A critical evaluation and framework of business process improvement methods

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RESEARCH PAPER

A Critical Evaluation and Framework of Business Process Improvement Methods

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Abstract The redesign of business processes has a huge potential in terms of reducing costs and throughput times, as well as improving customer satisfaction. Despite rapid developments in the business process management discipline during the last decade, a comprehensive overview of the options to methodologically support a team to move from as-is process insights to to-be process alternatives is lacking. As such, no safeguard exists that a systematic exploration of the full range of redesign possibilities takes place by practitioners. Consequently, many attractive redesign possibilities remain unidentified and the improvement potential of redesign initiatives is not fulfilled. This systematic literature review establishes a comprehensive methodological framework, which serves as a catalog for process improvement use cases. The framework contains an overview of all the method options regarding the generation of process improvement ideas. This is established by identifying six key methodological decision areas, e.g. the human actors who can be invited to generate these ideas or the information that can be collected prior to this act. This framework enables practitioners to compose a well-considered method to generate process improvement ideas themselves. Based on a critical evaluation of the framework, the authors also offer recommendations that support academic researchers in grounding and improving methods for generating process

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improvement ideas. Next to the framework and its critical evaluation, this review investigates the research procedures of the studies that were used to create the framework. Related to this investigation, academic researchers can find additional guidance regarding procedures for building and evaluating new methods.

Keywords Business process management · Business process redesign · Systematic literature review · Framework

1 Introduction

The discipline of business process management (BPM) integrates insights from the information systems and management sciences domain, and has developed a variety of methods, techniques, and tools to support the (re)design, enactment, management, and analysis of operational business processes (van der Aalst 2004, 2013; Weske 2007). Nonetheless, comprehensive methodological support for generating process improvement ideas during the (re)design phase of BPM initiatives is still not available (van der Aalst 2013; Chai et al. 2005; Griesberger et al. 2011; Netjes et al. 2010; Valiris and Glykas 1999; Zellner 2011). This means that practitioners are not supported by a complete overview of the key choices to be made when faced with the task of composing a respective method. Nor do they have access to all options available for each of these methodological decision areas, such as the different types of information that can be collected prior to generating process improvement ideas. In the absence of this support, highly intuitive approaches have gained widespread use to generate process alternatives (Chai et al. 2005; Limam Mansar et al. 2009). For example, starting from a set of process improvement goals, process actors just brainstorm about process improvement ideas during a few workshops chaired by an external consultant (Limam Mansar et al. 2009). Such redesign sessions are at risk to lead to biased choices and to neglect attractive process alternatives (Chai et al. 2005; Limam Mansar et al. 2009). As such, many opportunities for reducing costs and throughput times as well as for improving customer satisfaction are missed. As argued by Recker and Rosemann (2014), method-ism that ensures a more systematic exploration of the solution space might be highly beneficial for the creative act of generating process improvement ideas.

Existing research efforts that aim at providing methodological support for this act have two limitations that inhibit them from providing comprehensive support. First, these efforts typically do not cover all important methodological decision areas (Zellner 2011). Often, they only investigate a few of these methodological decision areas, such as the software packages supporting the generation of process improvement ideas, and they neglect other but related methodological decisions areas, such as the different process stakeholders that have to participate in redesign sessions (Kim and Kim 1998; Lee et al. 2008; Lee and Pentland 2000). Second, we observe that existing research efforts are fragmented and performed in different research domains, e.g. the domains of information systems and management sciences. Screening classification systems of electronic search databases within these domains reveals an even larger set of labels, e.g. "Business Process Reengineering", "Business Process Improvement", "Workflow Engineering", "Lean", and "Service Engineering". Due to the lack of methodological coverage by individual research efforts and the fragmented nature of the field, a systematic literature review is called for in this cross-domain area to establish comprehensive methodological support for generating process improvement ideas.

