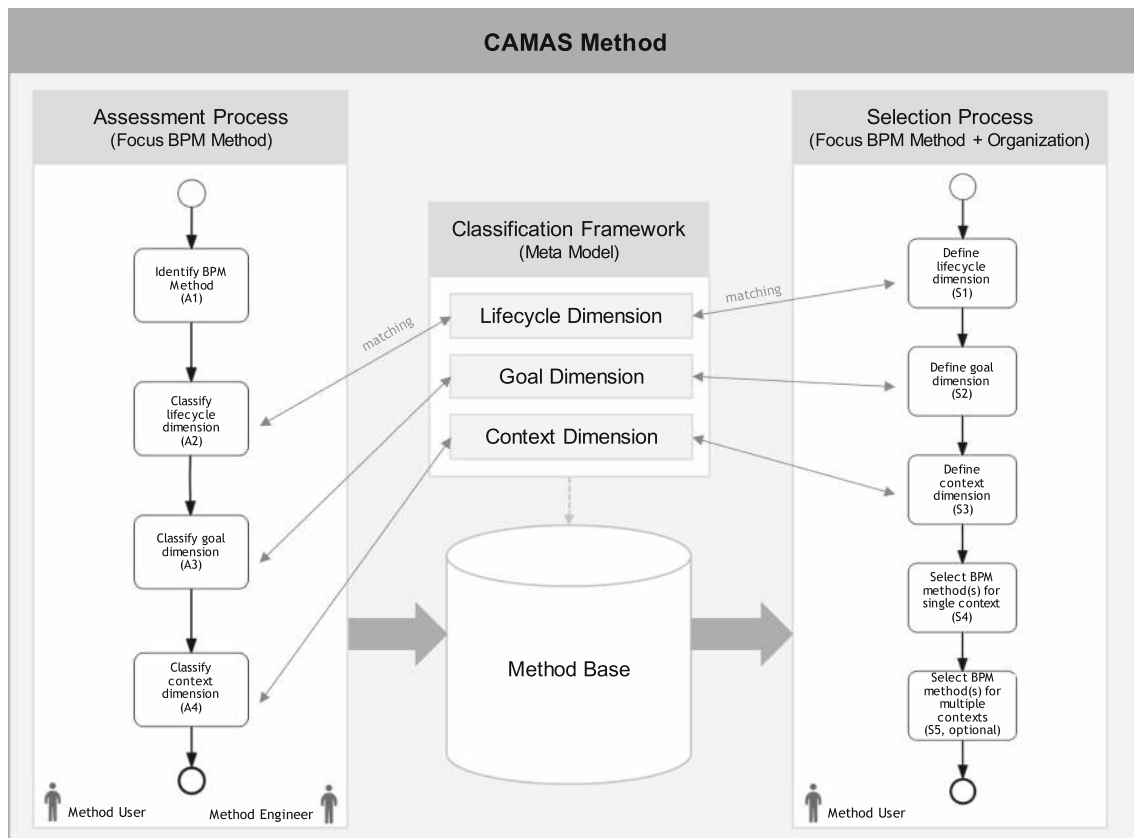
Table 1, it focuses on the context awareness of BPM methods (*goal orientation*). Therefore, the Classification Framework structures context along three dimensions that build on the BPM lifecycle and the BPM context framework introduced in Sect. 2 (*principle orientation*). Guidelines for the application of the Classification Framework are embedded in the Assessment and the Selection Process (*systematic approach*). The Assessment Process guides BPM method engineers and users to assess existing or newly developed BPM methods regarding their applicability to specific contexts (use case 1). Assessed BPM methods feed into the Method Base of the CAMAS Method, so the Assessment Process is an important prerequisite for the application of the Selection Process. The Selection Process, in turn, guides BPM method users to select BPM methods that fit their contexts at hand (use case 2). Both processes are further specified in terms of *activities*, which comprise *techniques*, *tools*, *roles*, and *outputs* that support their execution in various contexts and among various users (*repeatability*). Figure 4 illustrates the structure of the CAMAS Method and the relationship among its components. Details on each component are provided in Sect. 4.2 (Classification Framework), Sect. 4.3 (Assessment Process), and Sect. 4.4 (Selection Process).

## 4.2 Classification Framework

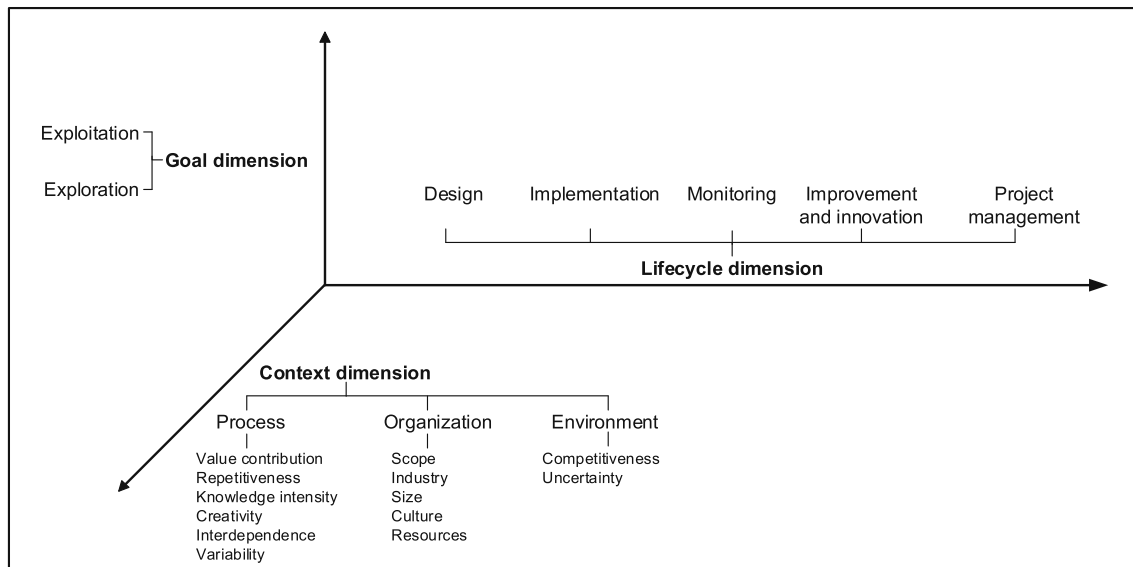
At the center of the CAMAS Method, the Classification Framework facilitates the assessment of BPM methods' applicability in terms of BPM lifecycle stages (*lifecycle dimension*), goal orientation (*goal dimension*), and various context dimensions of the BPM context framework (*context dimension*). The Classification Framework extends an existing assessment scheme (Denner et al. 2018a) and builds on the BPM lifecycle (Rosemann and vom Brocke 2015) as well as the BPM context framework (vom Brocke et al. 2016). Figure 5 illustrates the Classification Framework as a three-dimensional cuboid that serves as joint meta model for the Assessment and the Selection Process.

The *lifecycle dimension* represents the BPM lifecycle stages, so BPM methods can be categorized along five elements: process design and modelling, implementation and execution, monitoring and control, improvement and innovation, and project and program management (Rosemann and vom Brocke 2015). For reasons of simplicity, we shortened the names to design, implementation, monitoring, improvement and innovation, and project management.

The *goal dimension* refers to a BPM method's goal orientation, differentiating exploitation and exploration



**Fig. 4** Overview of the CAMAS method



**Fig. 5** Overview of the Classification Framework

(Benner and Tushman 2003). In line with its strategy, an organization decides whether to exploit (i.e., improve), explore (i.e., innovate), or both (vom Brocke et al. 2016). The other dimensions of the BPM context framework refer to the given context and cannot be modified, so the Classification Framework separates the goal dimension from the process, organization, and environment dimensions.

The *context dimension* covers the last three dimensions of the BPM context framework, which consist of additional hierarchically structured context factors and characteristics. Unlike the BPM lifecycle and the goal dimension, most characteristics of the context dimension are not assessed in a yes-or-no but a high-or-low logic. In contrast to vom Brocke et al.'s (2016) BPM context framework, we assess each context factor on a two-point scale and avoid medium-level characteristics (e.g., medium knowledge intensity) to achieve a binary categorization of BPM methods. The medium-level characteristics of the context factors lack a clear definition, so they depend heavily on subjective interpretation that could bias assessment and selection results (Christenfeld 1995). As unified measures and thresholds for context characteristics yet need to be developed, we used generic definitions (vom Brocke et al. 2016).

