Bus Inf Syst Eng 58(1):1–6 (2016)
DOI 10.1007/s12599-015-0409-x

EDITORIAL

Business Process Management

Don't Forget to Improve the Process!

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Published online: 4 January 2016

1 Introduction

Over the last decade business process management (BPM) has become a mature discipline, with a well-established set of principles, methods and tools that combine knowledge from information technology, management sciences and industrial engineering with the purpose of improving business processes (van der Aalst 2004, 2013; Weske 2007; Dumas et al. 2013). The successful international BPM conference series (http://bpm-conference.org) shows that there is a stable scientific core and substantial progress in specific BPM areas. Examples of BPM areas where remarkable progress has been made include:

- The syntactic verification of complex business process models before implementing them via IT, to avoid potentially costly mistakes at run time.
- The systematic identification of typical process behaviors based on scientific insights provided by the Workflow Patterns initiative.[1]
- The automatic creation of configurable process models from a collection of process model variants, used to guiding analysts when selecting the right configuration.
- The automatic execution of business process models based on rigorously defined semantics, and through a variety of BPM systems.
- The adaptation of processes on-the-fly and the evaluation of the impact of their changes, in order to react to (unexpected) exceptions.
- The automatic discovery of process models from raw event data produced by common information systems found in organizations.

Looking at the evolution of the BPM conference series one can conclude that some of the scientific problems have been successfully solved and these results (partly) adopted in practice.

BPM is a broad discipline. Hence, numerous BPM papers can be found in broader conferences such as the International Conference on Information Systems (ICIS), the European Conference on Information Systems (ECIS), the International Conference on Advanced Information Systems Engineering (CAiSE), the International Conference on Cooperative Information Systems (CoopIS), the International Conference on Business Information Systems (BIS) and Business Process Modeling, Development, and Support (BPMDS), as well as a number of scientific journals. There is also significant interest from practitioners. Large organizations model their processes in languages such as BPMN (Business Process Model and Notation) and

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[1] http://workflowpatterns.com.

have programs related to process improvement. Nowadays, one could argue that the "process thinking" mindset is common in most organizations.

Despite the attention for BPM in academia and industry, there is a considerable gap between (1) the state-of-the-art BPM technologies and approaches and (2) the actual usage by BPM practitioners and their needs. For example, only few organizations use BPM systems to automatically execute their operational processes. In many cases, processes are hard-coded in applications (e.g., ERP systems like SAP or home-grown systems). Of course, BPM does not imply the use of BPM systems. Business processes need to be managed in environments where processes are only partly documented and a range of information systems is used. These systems are often "unaware" of the processes in which they are used.

In this paper, we reflect on the current state of BPM and what could be done to bridge the gap between BPM research and practical use of BPM technologies. We argue that in BPM research there has frequently been an excessive focus on specific artifacts (such as process models). However, better *models* do not automatically yield better *processes*. Hence, research should be better aligned to the original goal of BPM of improving business processes, rather than improving process models – an observation also made by Marlon Dumas in his recent keynote speech at BPM'15 (Dumas 2015).

Key Performance Indicators (KPIs) related to common process performance dimensions such as time, quality, costs and compliance are often mentioned in research on process improvement, but it is often unclear how research results and related BPM technology concretely contribute to better KPIs. At the same time, many good ideas are not adopted: they are not implemented in the information systems people actually use. Moreover, organizational resistance may provide major roadblocks to the successful execution of BPM initiatives.

Accordingly, the remainder of the paper is organized as follows. Section 2 provides a very brief history of BPM to put things in context. In Sect. 3, we identify the goal of BPM (better processes rather than better models). Section 4 highlights directions that may help to bridge the gap identified. Section 5 overviews the papers contained in this special issue and Sect. 6 concludes this paper.

2 A Brief History of BPM

Since the first industrial revolution, productivity has been increasing due to technical innovations, improvements in the organization of work, and the use of information technology. During the first industrial revolution (1784–1870) machines (e.g., driven by water and steam power) entered the workplace. The second industrial revolution (1870–1969) was based on mass production, the division of labor, and the use of electrical energy. The third industrial revolution (1969–2015) was driven by the availability of computers, networks, and other IT systems. Today, people talk about "Industry 4.0" (Hermann et al. 2015) as the fourth industrial revolution. The goal is to create "smart" manufacturing systems using a combination of embedded systems, sensors, networks, service orientation, big data, and analytics.

Although the above four industrial revolutions are often associated with factories and physical production systems, they also apply to administrative processes and services. Governmental agencies, banks, insurance companies etc. can be seen as "administrative factories". The division of labor (i.e., specialization), the economies of scale and experience curve effects, and computerization radically changed these administrative processes. In such modern "production processes", the product is often *information* provisioned through a service, rather than a physical entity. BPM should be viewed in this context. The early Workflow Management (WFM) systems were clearly inspired by production processes in the manufacturing industry. The term "Straight-Through Processing" (STP) refers to the desire for fully automating processes without any human involvement, like a fully-automated assembly line to produce cars.