In this study, a detailed literature review protocol is used to develop a comprehensive methodological framework for generating process improvement ideas. This framework contains an overview of method options for six key methodological decision areas: aim, actors, input, output, technique, and tool (Alt et al. 2001; Brinkkemper 1996; Cossentino et al. 2006; Henderson-Sellers and Ralyté 2010; Kettinger et al. 1997; Reijers and Limam Mansar 2005; Zellner 2011). As such, the framework provides a catalog for process improvement use cases. Screening this catalog enables practitioners to compose a well-considered method for generating process improvement ideas based on method options offered by existing methods. Moreover, a critical evaluation of this framework enabled us to provide recommendations that support academic researchers in grounding and improving methods for generating process improvement ideas.

It should be emphasized that the catalog is not directly applicable to generate process improvement ideas. Rather, it is the result of a review of the various existing methods and their success factors in generating process improvement ideas. The presented catalog, due to its identification of important methodological decision areas and options for improvement methods, should be considered as solid and useful support to anyone composing or developing a new process improvement method.

Apart from a presentation of the catalog and its related recommendations, this review includes a critical evaluation of characteristics of the studies that were used to create the framework (e.g. an evaluation of the applied research methods). Based on this evaluation, recommendations are formulated that assist academic researchers in developing rigorous build and evaluation procedures for new methods.

This paper is structured as follows. In Sect. 2, we position our methodological framework regarding two

related recent taxonomies. Section 3 outlines our literature review methodology. Section 4 provides the results of our literature review. In Sect. 5, we determine the implications of these results for research and practice, and Sect. 6 concludes this paper.

2 Related Taxonomies

Our work enriches two related BPM taxonomies that were recently developed: van der Aalst's (2013) BPM use case classification and Recker and Rosemann's (2014) Innovation thinking style matrix. Van der Aalst (2013) provides a set of twenty BPM use cases, with *process models* as fundamental concepts for analyzing, understanding, configuring, and improving business processes. In our review, the act of *generating process improvement ideas*, instead of the process model with all its application possibilities, is at the center of attention. This does not mean that the concept of a process model is beyond the scope of our work. Process models and related data elements are potential inputs for and outputs of the act of generating process improvement ideas, such as illustrated in the BPM use case "Improve Model" (van der Aalst 2013). These elements are, however, just one of the possible inputs and outputs. For example, process weaknesses as identified by customers are also considered as potential inputs in our review. Our review enriches van der Aalst's (2013) review also in terms of the kind of aspects that are taken into account. His use cases mainly describe *aim*, *input*, *output,* and *technique* aspects of BPM use cases. In this review, we also extensively discuss the kind of *human actors* who can be invited to generate process improvement ideas and the *tools* that can be used to support this act. As such, we provide a comprehensive overview of method options for generating process alternatives.

Recker and Rosemann (2014) provide a classification of different innovation thinking styles and methods, which can be used to innovate processes, products, and assets. Their matrix contains the following two axes: where you seek to innovate and how you identify potential innovations. The first axis distinguishes *operational assets and procedures* from *strategic assets and capabilities*. The second axis differentiates three innovation strategies: *understand yourself*, *learn from others*, and *design*. Our review focuses on process innovation on an operational level and covers the lower segment of the matrix, i.e. the three different innovation strategies with regard to operational procedures. We extend Recker and Rosemann's (2014) work by elaborating on methods that are part of this segment of the matrix, i.e. by addressing the six key underlying aspects of these methods.

In addition to the fact that our work enriches two existing BPM taxonomies, this study also includes related recommendations that further support researchers in developing well-designed methods for generating process improvement ideas.

3 Research Methodology

3.1 Introduction

This systematic review consists of two parts, which apply a similar but separate search and screening procedure:

1. The first part targets studies that have either developed a method for generating process improvement ideas (*method development studies*) or reviewed these methods (*method review studies*).
2. The second part targets studies that have investigated critical success factors of generating process improvement ideas (*success factor studies*).

Both parts provide input for the critical evaluations as well as for the methodological framework. In the remainder of this methodology section, our general search, screening, extraction, and coding procedures are discussed and the search and selection procedure fragments that were customized for a part are explicitly indicated. An extended discussion of all procedures is available in Supplementary material Appendix A "Review Protocol"[1] (the appendices are available online via http://link.springer.com).