### 4.3 Assessment Process

Linking the Assessment Process to the method attributes (Table 1), it strives for assessing the applicability of existing or newly developed BPM methods in specific contexts (*goal orientation*) and, using the Classification Framework, it integrates the lifecycle dimension and the BPM context dimension outlined in Sect. 2 (*principle*

*orientation*). Comprised of four consecutive steps, the Assessment Process starts with determining which BPM method to assess. This method is then assessed in terms of the lifecycle dimension. Finally, the method is classified based on the characteristics of the goal dimension and other context dimensions (*systematic approach*). Completing each step (Table 2) supports the execution of the Assessment Process in various contexts and among various users (*repeatability*). We provide more detailed insights below. The evaluation of the Assessment Process is discussed in Sect. 5.1.

*Identifying a BPM method (A1)* requires determining an existing or newly developed BPM method whose applicability to a specific context should be assessed (*technique/output*). Therefore, a literature review can be helpful (*tool*). To ensure that the identified BPM method is suitable to go through the Assessment Process (*technique*) and, thus, to be an appropriate input for the Selection Process, it should match the definition of a BPM method (Sect. 2) (*tool*). Depending on the used technique, activity A1 is performed by a BPM method engineer who developed a new BPM method or by a BPM method user who comes across an unclassified BPM method in the course of their daily business (*role*).

*Classifying the lifecycle dimension (A2)* requires classifying the BPM method with respect to the targeted BPM lifecycle stage in line with the Classification Framework (*technique/output*). If a BPM method is applicable to more than one BPM lifecycle stage, a multiple assessment can be performed. This activity is supported by the proposed Excel prototype (*tool*). For a better understanding on how the Excel prototype works, please find a blank version in the electronic supplementary material. Activity A2 is

**Table 2** Overview of the Assessment Process' elements

| Activity                          | Technique   | Tool  | Role  | Output  |
|-----------------------------------|---|---|---|---|
| Identify BPM method (A1)          | Identify an existing or newly developed BPM method to be assessed     | Literature review (e.g., Journals, Conferences, textbooks, consultancies)         | BPM method engineer (e.g., BPM researcher, consultancies) | Newly developed/identified BPM method suitable to go through the Assessment Process   |
|                                   | Ensure suitability of BPM method to go through the Assessment Process | BPM method definition (Sect. 2)   | BPM method user (e.g., BPM researcher, process manager)   |   |
| Classify lifecycle dimension (A2) | Classify the BPM method regarding the lifecycle dimension             | Classification framework (Excel prototype)<br>BPM lifecycle                       |   | BPM method classified with respect to BPM lifecycle stage(s)  |
| Classify goal dimension (A3)      | Classify the BPM method regarding the goal dimension                  | Classification framework (Excel prototype)<br>BPM context framework               |   | BPM method classified with respect to goal characteristic(s)  |
| Classify context dimension (A4)   | Classify the BPM method regarding the context dimensions              | Classification framework (Excel prototype)<br>Assessment criteria: (na), (a), (–) |   | BPM method classified with respect to context characteristics<br>BPM method assessed as special- or general- purpose method |
|                                   | Ensure validity and reliability of the assessment                     | Hit ratios, Cohen's Kappa   |   | Extended Method Base  |
|                                   | Assess context specificity of the BPM method                          | Indicator: degree of context specificity ( <i>DCS</i> )                           |   |   |

performed by a BPM method engineer for a newly developed BPM method or a BPM method user for an existing BPM method (*role*).

*Classifying the goal dimension (A3)* requires classifying the BPM method with respect to its characteristic(s) in the goal dimension (*output*), that is, to assess whether the BPM method is geared to incremental improvement (exploitation), radical (re-)design (exploration), or both (Rosemann 2014) (*technique*). This activity is supported by the proposed Excel prototype (*tool*). Again, activity A3 is performed by a BPM method engineer or BPM method user (*role*).

*Classifying the context dimension (A4)* requires using the process, organization, and environment dimensions of the BPM context framework to classify the BPM method according to the Classification Framework (*output*). The BPM method user determines whether the BPM method is applicable to the underlying characteristics (*technique*). The applicability of a BPM method to a specific context is expressed by a nominal scale that consists of three assessment criteria: not applicable (na), applicable (a), and not assessable (–) (*tool*). The last criterion serves as an auxiliary value for external assessors who do not know the original BPM method engineer's intention. In summary, the assessment criteria have the following semantics:

- (na): the BPM method is not applicable to a specific context characteristic.

- (a): the BPM method applies to a specific context characteristic.
- (–): the method's applicability to a specific context characteristic cannot be assessed.

If the Assessment Process is not performed by the original BPM method engineer, we recommend ensuring the assessment's reliability by involving at least two independent judges (*technique*). Therefore, the Excel prototype calculates Cohen's Kappa (Cohen 1960) per BPM method (online Appendix 2) (*tool*). Besides ensuring the reliability of the assessment, we recommend analyzing the assessed BPM methods with respect to their degree of context specificity (*DCS*), i.e., an indicator to classify whether the BPM method follows a special or a general purpose (*technique*). This addresses the need for selecting suitable BPM methods that support the efficient use of organizational resources. As no suitable indicator for measuring the *DCS* is available in the literature, we developed the formula shown in Eq. (1) (*tool*). An exemplary calculation can be found in online Appendix 2.

$$DCS = \left( 1 - \left( \frac{\sum_{f \in F} \alpha_f}{|F|} \right) \right) \cdot \left( 1 - \frac{\gamma}{\sum_{f \in F} |C_f|} \right) \quad (1)$$

with  $F$  Set of context factors included in the context dimension of the Classification Framework,  $C_f$  Set of characteristics per context factor  $f \in F$ ,  $\alpha_f$  Number of characteristics assessed with (a) for context factor  $f \in F$ ,  $\gamma$



Number of characteristics assessed with (–) across all context factors  $F$

According to Eq. (1), the  $DCS$  represents a weighted fraction of the characteristics per context factor in which a specific BPM method can be applied. To make the  $DCS$  comparable across different BPM methods in the case that some characteristics cannot be assessed, the second factor of Eq. (1) adjusts the weighted fraction based on the number of characteristics assessed with (–). Hence, in the absence of characteristics that cannot be assessed, a  $DCS$  of 100% means that a BPM method is applicable to only one characteristic per context factor (i.e., special-purpose method), while a  $DCS$  of 0% means that a BPM method applies to all characteristics of all context factors (i.e., general-purpose method). Again, activity A4 is performed by a BPM method engineer or method user (*role*).

#### 4.4 Selection Process

Linking the Selection Process to the method attributes (Table 1), it assists BPM method users to select BPM methods applicable to their organizational contexts (*goal orientation*) and, just like the Assessment Process, relies on the Classification Framework (*principle orientation*). Comprised of four necessary and one optional step, the Selection Process starts with defining the BPM lifecycle stage to which BPM methods should be applicable. Then, the method's overall target is determined. After that, the characteristics of the other context dimensions to which BPM methods should be applicable are defined. The last task is to identify and select the BPM method(s) that performs best across all dimensions. An additional optional step accounts for the fact that several contexts need to be considered in a single organization (Kerpedzhiev et al. 2020), so the query of the Method Base can vary depending on the method user's specific role. For example, a BPM process owner or manager may be searching for BPM methods for a specific process in a defined BPM lifecycle stage, while a Head of BPM or a process portfolio manager may take a multi-context perspective, aiming to identify BPM methods that meets as many contextual needs as possible. As the Selection Process refers to only one context, it must be applied repeatedly in that case (*systematic approach*). The detailed description of each step (Table 3) supports the execution of the Selection Process in various contexts and among various users (*repeatability*). Again, we provide deeper insights below. An evaluation of the Selection Process is given in Sect. 5.2.