Through WFM systems, business process automation resonated well in organizations heavily investing in Business Process Reengineering (BPR) in the 1990s (Hammer and Champy 1993). As a result, an explosion of commercial WFM systems started around 1995 (cf. systems such as Staffware, COSA and IBM MQ Series Workflow). However, the roots of such systems can already be found in the late seventies. At that time people like Skip Ellis, Anatol Holt and Michael Zisman worked on Office Information (OI) systems driven by explicit process models (van der Aalst 2013). OI systems like Officetalk and SCOOP used Petri nets to model and enact operational processes. These systems and also the later WFM systems did not pay much attention to management aspects. Moreover, they were typically very restrictive, straight-jacketing processes into some structured and "idealized" process.

BPM can be seen as an evolution of the concept of WFM (van der Aalst 2013). WFM primarily focuses on the automation of business processes, whereas BPM has a broader scope: from process automation and process analysis to operations management and the organization of work. On the one hand, BPM aims to improve business processes, possibly without the use of new technologies. For example, by modeling a business process and analyzing it using simulation, management may hit on ideas on how to reduce costs while improving service levels. On the other hand, BPM is often associated with software to manage, control and support operational processes. This gave rise to a new type of technology, called BPM systems, which can connect with a variety of (legacy) systems as well as emerging technology (e.g., cloud networks, mobile devices), and have effectively replaced their predecessors, the WFM systems.

This short discussion of the history of BPM shows that there is a trend from automating processes (OI and WFM systems) to managing processes (BPM). However, the majority of existing BPM research approaches still seems to be based on the assumptions used by WFM and the early OI systems. Process management has turned out to be much more "thorny" than envisioned by the pioneers in the field.

3 What Defines a Better Process?

The lion's share of BPM and WFM literature seems to focus on process models. The *control-flow perspective* (modeling the ordering of activities) is often the backbone of such models. Other perspectives such as the *resource perspective* (modeling organizational units, roles, authorizations, IT systems, equipment etc.), the *data or artifact perspective* (modeling decisions, data creation, forms, etc.), the *time perspective* (modeling durations, deadlines, etc.), and the *function perspective* (describing activities and related applications) are often mentioned, but receive less attention. There is the belief that better (control-flow) models will lead to better processes. We dare to question this belief for several reasons. First of all, the process models used for performance analysis may not resemble reality. They are mainly rely on information from those who participate in the process (the process participants), through workshops or interviews, and as such may be subject to their knowledge bias and influenced by norms and expectations of the organization. They may describe an idealized or particular situation and thus are often not useful to provide the insights needed (van der Aalst 2011). Second, these conceptual models are rarely used to guide the implementation of a process automation solution. Indeed, few organizations actually use BPM technology to run their processes. Most resort to custom-made or standard software where processes are hard-coded or not supported at all. There is no indication that this will change dramatically in the near future. Despite all work on flexibility (Reichert and Weber 2012), BPM systems are still perceived as being too restrictive, yet very costly. Therefore, we argue that a focus on automation will not help to bridge the gap mentioned earlier. Process models are only useful if they actually help to *improve* processes. For example, verifying the absence of deadlocks in models is a prerequisite for process automation. However, models that are sound but at the same time not used to configure a BPM system do not improve performance. Even if they were used for process automation, they would not necessarily lead to better processes just because they are deadlock-free. A sound process model may still cause unnecessary bottlenecks and rework.

Therefore, we advocate a focus on the process rather than on its model. This does not mean that process models should be abandoned, but rather that they should be created with a clear purpose in mind. For example, while it makes sense to employ a very detailed process model if the purpose is automation, this level of sophistication, which clearly comes at a cost, is not justified if the purpose of the model is to identify redesign opportunities aimed at reducing waste. For this, a high-level process model would be sufficient, so long as it is possible to distinguish value-adding from non-value-adding or redundant activities. In fact, the perspectives of a process model one should focus on, and their level of detail, should be determined by the strategic objective of the BPM project at hand (e.g., increasing operational efficiency rather than outsmarting competitors).