3.2 Search and Selection

For each part, we started with an electronic database search to enable a comprehensive search (Fink 2010; Okoli and Schabram 2010; Randolph 2009; Rowley and Slack 2004). The electronic databases INSPEC and ABI/Inform were selected to provide coverage of the information systems and management sciences domain. Moreover, we explicitly considered the literature in the health sciences domain by making use of electronic database Medline. In this domain, administrative processes, which have been the target of many traditional BPM initiatives, meet (patient-)logistic processes, which are often characterized by a highly complex and flexible interplay of different specialized organizational units (Mans et al. 2009, 2013). As such, the healthcare domain faces special process integration and redesign challenges which make this domain a particularly interesting

[1] A preliminary version of this protocol has already been published: Vanwersch et al. (2011).

development ground for process improvement methods. Our decision to focus on healthcare in this study, beside domain-independent methods and success factors, implies that our review results can certainly be enriched by also taking into account papers from other application domains (e.g. by looking at other domain-specific catalogues).

In order to identify relevant search terms for both parts of the literature review (1: method development/review studies; 2: success factor studies), synonyms, acronyms, and abbreviations related to the terms "process", "redesign", "method", and "factor" were systematically investigated and led to one extensive Boolean search expression for each part (see Supplementary material Appendix A). This Boolean expression was complemented with database-specific headings. Besides querying electronic databases, two relevant sources outside the scope of these search engines, i.e. the EPOC Cochrane database and the International Journal of Care Pathways, were manually scanned. To identify high quality studies efficiently, we decided to target only peer-reviewed journal articles and conference papers (Rowley and Slack 2004; Webster and Watson 2002). In addition, only articles in English, containing an abstract and published since 1990, were considered.

After this primary search, two reviewers independently executed a two-stage relevance screening and a quality screening to select relevant and high quality studies for each part (Brereton et al. 2007; Webster and Watson 2002). Regarding each screening activity, inter-rater-agreement was assessed by means of the Kappa statistic (Fink 2010) and any disagreements between reviewers were resolved by consensus.

The two-stage relevance screening included a title and abstract screening as well as a full copy screening. Several criteria used during the two-stage relevance screening applied to both parts of our literature review. For example, we evaluated for all included types of studies whether the study focused on *generating process improvement ideas*. Articles focusing on framing the process of interest, modeling or analyzing as-is processes, and/or implementing or evaluating process alternatives were excluded from further examination (e.g. Raisinghani et al. 2005). Other relevance criteria applied to only one part of our literature review. For instance, regarding the second part, we evaluated whether success factors could be translated to concrete method options for generating process improvement ideas. Articles that only discussed highly abstract success factors (e.g. improving the quality culture) were excluded from further examination (e.g. Talib et al. 2010). The quality screening was conducted for the full copies that passed the two-stage relevance screening. As part of this screening, we excluded, for example, method development studies that solely relied on expert opinion to develop a method (e.g. Furey 1993). For each part of our literature review, an overview of all inclusion and exclusion criteria can be found in Supplementary material Appendix A.

After the primary search and screening procedures, two additional search strategies were used for each part (Fink 2010; Okoli and Schabram 2010). First, a secondary search was conducted to identify additional studies by means of backward and forward tracing of references. Second, we contacted an advisory committee consisting of six senior researchers together covering the information systems, management sciences, and health sciences domain. These members were invited to assess the completeness of the primary and secondary search and recommend additional literature to further ascertain that important studies did not remain unidentified. For both strategies, which also targeted technical reports and book chapters, the full copies of the papers were screened similarly to the full copy screening procedures of the primary search.

3.3 Data Extraction and Coding

All identified and selected studies entered the data extraction and coding phase, which was identical for both parts. A detailed data extraction form (see Supplementary material Appendix A) was used to extract data fragments from these studies (Brereton et al. 2007; Fink 2010; Kitchenham 2004; Okoli and Schabram 2010; Randolph 2009; Webster and Watson 2002). Based on Method Engineering research (Brinkkemper 1996; Cossentino et al. 2006; Henderson-Sellers and Ralyté 2010) and related research in the field of business process redesign (Alt et al. 2001; Kettinger et al. 1997; Reijers and Limam Mansar 2005; Zellner 2011), we decided to extract data with regard to six key methodological decision areas. These areas, i.e. *method elements*, with respect to the act of generating process improvement ideas are:

1. the *aim* that explains the objective of the act;
2. the human *actors* invited to participate;
3. the *input* specifying the information that is collected prior to the act;
4. the *output* describing the artifacts that are the result of the act;
5. the *technique* that prescribes how to generate process improvement ideas;
6. the *tool* defined as a software package that is able to support the act.