*Defining the lifecycle dimension (S1)* involves defining the BPM lifecycle stage to which BPM methods should be applicable according to the Classification Framework (*technique*). This activity is supported by the Excel prototype (*tool*). Just like for the Assessment Process, the

Excel prototype including a preliminary Method Base of 103 BPM methods can be found in the electronic supplementary material. Activity S1 is usually performed by a process owner or manager (*role*). All subsequent activities consider only those methods that fit the defined BPM lifecycle stage (*output*).

*Defining the goal dimension (S2)* requires defining to which characteristic(s) of the goal dimension BPM methods should be applicable (*technique*). As in the previous activity, one filters the characteristics of exploitation and/or exploration within the goal dimension (vom Brocke et al. 2016) in line with the Classification Framework (*tool*). As this decision may be relevant to the organization's strategy, activity S2 is probably not only performed by a process owner or manager, but also supported by the Head of BPM or similar roles (*role*). All subsequent activities consider only those BPM methods that fit the defined characteristic(s) of the goal dimension (*output*).

*Defining the context dimension (S3)* requires defining to which of the context dimension's characteristics BPM methods should be applicable (i.e., considering all characteristics of the process, organization, and environment dimensions) (*technique*). BPM method users must go through all characteristics and decide which characteristics represent their organizational contexts. As all characteristics are mutually exclusive, one characteristic per context factor, at most, can be chosen (e.g., scope: intra-organizational processes or inter-organizational processes). In the Excel prototype, the characteristics to which BPM methods should be applicable are assessed with the value of "1", all others with "0". If a method should be applicable to more than one characteristic, the Selection Process must be applied repeatedly. Afterwards, the characteristics can be prioritized by determining relative weights. As the weighting happens on two hierarchy levels (i.e., context factors and dimensions), we draw from knowledge on multi-criteria decision analysis, such as the Analytical Hierarchy Process (Saaty 1990). To reduce complexity, the Excel prototype proposes an initial configuration, assuming that all characteristics are equally important, but the configuration can be changed as required (*tool*). Since this activity is related to the organization's strategy, it should be performed by several stakeholders, such as a process owner, process manager, or Head of BPM (*role*). If many stakeholders are involved, they may use techniques like brainstorming, moderated group discussion, and team estimation games to determine appropriate ratings (Schwaber 1997; Yoo et al. 2009). All subsequent activities consider only those BPM methods that fit the defined BPM lifecycle stage (activity S1) as well as the goal dimension's (activity S2) and context dimension's defined characteristics (*output*).

**Table 3** Overview of the elements of the Selection Process

| Activity  | Technique  | Tool  | Role  | Output  |
|---|--|---|---|---|
| Define lifecycle dimension (S1)                           | Define to which BPM lifecycle stage BPM methods should be applicable   | Classification Framework (Excel prototype)<br>Method Base   | BPM method user (e.g., BPM researcher, process manager) | Defined BPM lifecycle stage                                 |
| Define goal dimension (S2)                                | Define the characteristic(s) of the goal dimension to which BPM methods should be applicable   | Classification Framework (Excel prototype)<br>Method Base   |   | Defined goal characteristic(s)                              |
| Define context dimension (S3)                             | Define the characteristics of the context dimension to which BPM methods should be applicable<br>Determine the relative importance of all factors and dimensions | Classification Framework (Excel prototype)<br>Method Base<br>Multi-criteria decision analysis   |   | Defined (weighted) characteristics of the context dimension |
| Select BPM method(s) for single context (S4)              | Identify BPM method(s) that fit given context  | Classification Framework (Excel prototype)<br>Method Base<br>Indicator: degree of applicability ( <i>DA</i> ) including risk-averse and risk-taking calculation modus, degree of context specificity ( <i>DCS</i> ), additional optional criteria |   | BPM method(s) that take a single-context perspective        |
| Select BPM method(s) for multiple contexts (S5, optional) | Perform activities S1-3 repeatedly<br>Identify BPM method(s) that fit various contexts   | Classification Framework (Excel prototype)<br>Method Base   |   | BPM method(s) that take a multi-context perspective         |

*Selecting BPM method(s) for a single context (S4)* requires analyzing all previous results and identifying the most suitable BPM method(s) (*technique*). Therefore, we recommend analyzing the degree of applicability (*DA*) of each BPM method for the context at hand. Again, as no suitable indicator is available in the literature, we developed the measure shown in Eq. (2), which reflects the extent to which a given BPM method is applicable to the context specified in the Selection Process (i.e., how often the criteria (a) or (na) match the specified context), considering that context dimensions and factors can differ in importance. In case a BPM method has not been assessed by the original method engineer, we offer two calculation modes. In the risk-averse mode, all (–) are treated as (na), i.e., context characteristics which could not be assessed based on publicly available data are treated as if the method were not applicable. In the risk-taking mode, however, all (–) are treated as (a). To prepare the calculation of the *DA*, all (a) and (na) values are replaced by 1 and 0, respectively. The *DA* of a given BPM method for a specified context is calculated as shown in Eq. (2). An illustrative example is included in online Appendix 2.

$$DA = \sum_{d \in D} \sum_{f \in F_d} \sum_{c \in C_f} \omega_d \cdot \varphi_f \cdot \delta_c \cdot \varepsilon_c \quad (2)$$

with *D* Set of dimensions included in the context dimension of the Classification Framework, *F<sub>d</sub>* Set of context factors per context dimension  $d \in D$ , *C<sub>f</sub>* Set of characteristics per context factor  $f \in F$ ,  $\omega_d$  Weight of context dimension  $d \in D$  with  $\omega_d \in [0; 1]$  and  $\sum_{d \in D} \omega_d = 1$ ,  $\varphi_f$  Weight of context factor  $f \in F_d$  with  $\varphi_f \in [0; 1]$  and  $\sum_{f \in F_d} \varphi_f = 1$ ,  $\delta_c$  Assessed context characteristic  $c \in C_f$  of given BPM method with  $\delta \in \{0, 1\}$ ,  $\varepsilon_c$  Assessed context characteristic  $c \in C_f$  of given context with  $\varepsilon \in \{0, 1\}$

According to Eq. (2), a *DA* value of 100% means that a BPM method perfectly fits the specified context, while 0% means that a BPM method is not applicable at all. The *DA* is meant to be the main evaluation criterion for selecting suitable BPM methods, as it increases inter-subjectivity when comparing methods based on a consistent calculation logic. Depending on the *DA*, all remaining BPM methods are ranked so users can shortlist the BPM methods that will be subject to a detailed assessment. To support this narrowing-down, the *DCS* indicator, which we introduced in activity A4, should also be considered to assess whether a BPM method follows a special or a general purpose. Details on comparing BPM methods based on their *DCS* and *DA* values are provided in Sect. 5.2. If desired and necessary, organizations can also integrate further criteria

like the methods' ease of use, training effort (Recker et al. 2009), or required upfront investments (Neubauer and Stummer 2007) (*tool*). Depending on how the BPM method will be applied, we recommend involving all relevant stakeholders in the shortlisting process (*role*). The result is the identification of BPM method(s) that meet the given context needs, thus taking a single-context perspective (*output*).

*Selecting BPM method(s) for multiple contexts (S5, optional)* instructs the user of the Selection Process to perform activities S1, S2, and S3 repeatedly if there are several contexts in one organization to be considered. Unlike activity S4, activity S5 requires comparing multiple results and selecting the BPM method(s) that fit various contexts, not just one context (*technique*). The *DA* and *DCS* of multiple iterations are compared using a cross-context validation. If each iteration yields similar BPM methods in its shortlist, it is not necessary to implement various methods to account for all contexts. If each iteration yields different shortlisted methods, it might be necessary to implement multiple BPM methods. As outlined in activity S4, the *DA* and *DCS* are automatically calculated by the Excel prototype to support the selection decision (*tool*). Activity S5 is performed by roles such as Head of BPM or process portfolio manager (*role*). The result is the identification of BPM method(s) that meet as many of the context's needs as possible, thus taking a cross-context perspective (*output*).