Additionally, we extracted data regarding two study characteristics to gain insights into the context of method development. These two *context elements* are:

1. the *label* used by the authors to refer to the redesign of business processes;
2. the *study design* summarizing the research method types used.

In line with the grounded theory approach (Wolfswinkel et al. 2013), all data fragments were extracted and coded in an iterative fashion by making use of a structured procedure. The first author of this paper extracted data from all studies and assigned an initial code to each data fragment, using terms taken directly from the articles whenever available. The second author of this paper independently extracted and coded data for a 10 % random sample of the studies. Subsequently, data extraction and coding discrepancies were discussed in detail by both reviewers and resolved by consensus. In line with review recommendations (Brereton et al. 2007), an extractor-checker construction was used to efficiently extract and code data from the remaining studies. After this data extraction and initial coding step, the relationships between the initial codings were analyzed in more detail by both reviewers. This axial coding step (Wolfswinkel et al. 2013) resulted in updated concepts and categories. Microsoft Excel and the annotation tool Qiqqa were used to facilitate these iterative data extraction and coding activities.

4 Results

4.1 Search and Selection Results

The search and selection results of both literature review parts are summarized in Table 1. Regarding the first part, the primary search retrieved 3791 matching articles. Of these, 32 passed the removal of duplicates, two-stage relevance screening, and quality screening. Based on these 32 articles, we identified 21 additional studies by means of backward and forward tracing of references. 18 out of these 21 studies passed the related assessment. Subsequently, the advisory committee suggested eight additional articles. Of these, one study passed the related evaluation. A further examination of the 51 (32 + 18 + 1) reports revealed that two articles could be excluded because these reports were predecessors of other articles and did not contain any new information. Furthermore, one article was an appendix that we decided to merge with the main publication that was also selected for inclusion. Hence, the first part contains 48 unique studies.

Regarding the second part, 2055 matching articles were obtained by means of the primary search. Here, nine articles passed the removal of duplicates, two-stage relevance screening, and quality screening. By means of backward and forward tracing of references, seven additional studies were identified. Of these, two passed the related assessment. In addition, two out of eight studies suggested by the advisory committee passed our screening. In summary, the second part contains 13 (9 + 2 + 2) unique studies.

In total, 61 unique studies entered the data extraction and coding phase. For all relevance and quality screening activities, inter-rater-agreement, as determined by Kappa statistics, varies between substantial (min Kappa = 0.63)

Table 1 Summary search and screening results

Label	Part 1	Part 2
Primary search		
ABI/inform	1672	855
INSPEC	1518	729
Medline	469	339
EPOC cochrane	60	60
IJCP	72	72
Total identified	3791	2055
Total after removal of duplicates	3494	1906
Total after relevance screen title and abstract	163	65
Total after relevance screen full copies	79	15
Total after quality screen full copies	32	9
Back and forward tracing		
Total identified	21	7
Total after relevance screen full copies	19	3
Total after quality screen full copies	18	2
Advisory committee suggestions		
Total identified	8	8
Total after relevance screen full copies	1	2
Total after quality screen full copies	1	2
Total		
Total before selection unique ideas	51	13
Total after selection unique studies	48	13

Part 1: method development studies + method review studies; Part 2: success factor studies

Table 2 Study labels

Label	No. of studies part 1	No. of studies part 2	No. of studies part 1 + 2
Business process reengineering	10	8	18
Business process redesign	13	0	13
Business process improvement	5	0	5
New service development	3	0	3
Business process change	1	1	2
Service engineering	2	0	2
Clinical pathways	0	2	2
Business re-engineering	1	0	1
Process life cycle engineering	1	0	1
Workflow reengineering	1	0	1
Lean six sigma	1	0	1
Service design	1	0	1
Service innovation	1	0	1
Total quality management	0	1	1
Care pathways	0	1	1
No label	8	0	8
Total	48	13	61

and perfect agreement (max Kappa = 1.00). An extended discussion of the search and screening results is available in Supplementary material Appendix B "Search and Selection Results".

4.2 Data Extraction and Coding Results: Context Elements

An analysis of the sources of the 61 selected articles reveals that our set consists of 42 journal papers (69 %), 17 conference papers (28 %), one technical report (1.5 %), and one book chapter (1.5 %). As shown in Table 2, 15 different *labels* were used by the authors of these studies to refer to the redesign of business processes. Business Process Reengineering (30 %), Business Process Redesign (21 %), Business Process Improvement (8 %), and New Service Development (5 %) are the most popular labels assigned.

Table 3 summarizes the analysis of the *study designs* of the included studies. Our set of studies contains three types of studies as explained in the methodology section: 45 *method development studies*, three *method review studies* and 13 *success factor studies*. With regard to *method development studies*, design science researchers distinguish a build and evaluation phase (Hevner et al. 2004; March and Smith 1995). Regarding the build phase of method development studies, a further examination of the study designs reveals that the researchers rarely used research method types other than literature reviews to support the construction of new methods. After finalizing the build phase, case studies (51 %) and illustrations (22 %) were frequently used by researchers during the evaluation phase. Interestingly, none of the literature reviews and less than half of the case studies (48 %) of the *method development studies* include a discussion of their data collection and analysis strategy. Among *method review* and *success factor studies*, literature reviews (94 %) and field surveys (38 %) dominate. Again, only a minority of the literature reviews of these study types (40 %) includes an explanation of their data collection and analysis strategy.

For all context elements discussed above, a detailed overview of all codings per study is available in Supplementary material Appendix C "Context Element Codings per Study".

4.3 Data Extraction and Coding Results: Method Elements

As discussed in the methodology section, we decided to extract and code data fragments regarding six methodological decision areas, i.e. six method elements. As shown in Table 4, the *input* element is most frequently addressed in our set of 61 studies (93 %). The decision areas *aim* (79 %), *output* (74 %), *technique* (71 %), *actors* (64 %) and *tool* (51 %) follow suit: these are still discussed in a majority of the reports.

For each methodological decision area, the extraction and coding procedure resulted in an overview of method options. As discussed in the methodology section, method option names were based on our initial codings that were taken directly from the articles whenever possible. If several initial codings had an identical meaning, these codings were merged. For example, the *external quality* option includes among others the following initial codings:

Table 3 Study designs

Research method type	No. of studies[a]	No. of studies explaining DCAS
Part 1		
Method development studies (N = 45)		
Literature review (build)	45	0
Field study (build)	1	0
Case study (evaluation)	23	11
Formal analysis (evaluation)	1	–
Illustration (evaluation)	10	–
Method review studies (N = 3)		
Literature review	3	3
Field study	1	1
Lab study	1	1
Part 2		
Success factor studies (N = 13)		
Literature review	12	3
Case study	4	4
Field survey	6	6
Field study	1	1

DCAS Data collection and analysis strategy

[a] Authors of each study may apply multiple research method types

Table 4 Method elements

Method element	No. of studies part 1	No. of studies part 2	No. of studies part 1 + 2
Input	45	12	57
Aim	36	12	48
Output	43	2	45
Technique	42	1	43
Actors	26	13	39
Tool	29	2	31

customer satisfaction, customer perceptions of quality and customer complaints. Furthermore, we classified the method options into (sub-)categories by looking at the underlying concepts of the method options during the axial coding step. For example, the inputs *textual process description*, *process model* and *simulation model* share the concept of "specifying an AS-IS process". Hence, we assigned all these method options to the category *AS-IS process specification*.

The complete methodological framework, which includes definitions of all method options and related (sub-)categories, as well as a quantitative analysis of the number of citations per method option is available in Supplementary material Appendix D "Details Methodological Framework". An overview of all coded method options per study is available in Supplementary material Appendix E "Method Element Codings per Study". Figure 1 provides a graphical, high-level summary of the methodological framework. In the next subsections, we briefly discuss our main results.