## 5 Artifact Evaluation

### 5.1 Evaluation of the Assessment Process

To evaluate the Assessment Process and the Classification Framework, we applied the Assessment Process in two phases. In the first phase, we applied it to a sample of 103 BPM methods (102 BPM methods from the literature and the CAMAS Method) to gain preliminary insights into its ease of use, real-world fidelity, effectiveness, and efficiency. Two co-authors independently assessed each BPM method. This setup is sensible as a two-assessor setting is commonly used in the literature (Montazemi and Qahri-Saremi 2015; Paré et al. 2015; Wolfswinkel et al. 2013) and as the co-authors are both academic BPM method engineers and users, developing new BPM methods and using BPM methods in projects. As organizations typically do not have access to the original engineers of the BPM methods included in the Method Base, we deliberately decided not to involve them in the first evaluation phase.

Following the Assessment Process, activity A1 revealed that all 103 identified BPM methods are suitable for being assessed, as they comprise all method components and

apply to at least one BPM lifecycle stage (Table 1, Sect. 2). However, as most BPM methods do not explicitly state each component, the authors discussed their fit based on indications and decided on their suitability for being assessed. Conducting activity A2 to A4 revealed that especially activity A4 was challenging, leading to discrepancies in assessing the applicability of BPM methods. As almost no BPM method explicitly stated its applicability to specific contexts, the assessment is mainly based on indications, which leave room for interpretation and differing assessments. Thus, we only used the criteria (a) and (na) if, in the respective research paper, a method explicitly stated or clearly indicated its applicability to a specific context characteristic. Otherwise, we used the auxiliary criterion (–). In case of disagreement, the authors discussed all mismatches and decided on a single criterion for the final assessment. To account for discrepancies and ensure the reliability of the classification as performed by the co-authors, we calculated Cohen's Kappa (Cohen 1960). The Kappa ranged from 61 to 100% with an average of 77%, which indicates substantial agreement (Landis and Koch 1977). All assessment results are presented in online Appendix 3. Figure 6 shows two methods per BPM lifecycle stage and goal characteristics assessed along A2 to A4.

In the second phase, we asked original BPM method engineers to assess selected BPM methods based on the Assessment Process. We asked 20 BPM method engineers to cover around 20% of BPM methods per lifecycle stage from our sample (30 in total). All BPM method engineers received a questionnaire (online Appendix 4) including questions related to activity 2 to 4 of the Assessment Process. Additionally, the method engineers were asked to comment on and assess the ease of use of the Assessment Process using a 7-point scale. Overall, we received first-hand classifications from 12 BPM method engineers who assessed 20 BPM methods. To get insights into the validity of the assessment performed by the co-authors, we compared their classification with that performed by the original BPM method engineers and calculated hit ratios (Moore and Benbasat 1991), which measure the frequency of correctly assigned objects (Nahm et al. 2002). In case we used the auxiliary criterion (–), we assumed a match of both assessments, and in case of a different assessment using (a) and (na), we assumed a mismatch. The co-authors achieved hit ratios between 90 and 100%, yielding an average of 97%, which reflects significant agreement (Moore and Benbasat 1991). All assessment results are presented in online Appendix 5.

The application of the Assessment Process 226 times with co-authors and original BPM method engineers showed its *effectiveness* and *efficiency* to assess BPM methods in a context-aware manner (use case 1). Even

| ID  | Author                  | Lifecycle dimension<br>(see Activity A2) | Goal dimension<br>(see Activity A3) | Context dimension<br>(see Activity A4) |                    |                     |            |                  |                         |                          |                |                 |                      |                       |                 |                        |                                |                                |                  |                  |                            |          |                             |                       |                                  |                               |                              | Indicator | Reliability |                               |                             |                              |                               |                                |   |    |     |
|-----|-------------------------|--|-------------------------------------|--|--------------------|---------------------|------------|------------------|-------------------------|--------------------------|----------------|-----------------|----------------------|-----------------------|-----------------|------------------------|--------------------------------|--------------------------------|------------------|------------------|----------------------------|----------|-----------------------------|-----------------------|----------------------------------|-------------------------------|------------------------------|-----------|-------------|-------------------------------|-----------------------------|------------------------------|-------------------------------|--------------------------------|---|----|-----|
|     |                         |  |                                     | Process dimension                      |                    |                     |            |                  |                         |                          |                |                 |                      |                       |                 | Organization dimension |                                |                                |                  |                  |                            |          |                             | Environment dimension |                                  |                               |                              |           |             |                               |                             |                              |                               |                                |   |    |     |
|     |                         |  |                                     | Value contribution                     | Repetitive-ness    | Knowledge intensity | Creativity | Inter-dependence | Variability             | Scope                    | Industry       | Size            | Culture              | Resources             | Competitiveness | Uncertainty            |                                |                                |                  |                  |                            |          |                             |                       |                                  |                               |                              |           |             |                               |                             |                              |                               |                                |   |    |     |
|     |                         |  |                                     | Core process                           | Management process | Support process     | Repetitive | Non-repetitive   | Low knowledge-intensity | High knowledge-intensity | Low creativity | High creativity | Low inter-dependence | High inter-dependence | Low variability | High variability       | Intra-organizational processes | Inter-organizational processes | Product industry | Service industry | Product & service industry | Start-up | Small and medium enterprise | Large organization    | Culture highly supportive of BPM | Culture non-supportive of BPM | Low organizational resources |           |             | High organizational resources | Low competitive environment | High competitive environment | Low environmental uncertainty | High environmental uncertainty |   |    |     |
| 3   | Anastassiou et al. 2016 | Design                                   | Exploitation                        | a                                      | -                  | -                   | a          | -                | -                       | -                        | -              | -               | -                    | -                     | a               | -                      | a                              | a                              | -                | -                | -                          | -        | -                           | -                     | -                                | -                             | -                            | -         | -           | -                             | -                           | -                            | -                             | -                              | - | -  | 21% |
| 30  | Fähli et al. 2015       | Implementation                           | Exploitation                        | a                                      | -                  | a                   | -          | -                | -                       | -                        | -              | -               | -                    | -                     | -               | na                     | na                             | a                              | a                | -                | -                          | -        | -                           | -                     | -                                | -                             | -                            | -         | -           | -                             | -                           | -                            | -                             | -                              | - | -  | 15% |
| 43  | Johannsen and Fill 2014 | Implementation                           | Exploitation                        | -                                      | -                  | -                   | -          | -                | -                       | -                        | -              | -               | -                    | -                     | -               | na                     | a                              | na                             | a                | a                | -                          | -        | -                           | -                     | -                                | -                             | -                            | -         | -           | -                             | -                           | -                            | -                             | -                              | - | -  | 27% |
| 1   | Abe and Kiado 2014      | Monitoring                               | Exploitation                        | -                                      | -                  | -                   | -          | -                | -                       | -                        | -              | -               | -                    | -                     | -               | -                      | -                              | -                              | -                | -                | -                          | -        | -                           | -                     | -                                | -                             | -                            | -         | -           | -                             | -                           | -                            | -                             | -                              | - | -  | 6%  |
| 2   | Accorsi et al. 2015     | Monitoring                               | Exploitation                        | -                                      | -                  | -                   | -          | -                | -                       | -                        | -              | -               | -                    | -                     | -               | -                      | -                              | -                              | -                | -                | -                          | -        | -                           | -                     | -                                | -                             | -                            | -         | -           | -                             | -                           | -                            | -                             | -                              | - | -  | 3%  |
| 4   | Antunes et al. 2014     | Improvement and innovation               | Exploitation                        | -                                      | -                  | -                   | a          | -                | -                       | -                        | -              | -               | -                    | -                     | -               | -                      | -                              | -                              | -                | -                | -                          | -        | -                           | -                     | -                                | -                             | -                            | -         | -           | -                             | -                           | -                            | -                             | -                              | - | -  | 17% |
| 9   | Bergener et al. 2015    | Improvement and innovation               | Exploitation                        | -                                      | -                  | -                   | a          | na               | -                       | -                        | -              | -               | -                    | -                     | -               | -                      | a                              | na                             | a                | na               | -                          | -        | -                           | -                     | -                                | -                             | -                            | -         | -           | -                             | -                           | -                            | -                             | -                              | - | -  | 34% |
| 103 | CAMAS Method            | Project management                       | Exploitation                        | a                                      | a                  | a                   | a          | a                | a                       | a                        | a              | a               | a                    | a                     | a               | a                      | a                              | a                              | a                | a                | a                          | a        | a                           | a                     | a                                | a                             | a                            | a         | a           | a                             | a                           | a                            | a                             | a                              | a | 0% |     |
| 19  | de Boer et al. 2015     | Project management                       | Exploitation                        | -                                      | a                  | -                   | -          | -                | -                       | -                        | -              | -               | -                    | -                     | -               | -                      | -                              | -                              | -                | na               | -                          | -        | -                           | -                     | -                                | -                             | -                            | -         | -           | -                             | -                           | -                            | -                             | -                              | - | -  | 21% |
| 84  | Ruiz et al. 2015        | Design                                   | Exploration                         | -                                      | -                  | -                   | -          | -                | -                       | -                        | -              | -               | -                    | -                     | -               | -                      | -                              | -                              | -                | -                | -                          | -        | -                           | -                     | -                                | -                             | -                            | -         | -           | -                             | -                           | -                            | -                             | -                              | - | -  | 9%  |
| 57  | Ladman et al. 2016      | Implementation                           | Exploration                         | a                                      | na                 | na                  | -          | -                | -                       | -                        | -              | -               | -                    | -                     | -               | -                      | -                              | -                              | -                | -                | -                          | -        | -                           | -                     | -                                | -                             | -                            | -         | -           | -                             | -                           | -                            | -                             | -                              | - | -  | 24% |
| 95  | Tikman et al. 2015      | Implementation                           | Exploration                         | a                                      | na                 | na                  | -          | -                | -                       | -                        | -              | -               | -                    | -                     | -               | -                      | -                              | -                              | -                | -                | -                          | -        | -                           | -                     | -                                | -                             | -                            | -         | -           | -                             | -                           | -                            | -                             | -                              | - | -  | 23% |
| 5   | Appel et al. 2014       | Design                                   | Exploration & exploitation          | -                                      | -                  | -                   | a          | -                | -                       | -                        | -              | -               | -                    | -                     | -               | -                      | a                              | na                             | -                | -                | -                          | -        | -                           | -                     | -                                | -                             | -                            | -         | -           | -                             | -                           | -                            | -                             | -                              | - | -  | 10% |

a applicable to a specific context characteristic    na not applicable to a specific context characteristic    - applicability is not assessable

Fig. 6 Exemplary exploitative and explorative BPM methods related to all stages of the BPM lifecycle

though slight discrepancies between the co-authors occurred when conducting activity A4, a circumstance that would also happen in industry settings, the achieved Cohen’s Kappa values confirm reliability. Moreover, the hit ratios between the co-authors and the original BPM method engineers underpin the validity of the Assessment Process. This also led us to conclude that the Method Base with 103 exemplary BPM methods was a solid basis for evaluating the Selection Process (Sect. 5.2). As for *real-world fidelity*, the evaluation showed that the assessed methods cover diverse contexts in which BPM methods are applied. Regarding *ease of use*, the original BPM method engineers assessed the ease of use with 5 out of 7 points. Even though the co-authors stated that the classification of some methods was challenging, it is reasonably easy for BPM method engineers. Most original BPM method engineers confirmed the detailed description of each activity, corresponding techniques, tools as well as definitions per dimension, context factor, and characteristic as sufficient to assess BPM methods. Nevertheless, some of them asked for extended guidelines in the sense of a manual, which we plan to provide when publicly sharing the CAMAS Method after publication. Overall, the evaluation confirmed that the Assessment Process is appropriate to assess BPM methods in a context-aware manner.

5.2 Evaluation of the Selection Process

Two BPM method users from two different organizations applied the Selection Process to gain insights into its ease of use, real-world fidelity, effectiveness, and efficiency. We chose experts from two organizations that differ widely in terms of their organizational setup. In both organizations, we interviewed the key expert responsible for BPM

(Table 4) using qualitative semi-structured interviews (Myers and Newman 2007) along the activities of the Selection Process, also using the Excel prototype. Each interview took about two hours and was attended by two co-authors. After introducing the Selection Process, we asked the experts to select three real processes from their organizations, to apply each of the Selection Process’ activities. Besides, we asked for comments on ease of use, real-world fidelity, effectiveness, and efficiency. To obtain results, we pre-filled the Method Base with the 103 BPM methods we had assessed during the evaluation of the Assessment Process (Sect. 5.1). An overview of the two organizations, their experts, and the processes in focus is presented in Table 4.

We present as an example the results of the evaluation related to the product development process (P4) at the PRODUCT organization (Table 4), while the results of all other processes are shown in online Appendix 6. As P4 has already been designed, implemented, and improved at PRODUCT, the expert searched for a method with which to “monitor” the process (S1). Moreover, PRODUCT requested an exploitative BPM method (S2). Regarding the context characteristics, all relevant characteristics were marked. The context factors and dimensions were also weighted. PRODUCT was more interested in considering the process (0.6) and the organization dimension (0.4) than the environment dimension (S3). Finally, the results were analyzed (S4). The results of activities S1 to S4 are presented in Fig. 7.

To compare the most suitable BPM methods for the given context, all BPM methods are ranked according to the indicator DA, i.e., the extent to which they are applicable to the specified context. PRODUCT calculated the DA based on the risk-averse mode. The results show that





way to reason about how to select BPM methods in a context-aware manner (use case 2). It reduces time and uncertainty in selecting suitable BPM methods and, thus, facilitates an efficient use of resources for their implementation. The experts acknowledged that the Method Base includes not only well-known BPM methods, but also unknown BPM methods that inspire to consider context from various perspectives and support the exploration goal of BPM. As for *real-world fidelity*, the experts confirmed that the Selection Process is suitable for various contexts as the multi-dimensional architecture of the Classification Framework allows for a comprehensive analysis. As for *ease of use*, the experts confirmed that the activities of the Selection Process are understandable for people typically involved in BPM. The experts particularly appreciated the detailed description of each activity, corresponding tools (e.g., Excel prototype), and definitions of each dimension, context factor, and characteristic (vom Brocke et al. 2016). Even though the determination of the relative importance of factors and dimensions (S3), the analysis of *DA* and *DCS* (S3), and the cross-context validation of various BPM methods (S5) was challenging, the experts appreciated the possibility to prioritize specific contexts and analyze the results in detail. Additionally, the experts emphasized the need of activity S5 as due to scarce resources and training effort for new BPM methods, it is indispensable to select BPM methods that fit various contexts. To overcome these challenges, techniques like brainstorming, moderated group discussion, and team estimation games (Schwaber 1997; Yoo et al. 2009) are appreciated. Nevertheless, the experts also saw *room for improvement* in the visualization of the Excel prototype, e.g., by directly providing access to definitions of all dimensions and descriptions of all BPM methods. We outline respective ideas for future research in Sect. 6.3.

## 6 Discussion

### 6.1 Analysis of Existing BPM Methods

The literature review (online Appendix 1) we used to evaluate the Classification Framework and the Assessment Process also provided general insights into the applicability of the identified 103 BPM methods to specific contexts. We structured these insights along the *lifecycle*, *goal*, and *context dimension* (Fig. 8). First, when analyzing the 103 BPM methods per *lifecycle stage* (Fig. 8A), we found that BPM methods for implementation ( $n = 10$ ), improvement and innovation ( $n = 16$ ), and project management ( $n = 12$ ) are rare compared to other BPM lifecycle stages. These findings confirm prior investigations, indicating that these stages still need more attention from BPM researchers

(Recker and Mendling 2016). Second, regarding the *goal dimension* (Fig. 8B), we found that 102 BPM methods only apply to exploitation, while two BPM methods are for exploration only and seven fit both exploitation and exploration. Also these findings comply with prior studies, indicating the lack of explorative BPM methods (Gross et al. 2019; Kohlborn et al. 2014). Third, regarding the *context dimension*, we investigated the *DCS* (Fig. 8C). The *DCS* ranges between 0 and 45% with an average of 16% indicating that most methods included in our sample rather follow a general-purpose approach. This finding supports our research problem and calls for further research (Sect. 6.3).