4.3.1 Aim

The aim element outlines the objective of the act of generating process improvement ideas. An overview of potential objectives assists practitioners in selecting an aim that is aligned with the vision and strategy of the involved organizations. Two aim elements can be distinguished:

- *Performance dimensions*, which delineate the kind of performance measures that need improvement, such as *costs*, *time* and *external quality*.
- *Degree of improvement*, which addresses whether *incremental* or *radical improvements* are needed.

4.3.2 Actors

The selection of human actors who have to participate in redesign sessions is another important methodological decision area. An overview of actors supports practitioners in composing a redesign team that is able to generate a

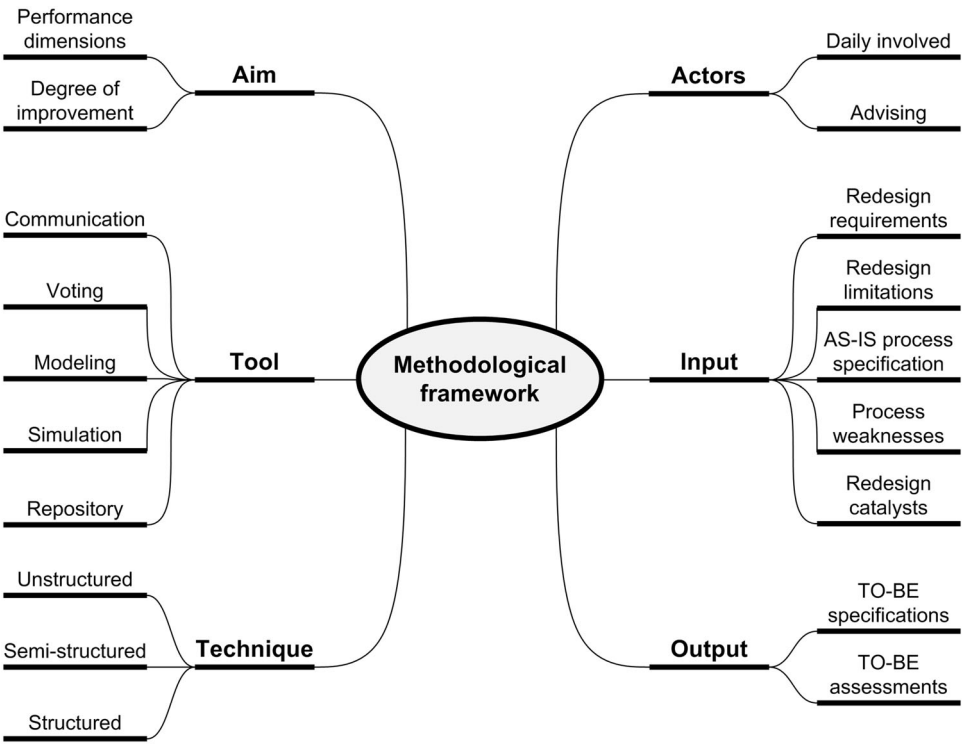

Fig. 1 Graphical summary methodological framework

variety of effective ideas and enables a smooth course of implementation. We identified two groups of actors:

- *Daily involved actors*, who are involved in either executing tasks within the process under study, i.e. so-called *process actors*, or managing the process, i.e. *management*.
- *Advising actors*, who do not have any responsibility for the process under study, but are able to contribute to the development of process alternatives due to their expertise or experience. Examples of advising actors are *external consultants* and *customers*.

4.3.3 Input

Prior to generating improvement ideas, it is important to collect useful information regarding the process under study. An overall picture of input options prevents neglecting interesting information that enables the generation of effective process improvement ideas. Five input categories can be distinguished:

- *Redesign requirements*, which delineate the redesign objectives that need to be achieved in terms of *process output goals* or *stakeholder/customer needs*.
- *Redesign limitations*, which outline the factors that restrict the solution space, i.e. *constraints*, or influence it, i.e. *risks*.
- *As-is process specification*, which provides a description of the current process, such as a *process model* or *simulation model*.
- *Process weaknesses*, which identify redesign priorities, such as *process output measures* and *problem investigations*.
- *Redesign catalysts*, which provide inspiration for the creation of effective process alternatives, such as *benchmark process insights* and *technology developments*.