### 6.2 Theoretical and Managerial Implications

Existing research offers limited insights into the question *how BPM methods can be assessed and selected in a context-aware manner*. In particular, research on the application possibilities of BPM methods and their design for specific contexts is missing (Dumas et al. 2018; Rosemann and vom Brocke 2015; vom Brocke et al. 2016). At the same time, guidance on how to assess and select BPM methods in a context-aware manner is lacking (Zelt et al. 2018). The CAMAS Method proposed in this research is the first to conceptualize and operationalize the context-aware assessment and selection of BPM methods, so it contributes to both theory and practice.

We distinguish two *theoretical implications* that add to the descriptive and prescriptive knowledge on context-aware BPM. Regarding *descriptive knowledge*, our study extends the assessment scheme by Denner et al. (2018a) in two different ways: first, the Classification Framework included in the CAMAS Method draws from the original assessment scheme and extends the context perspective (vom Brocke et al. 2016) through the lifecycle perspective (Rosemann and vom Brocke 2015). With the combination of both perspectives, we expect a more precise assessment of existing or newly developed BPM methods. Thereby, the Classification Framework's modular design enables high flexibility. As existing context dimensions can be dropped or new ones added easily, we account for future developments of context-aware BPM. Second, we extended the number of BPM methods in the Method Base from 25 (Denner et al. 2018a) to 103 by applying the Assessment Process (Sect. 5.1). Analyzing the status quo of this sample as a byproduct of our evaluation, we revealed various insights into existing BPM methods. Regarding the lifecycle perspective, we found that BPM methods for implementation, improvement and innovation, and project management are rare compared to the other lifecycle stages. As for the goal dimension, we identified a lack of explorative BPM methods. While existing research

| <p>[A] 103 BPM methods classified by BPM lifecycle stages*</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">BPM lifecycle stages</th> <th style="text-align: right;">Total numbers</th> </tr> </thead> <tbody> <tr> <td>Design</td> <td style="text-align: right;">44</td> </tr> <tr> <td>Implementation</td> <td style="text-align: right;">10</td> </tr> <tr> <td>Monitoring</td> <td style="text-align: right;">35</td> </tr> <tr> <td>Improvement and innovation</td> <td style="text-align: right;">16</td> </tr> <tr> <td>Project management</td> <td style="text-align: right;">12</td> </tr> </tbody> </table> | BPM lifecycle stages | Total numbers                       | Design        | 44 | Implementation | 10 | Monitoring | 35 | Improvement and innovation | 16 | Project management | 12 | <p>[B] 103 BPM methods classified by goal characteristic(s)*</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Goal characteristics</th> <th style="text-align: right;">Total numbers</th> </tr> </thead> <tbody> <tr> <td>Exploitation</td> <td style="text-align: right;">102</td> </tr> <tr> <td>Exploration</td> <td style="text-align: right;">2</td> </tr> <tr> <td>Exploitation and exploration</td> <td style="text-align: right;">7</td> </tr> </tbody> </table> | Goal characteristics | Total numbers | Exploitation | 102 | Exploration | 2 | Exploitation and exploration | 7 |
|---|----------------------|-------------------------------------|---------------|----|----------------|----|------------|----|----------------------------|----|--------------------|----|---|----------------------|---------------|--------------|-----|-------------|---|------------------------------|---|
| BPM lifecycle stages  | Total numbers        |                                     |               |    |                |    |            |    |                            |    |                    |    |   |                      |               |              |     |             |   |                              |   |
| Design  | 44                   |                                     |               |    |                |    |            |    |                            |    |                    |    |   |                      |               |              |     |             |   |                              |   |
| Implementation  | 10                   |                                     |               |    |                |    |            |    |                            |    |                    |    |   |                      |               |              |     |             |   |                              |   |
| Monitoring  | 35                   |                                     |               |    |                |    |            |    |                            |    |                    |    |   |                      |               |              |     |             |   |                              |   |
| Improvement and innovation  | 16                   |                                     |               |    |                |    |            |    |                            |    |                    |    |   |                      |               |              |     |             |   |                              |   |
| Project management  | 12                   |                                     |               |    |                |    |            |    |                            |    |                    |    |   |                      |               |              |     |             |   |                              |   |
| Goal characteristics  | Total numbers        |                                     |               |    |                |    |            |    |                            |    |                    |    |   |                      |               |              |     |             |   |                              |   |
| Exploitation  | 102                  |                                     |               |    |                |    |            |    |                            |    |                    |    |   |                      |               |              |     |             |   |                              |   |
| Exploration   | 2                    |                                     |               |    |                |    |            |    |                            |    |                    |    |   |                      |               |              |     |             |   |                              |   |
| Exploitation and exploration  | 7                    |                                     |               |    |                |    |            |    |                            |    |                    |    |   |                      |               |              |     |             |   |                              |   |
| <p>[C] DCS based on BPM methods classified by context characteristic(s)</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Degree of context specificity (DCS)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">0%–45%; Ø 16%</td> </tr> </tbody> </table>   |                      | Degree of context specificity (DCS) | 0%–45%; Ø 16% |    |                |    |            |    |                            |    |                    |    |   |                      |               |              |     |             |   |                              |   |
| Degree of context specificity (DCS)   |                      |                                     |               |    |                |    |            |    |                            |    |                    |    |   |                      |               |              |     |             |   |                              |   |
| 0%–45%; Ø 16%   |                      |                                     |               |    |                |    |            |    |                            |    |                    |    |   |                      |               |              |     |             |   |                              |   |

\* some BPM methods are classified to more than one BPM lifecycle stage and goal

**Fig. 8** Analysis of three dimensions of the Classification

introduces ambidextrous BPM only on a high-level abstraction, we identified a few specific BPM methods recognizing and confirming the importance of distinguishing exploitative and explorative BPM methods. Finally, investigating the context perspective revealed an overall lack of context-specific BPM methods. So far, BPM method engineers have not explicated specific application contexts for most existing methods. These insights serve as a starting point for further discussions that will strengthen research on context-specific BPM methods (Sect. 6.3).

Regarding *prescriptive knowledge*, our study used SME to build an ensemble artifact (i.e., the CAMAS Method), which not only includes the Classification Framework but also offers guidance on its application in terms of a newly developed Assessment and Selection Process. In the end, the CAMAS Method helps compare BPM methods based on a common set of context-related dimensions and characteristics. The Assessment and Selection Process provide guidance on how to assess BPM methods regarding their applicability to specific contexts (use case 1) and on how to select BPM methods that fit their contexts at hand (use case 2). As the CAMAS method is not an entirely new end-to-end method but composes existing fragments against the background of context awareness in BPM, it accounts for the DSR contribution type ‘exaptation’, extending known solutions to new problems (Gregor and Hevner 2013).

Further, our work has several *managerial implications*. First, our study supports BPM method engineers as it facilitates the targeted application of their methods, which may increase adoption in practice. Second, our study guides practitioners in assessing the applicability of existing BPM methods to specific contexts. As the CAMAS Method helps understand the nature of BPM methods in a

structured and well-founded manner, practitioners may challenge the applicability of BPM methods currently used in their organizations. Third, our study guides practitioners in selecting suitable BPM methods for specific contexts, reducing risks related to an inefficient use of resources or, in some cases, the failure of BPM projects (Sect. 1). The Method Base comprising 103 BPM methods can also inspire organizations to use new, perhaps locally unknown BPM methods. Finally, our study helps practitioners handle multiple contexts at the same time by applying the Selection Process repeatedly, comparing results, and selecting those BPM methods that fit various contexts. Overall, our findings reduce the uncertainty related to the selection of BPM methods and increase the transparency of related decisions.

### 6.3 Limitations and Future Research

Our research comes with *limitations* related to the design of the CAMAS Method and its evaluation. We present these limitations together with ideas for future research and make a call for action based on our findings. Finally, we point to research opportunities in related domains.

One limitation has to do with the *assumptions* we made for the CAMAS Method (Sect. 4) to reduce complexity. First, we assessed each context factor on a two-point scale, dropping medium-level characteristics (e.g., medium knowledge intensity). Future research may include more fine-granular specifications of the context characteristics, allowing for a more detailed assessment of BPM methods’ applicability. Second, we propose two indicators, i.e., the *DA* and *DCS*, to support the selection of suitable BPM

methods. Future research may investigate additional indicators to enhance BPM method selection.

The *evaluation of the CAMAS Method* also has limitations (Sect. 5). First, two co-authors independently assessed a sample of 103 BPM methods and 12 BPM method engineers were involved in obtaining first-hand classifications of 20 BPM methods. Future research may involve all original method engineers in the assessment of existing methods. Second, the evaluation builds on a structured literature review of articles in recognized journals and conferences in the BPM and IS discipline. However, we consciously decided not to include BPM methods from (text) books and/or consulting companies. This design decision had two reasons. On the one hand, we did not aim for a complete sample of BPM methods, as the identified methods primarily served the purpose of evaluating the Assessment Process and as a basis for applying the Selection Process. This purpose has been confirmed by applying the Assessment Process 226 times and the Selection Process six times with two organizations for real processes. On the other hand, we could not rigorously decide which (text) books or consulting methods should be included, as many consulting methods are not publicly available. Thus, we started with those BPM methods that have been published in well-known and high-ranked journals and conferences in the field of IS and BPM. To address both limitations mentioned above and to facilitate a first-hand classification by BPM method engineers, we provide the current Method Base and the Excel prototype for the Assessment and Selection Process in the electronic supplementary material. That way, many people can contribute to extending our compilation of existing BPM methods. Third, we evaluated the Selection Process in two organizations to gain preliminary insights. Future research should involve additional organizations from various contexts. Finally, future research may also further develop the prototype in terms of visualization and analysis functionality. For example, to automatize activity S5, a decision model could be proposed and implemented which automates the compilation, valuation, and selection of alternative combinations of BPM method(s) considering multiple contexts. To facilitate the real-world application of the Selection Process and developments of the prototype, we publicly shared the respective Excel prototype.

Beyond addressing limitations and future research, we make a *call for action*. Our key findings related to the status quo of BPM methods disposes us to call for more context awareness in BPM method design. In particular, we request that BPM method engineers assess the applicability of their methods to specific contexts when the method is being designed. We also call for the development of context-specific BPM methods that, for example, address frequent combinations of context characteristics.

Additionally, an extension of explorative BPM methods is required, as they become more important in today's dynamic business environments (Grisold et al. 2019) and as most extant BPM methods are exploitative in nature. In doing so, BPM method engineers may consider methods from other disciplines (e.g., innovation management, design thinking, product engineering) to derive explorative methods applicable for BPM purposes. Besides developing new context-specific BPM methods, we call for broadening the knowledge about context-aware BPM with respect to additional context dimensions (e.g., customer dimension), for supplementing the proposed dimensions of the BPM lifecycle and the BPM context framework, or by expanding our approach to other core elements of BPM (e.g., governance, culture, or strategic alignment).

## 7 Conclusion

Given the increasing importance of context-aware BPM and the lack of related prescriptive knowledge, our research investigated how BPM methods can be assessed and selected while taking context into consideration. In line with the DSR paradigm, the CAMAS Method was developed by using SME as research method. It assists BPM method engineers and users in assessing the applicability of newly developed or existing BPM methods to specific contexts (use case 1) as well as assisting BPM method users in selecting BPM methods that fit their contexts (use case 2). Drawing from justificatory knowledge about BPM in general and context-aware BPM in particular, the CAMAS Method consists of three components: a Classification Framework, an Assessment Process, and a Selection Process. We evaluated the CAMAS Method by building an Excel prototype, by assessing 103 BPM methods identified in a structured literature review, and by letting two organizations apply the method to six real-world processes. Our work contributes to the descriptive and prescriptive knowledge of context-aware BPM and helps practitioners select suitable BPM methods in order to efficiently use organizational resources.

**Funding** Open Access funding provided by Universität Liechtenstein.

**Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not

included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

## References

- Abe M, Kudo M (2014) Business monitoring framework for process discovery with real-life logs. In: Sadiq S, Soffer P, Völzer H (eds) Proceedings of the 12th international conference on business process management, pp 416–423
- Accorsi R, Lehmann A, Lohmann N (2015) Information leak detection in business process models: theory, application, and tool support. *Inf Syst* 47:244–257
- Anastassiou M, Santoro FM, Recker J, Rosemann M (2016) The quest for organizational flexibility. *Bus Process Manag J* 22(4):763–790
- Antunes AS, Rupino da Cunha P, Barata J (2014) MUVE IT: reduce the friction in business processes. *Bus Process Manag J* 20(4):571–597
- Appel S, Kleber P, Frischbier S, Freudenreich T, Buchmann A (2014) Modeling and execution of event stream processing in business processes. *Inf Syst* 46:140–156
- Avison DE (1996) Information systems development methodologies: a broader perspective. In: Brinkkemper S, Lyytinen K, Welke RJ (eds) Method engineering: principles of method construction and tool support. Springer, Boston, pp 263–277
- Benner MJ, Tushman ML (2003) Exploitation, exploration, and process management: the productivity dilemma revisited. *Acad Manag Rev* 28(2):238–256
- Bergener P, Delfmann P, Weiss B, Winkelmann A (2015) Detecting potential weaknesses in business processes. *Bus Process Manag J* 21(1):25–54
- Braun C, Wortmann F, Hafner M, Winter R (2005) Method construction: a core approach to organizational engineering. In: Haddad HM (ed) Proceedings of the 2005 ACM symposium on applied computing, pp 1295–1299
- Brinkkemper S (1996) Method engineering: engineering of information systems development methods and tools. *Inf Softw Technol* 38(4):275–280
- Bucher T, Klesse M, Kurpjuweit S, Winter R (2017) Situational method engineering: on the differentiation of “context” and “project type”. In: Ralyté J, Brinkkemper S, Henderson-Sellers B (eds) Situational method engineering: fundamentals and experiences, pp 33–48
- Christenfeld DJG (1995) Choices from identical options. *Psychol Sci* 6(1):50–55
- Cohen J (1960) A coefficient of agreement for nominal scales. *Educ Psychol Meas* 20(1):37–46
- de Bruin T, Rosemann M (2005) Towards a business process management maturity model. In: Bartmann D, Rajola F, Kallinikos J, Avison DE, Winter R, Ein-Dor P, Becker J, Bodendorf F, Weinhardt C (eds) Proceedings of the 13th European conference on information systems, pp 642–653
- de Boer FG, Müller CJ, Schwengber ten Caten C (2015) Assessment model for organizational business process maturity with a focus on BPM governance practices. *Bus Process Manag J* 21(4):908–927
- Denner M-S, Püschel L, Röglinger M (2018b) How to exploit the digitalization potential of business processes. *Bus Inf Syst Eng* 60(4):1–19
- Denner M-S, Röglinger M, Schmiedel T, Stelzl K, Wehking C (2018a) How context-aware are extant BPM methods? Development of an assessment scheme. In: Weske M, Montali M, Weber I, Vom Brocke J (eds) Business process management, vol 11080. Springer, Cham, pp 480–495
- Dey AK (2001) Understanding and using context. *Pers Ubiquitous Comput* 5(1):4–7
- Donaldson L (2001) The contingency theory of organizations. Sage, Thousand Oaks
- Dumas M, La Rosa M, Mendling J, Reijers HA (2013) Fundamentals of business process management, 1st edn. Springer, Heidelberg
- Dumas M, La Rosa M, Mendling J, Reijers HA (2018) Fundamentals of business process management, 2nd edn. Springer, Heidelberg
- Edvardsson B, Frow P, Jaakkola E, Keiningham TL, Koskela-Huotari K, Mele C, Tombs A (2018) Examining how context change foster service innovation. *J Serv Manag* 29(5):932–955
- Fdhila W, Indiono C, Rinderle-Ma S, Reichert M (2015) Dealing with change in process choreographies: design and implementation of propagation algorithms. *Inf Syst* 49:1–24
- Gregor S, Hevner AR (2013) Positioning and representing design science research for maximum impact. *MIS Q* 37(2):337–355
- Grisold T, Gross S, Röglinger M, Stelzl K, vom Brocke J (2019) Exploring explorative BPM – setting the ground for future research. In: Hildebrandt T, van Dongen B, Röglinger M, Mendling J (eds) Business process management: 17th International conference on BPM 2019, Vienna, vol 11675. Springer, Cham, pp 23–31
- Gross S, Malinova Mandelburger M, Mendling J (2019) Navigating through the maze of business process change methods. In: Proceedings of the 52nd Hawaii international conference on system sciences, pp 6270–6279
- Günther C, Rinderle-Ma S, Reichert M, van der Aalst WMP, Recker J (2008) Using process mining to learn from process changes in evolutionary systems. *Int J Bus Process Integration Manag* 3:61–78
- Harmon P, Wolf C (2018) The state of business process management 2018. A BPTrends Report
- Henderson-Sellers B, Ralyte J (2010) Situational method engineering: state-of-the-art review. *J Univ Comput Sci* 16(3):424–478
- Johannsen F, Leist S, Tausch R (2014) Wand and Weber's good decomposition conditions for BPMN. *Bus Process Manag J* 20(5):693–729
- Kerpedzhiev G, König U, Röglinger M, Rosemann M (2020) An exploration into future business process management capabilities in view of digitalization: results from a delphi study. *Bus Inf Syst Eng*. <https://doi.org/10.1007/s12599-020-00637-0>
- Kohlborn T, Mueller O, Poepelbuss J, Röglinger M (2014) Interview with Michael Rosemann on ambidextrous business process management. *Bus Process Manag J* 20(4):634–638
- Landis JR, Koch GG (1977) The measurement of observer agreement for categorical data. *Biometrics* 33(1):159–174
- Lindman M, Pennanen K, Rothenstein J, Scozzi B, Vincze Z (2016) The value space: how firms facilitate value creation. *Bus Process Manag J* 22(4):736–762
- March ST, Smith GF (1995) Design and natural science research on information technology. *Decis Support Syst* 15(4):251–266
- Melão N, Pidd M (2000) A conceptual framework for understanding business processes and business process modelling. *Inf Syst J* 10(2):105–129
- Montazemi AR, Qahri-Saremi H (2015) Factors affecting adoption of online banking: a meta-analytic structural equation modeling study. *Inf Manag* 52(2):210–226
- Moore GC, Benbasat I (1991) Development of an instrument to measure the perceptions of adopting an information technology innovation. *Inf Syst Res* 2(3):192–222