4.3.4 Output

The output element describes the artifacts that are the result of redesign sessions. An overview of possible outputs assists practitioners in selecting an effective way of communicating the results of redesign workshops. We identified two output categories:

- *To-be specifications*, which provide descriptions of process improvement ideas. *To-be service concepts*, *to-be process models* and *to-be exception-handlers* are examples of options that explain the to-be process at different levels of abstraction.
- *To-be assessments*, which include preliminary evaluations of process alternatives, such as *impact analysis* and *force-field-analysis*.

4.3.5 Technique

A technique prescribes how to generate process improvement ideas. An overview of techniques helps practitioners in choosing a well-considered way of generating these ideas. Three technique categories can be distinguished:

- *Unstructured techniques*, which are creativity techniques that do not contain a detailed procedure that specifies how to get from current process insights (as-is) to concrete improvement ideas (to-be) and do not provide guidance regarding the kind of process alternatives that need to be considered. *Brainstorming* and *out-of-the-box* thinking are examples of these techniques.
- *Semi-structured techniques*, which offer a work procedure that specifies how to get from current process insights (as-is) to concrete improvement ideas (to-be), but lack any guidance regarding the kind of process alternatives that need to be considered. Examples of these techniques are the *nominal group* and *multi-level design technique*.
- *Structured techniques*, which offer a work procedure that specifies how to get from current process insights (as-is) to concrete improvement ideas (to-be) and include guidance regarding the kind of process alternatives that need to be considered. *Rule-based* and *repository-based* techniques are instances of these techniques.

4.3.6 Tool

A tool is defined as a software package that is able to support the generation of process improvement ideas. An overview of these can support practitioners in choosing tools that are able to increase the efficiency and effectivity of the generation of process improvement ideas. Six tool functionalities were identified:

- *Communication* functionality, which enables large groups to communicate face-to-face or distributed in a computer-mediated electronic environment. Typically, this environment allows for parallel and anonymous input.
- *Voting* functionality, which allows participants to rate different process alternatives.
- *Modeling* functionality, which supports practitioners in creating graphical representations of process alternatives.
- *Simulation* functionality, which allows dynamic modeling of business processes and supports practitioners in validating and evaluating process alternatives.
- *Repository* functionality, which provides support for the storage and retrieval of descriptions of process alternatives and related discussions.

5 Discussion

5.1 Discussion of Context Elements

The analysis of context elements leads to three observations. First, we observe that authors use a wide variety of labels to refer to the redesign of business processes. This observation does not only reinforce the need for a systematic review that carefully selects its search terms, but more generally implies that researchers focused on one or a limited number of labels are at risk to overlook valuable literature. For example, two literature reviews, which limited their attention to "Business Process Improvement" (Zellner 2011) and "Lean" (Mazzocato et al. 2010) related terms respectively, do not cover any of the structured process improvement techniques. In particular, rule-based, case-based, and repository-based techniques are not covered by these studies. Therefore, researchers who want to gain insights into the state-of-the-art of methodological support for generating process improvement ideas are recommended to explore a broad spectrum of labels.

Second, the analysis of study designs reveals that method development studies do not contain a wide variety of research method types. Regarding the build phase of method development, researchers typically limit their attention to literature reviews, whereas other research method types are worthwhile considering, such as field studies that elicit the specific requirements which the new method needs to fulfill. Also, with regard to the evaluation phase, other research method types may be alternatives of interest. Many method development studies either do not include an evaluation mechanism or merely provide an illustration of how the method can be applied. Only a small majority of studies includes a case study investigating the application of the method in practice. These case studies evaluate a method without comparing its performance with an already existing method. Lab or field experiments offer opportunities to compare the performance of different method options, such as different techniques, in a controlled environment (Hevner et al. 2004; Zelkowitz and Wallace 1998) and are worth further examination. In summary, researchers are invited to consider different but complementary research method types to allow for a step forward in facilitating evidence-based choices between different method options.