- Myers MD, Newman M (2007) The qualitative interview in IS research: examining the craft. *Inf Organ* 17(1):2–26
- Nahm AY, Rao SS, Solis-Galvan LE, Ragu-Nathan TS (2002) The Q-sort method: assessing reliability and construct validity of questionnaire items at a pre-testing stage. *J Mod Appl Stat Methods* 1(1):114–125
- Neubauer T, Stummer C (2007) Extending business process management to determine efficient IT investments. In: Wainwright RL, Haddad HM, Shin SY (eds) Proceedings of the 22nd ACM symposium on applied computing, pp 1250–1256
- Niehaves B, Poepplbuss J, Plattfaut R, Becker J (2013) BPM capability development – a matter of contingencies. *Bus Process Manag J* 20(1):90–106
- Oc B (2018) Contextual leadership: a systematic review of how contextual factors shape leadership and its outcomes. *Leadersh Q* 29(1):218–235
- Paré G, Trudel MC, Jaana M, Kitsiou S (2015) Synthesizing information systems knowledge: a typology of literature reviews. *Inf Manag* 52(2):183–199
- Peffer K, Tuunanen T, Rothenberger MA, Chatterjee S (2008) A design science research methodology for information systems research. *J Manag Inf Syst* 24(3):45–77
- Pries-Heje J, Baskerville R, Venable JR (2008) Strategies for design science research evaluation. In: Proceedings of the 16th European conference on information systems, pp 1–12
- Ploesser K, Recker J (2011) Context-aware methods for process modeling. In: Beckmann JA (ed) Business process modeling: software engineering, analysis and applications. Nova, New York, NY, USA, pp 492–507
- Ralyté J, Deneckère R, Rolland C (2003) Towards a generic model for situational method engineering. In: Eder J, Missikoff M (eds) Advanced information systems engineering. Springer, Heidelberg, pp 95–110
- Recker J, Mendling J (2016) The state of the art of business process management research as published in the BPM conference. *Bus Inf Syst Eng* 58(1):55–72
- Recker J, Zur Muehlen M, Siau K, Erickson J, Indulska M (2009) Measuring method complexity: UML versus BPMN. In: Kendall KE, Varshney U (eds) Proceedings of the 15th Americas conference on information systems, pp 1–9
- Rosemann M (2014) Proposals for BPM research directions. In: Jung J-Y, Ouyang C (eds) Proceedings of the 2nd Asia pacific conference on business process management, pp 1–15
- Rosemann M, vom Brocke J (2015) The six core elements of business process management. In: vom Brocke J, Rosemann M (eds) Handbook on business process management 1. Springer, Heidelberg, pp 107–126
- Rosemann M, Recker J (2006) Context-aware process design: Exploring the extrinsic drivers for process flexibility. In: Proceedings of the workshops and doctoral consortium. Namur University Press, pp 149–158
- Rosemann M, Recker J, Flender C (2008) Contextualisation of business processes. *Int J Bus Process Integr Manag* 3(1):47–60
- Ruiz M, Costal D, España S, Franch X, Pastor Ó (2015) GoBIS: an integrated framework to analyse the goal and business process perspectives in information systems. *Inf Syst* 53:330–345
- Saaty TL (1990) How to make a decision: the analytic hierarchy process. *Eur J Oper Res* 48(1):9–26
- Schmidt R, Lyytinen K, Keil M, Cule P (2001) Identifying software project risks: an international delphi study. *J Manag Inf Syst* 17(4):5–36
- Schmiedel T, vom Brocke J (2015) Business process management: potentials and challenges of driving innovation. In: vom Brocke J, Schmiedel T (eds) BPM – driving innovation in a digital world. Springer, Cham, pp 3–15
- Schwaber K (1997) SCRUM development process. In: Sutherland J, Casanave C, Miller J, Patel P, Hollowell G (eds) Proceedings of the 1995 conference on business object design and implementation, pp 117–134
- Sonnenberg C, vom Brocke J (2012) Evaluations in the science of the artificial-reconsidering the build-evaluate pattern in design science research. In: Peffer K, Rothenberger MA, Kuechler B (eds) Proceedings of the 7th international conference on design science research in information systems, pp 381–397
- Trkman P, Mertens W, Viaene S, Gemmel P (2015) From business process management to customer process management. *Bus Process Manag J* 21(2):250–266
- van der Aalst WMP (2013) Business process management: a comprehensive survey. *ISRN Softw Eng* 2013:1–37
- Vanwersch RJB, Shahzad K, Vanderfeesten I, Vanhaecht K, Grefen P, Pintelon L, Mendling J, van Merode GG, Reijers HA (2016) A critical evaluation and framework of business process improvement methods. *Bus Inf Syst Eng* 58(1):43–53
- Venable J, Pries-Heje J, Baskerville R (2012) A Comprehensive framework for evaluation in design science research. In: Peffer K, Rothenberger MA, Kuechler B (eds) Proceedings of the 7th international conference on design science research in information systems, pp 423–438
- vom Brocke J, Mendling J (2018) Framework for business process management: a taxonomy for business process management cases. In: vom Brocke J, Mendling J (eds) Business process management cases: digital innovation and business transformation in practice. Springer, Cham, pp 1–26
- vom Brocke J, Schmiedel T, Recker J, Trkman P, Mertens W, Viaene S (2014) Ten principles of good business process management. *Bus Process Manag J* 20(4):530–548
- vom Brocke J, Zelt S, Schmiedel T (2016) On the role of context in business process management. *Int J Inf Manag* 36(3):486–495
- Wolfswinkel JF, Furtmueller E, Wilderom CPM (2013) Using grounded theory as a method for rigorously reviewing literature. *Eur J Inf Syst* 22(1):45–55
- Yoo S, Harman M, Tonella P, Susi A (2009) Clustering test cases to achieve effective and scalable prioritisation incorporating expert knowledge. In: Proceedings of the 18th international symposium on software testing and analysis, pp 201–211
- Zelt S, Recker J, Schmiedel T, vom Brocke J (2018) A theory of contingent business process management. *Bus Proc Manag J* 25(6):1291–1316