Third and finally, we observe that method development studies in particular lack information regarding data collection and analysis strategies. In such studies, it is reasonable to expect information to be present regarding evaluation metrics and subject groups involved in evaluating methods (Davidoff et al. 2008; Hevner et al. 2004; March and Smith 1995). Remarkably, only a minority of

method development studies includes this kind of information. Therefore, we advice researchers to improve the explanation of data collection and analysis strategies in order to facilitate learning from method build and evaluation procedures. This improved explanation will also make method limitations more transparent and, consequently, will enable further method development that is geared towards these limitations.

5.2 Discussion of Method Elements

An examination of the methodological framework (see Supplementary material Appendix D for all details) reveals that many method choices can and must be made regarding the act of generating process improvement ideas. Hence, we expect that the explicit examination of this comprehensive framework can support practitioners in making well-considered method choices. Therefore, we invite practitioners to use the methodological framework in their projects and encourage researchers to evaluate the benefits as well as shortcomings of its explicit usage.

A more in-depth examination of the options in the methodological framework reveals three gaps in literature that provide interesting directions for future research. First, we observe that redesign catalysts, which provide inspiration for generating process alternatives (e.g. benchmarking process insights and technology developments), seem to receive limited attention in the context of method development. A more intensive usage of these external information sources might enable a more complete exploration of attractive process alternatives. At the same time, a cookie-cutter approach regarding the use of benchmark and other examples should be prevented (Lee and Pentland 2000). Hence, an open and interesting research challenge is to investigate ways to smartly integrate redesign catalysts in methods for generating process improvement ideas.

Second, an in-depth examination of the framework reveals that existing methods seem to have a strong internal/intra-company focus. This focus is reflected in a limited involvement of customers, suppliers, and external peers in generating process improvement ideas and the lack of an explicit rethinking of the service concept, i.e. the positioning of the process in the complete value network (Patrício et al. 2011). This narrow internal/intra-company focus implies a high risk of missing interesting opportunities for repositioning the process in relation to customers, suppliers, and other stakeholders. For example, self-service concepts, outsourcing options, and co-creation possibilities are likely to be easily overlooked. Therefore, we encourage researchers to develop methods that are more geared towards an external/inter-company focus.

Third and finally, we observe that researchers sometimes investigate similar method options in a rather fragmented way. An appealing example can be observed regarding rule-based techniques. Rule-based techniques make use of generic process redesign rules that have been accumulated in literature or practice in order to develop process alternatives (Chai et al. 2005; Nissen 2000; Reijers and Limam Mansar 2005). When studying these rules, information systems researchers typically limit their attention to the "BPR best practices" literature, whereas researchers in the management sciences domain focus on "TRIZ innovation principles". More generally, we invite researchers to explore synergy/integration possibilities between existing research efforts with respect to similar method options.

5.3 Limitations

A major limitation of this work is that only studies until 2011 were part of the systematic literature review. Moreover, our search was limited to scientific reports. Many of these reports focus on developing methods based on scientific literature rather than on studying large scale applications of methods in practice. Hence, it seems desirable to enrich our findings with a further examination of methods that have recently been published in the scientific literature, as well as methods that have been used in business process redesign projects in practice.

6 Conclusion

This systematic literature review presents a methodological framework for generating process improvement ideas. This framework contains an overview of method options for six key methodological decision areas: aim, actors, input, output, technique, and tool. As such, the framework serves as a catalog for process improvement use cases. Screening this catalog enables practitioners to compose a well-considered method based on the method options as identified by our review. The methodological framework is complemented with recommendations that indicate several improvement directions for methods. Apart from the methodological framework and its critical evaluation, this review includes an analysis of the research procedures of the studies that were selected to develop the framework. Based on this analysis, recommendations are outlined that support academic researchers in building and evaluating new methods for generating process improvement ideas. We contend that, by employing a systematic review methodology, (a) a comprehensive methodological framework is developed that represents the body of knowledge in the information systems, management sciences, and health sciences domain, and (b) traceable and concrete recommendations are formulated that assist in developing well-designed methods for generating process improvement ideas.

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