A *better* process is thus one that better contributes to meeting the strategic objectives of an organization. When the level of contribution is not as expected, BPM projects are set up to *improve* business process performance. To measure process improvements we can use various Key Performance Indicators (KPIs). These KPIs, also known as process performance measures, are quantities that can be unambiguously determined for a given business process, assuming that the data to calculate these performance measures is available (Dumas et al. 2013). They are defined over performance dimensions such as time, quality, cost, flexibility, etc. For example, we can measure time using *cycle time*, *waiting time*, or *non-value adding time*; cost using *cost per execution*, *resource utilization*, and *waste*; and quality using *customer satisfaction*, *errors rate*, and *SLA violations*. Some KPIs can be measured quite easily, such as cycle time. Others may be more difficult and time-consuming to quantify, e.g., customer satisfaction may require aggregating data from customer experience surveys, product evaluations, loyalty analyses, etc.

The choice of which KPIs to measure should reflect the strategic objectives of the organization. For example, time- and cost-related KPIs are typically measured when the objective is to increase operational efficiency, while quality may be used when the objective is to increase market penetration. KPIs must be associated with target values, e.g., the cycle time of a claim handling process must not exceed 5 working days from the time the claim is lodged to the time it is approved or rejected. These targets should be determined in line with the strategic plan of an organization.

After identifying the KPIs, the question "how to improve the process in terms of its KPIs?" still needs to be answered, i.e., how to improve the process KPIs in order for these to meet the envisaged targets. Two possible research directions are discussed next.

4 How Can BPM Contribute to Better Processes?

One promising direction to better link BPM to the concrete improvement of process KPIs is to exploit event data present in the organization. For example, Six Sigma (Pyzdek 2003) has applied statistical analysis tools to organizational data for a long time, in order to measure and reduce the degree of business process variability. The idea is to identify and remove the causes for such variability, e.g., in terms of errors, defects or SLA violations in the output of business processes, and to control that such processes effectively perform within the desired performance targets (e.g., ensuring that there are no more than 10 SLAs per month). However, while Six Sigma is focused on improving business processes by statistically quantifying process performance changes, the data used for such analyses is typically collected manually, e.g., through surveys or observation. This makes the employment of such techniques, when carried out properly, very costly and time consuming. Moreover, Six Sigma rarely looks *inside end-to-end* processes. The focus is on a specific step in the process or on aggregate measures.

This problem can be obviated through the use of techniques that automatically extract process knowledge from event data logged by common information systems, e.g., ERP or ticketing systems. In this context, the process mining research area (van der Aalst 2011) has emerged, proposing a range of methods and tools for exploiting such data to automatically discover a process model, or check its compliance with existing reference models or norms, or to determine the causes for process deviations or variants. The advantage of relying on logged data as opposed to data that has been collected manually is that any insight extracted from this data is based on evidence, rather than on human confidence, and thus is a more accurate representation of reality. Moreover, the artifacts extracted through process mining, e.g., process models, can be enhanced with (live) process performance information such as statistics on activity duration and resource utilization. This allows organizations to look *inside end-to-end* processes. For these reasons, process mining methods are now being used across all phases of the BPM lifecycle, from discovery through to monitoring. However, while a wide range of techniques have been developed in this field, the research community has mostly devoted its attention to the quality of the artifacts produced (e.g., the accuracy of the process models extracted from the logs), rather than to improving the actual processes for which such logs are available.

Therefore, a possible research direction is to bridge the current gap between process mining and Six Sigma. For instance, process mining techniques could be used to extract detailed and accurate process performance measurements (e.g., in the form of process models enhanced with performance statistics) on top of which Six Sigma techniques could be applied to pinpoint causes for variability, and to identify and evaluate the impact of different process changes on the process KPIs.

Another avenue to obtain better processes consists in applying techniques from Operations Research to the realm of business processes. Operations Research (OR) is a well-established research area that aims to solve complex decision-making problems by employing a variety of mathematical techniques, such as simulation, queuing theory, optimization, and statistics (Moder and Elmaghraby 1978). Many process improvement problems can in fact be traced back to typical problems investigated by OR, since there are typically a number of constraints and options making it hard to find optimal solutions. In a way, the goal is to optimize a process according to given KPIs (typically time and resources usage). For example, OR techniques can be used to minimize cycle time by determining the optimal execution order of process activities, or to minimize process costs by determining the optimal assignment of process activities to participants. The value of linking Operations Research and BPM was first realized by John Buzacott, who advocated the use of queuing theory to evaluate the conditions under which radical process changes in the context of BPR initiatives are likely to be appropriate (Buzacott 1996). More recently, OR techniques have been applied to resolve resource contention issues in business processes (Mandelbaum and Zeltyn 2013; Senderovich et al. 2014) or to identify an optimal allocation of human resources to process activities in order to minimize risk (Conforti et al. 2015). However, barring these few exceptions, OR techniques have not been systematically applied to solve process improvement problems yet.

5 In This Special Issue

The twenty BPM Use Cases described in (van der Aalst 2013) were an initial attempt to structure the BPM discipline by identifying "how, where and when" BPM techniques can be used. These use cases were also used to categorize all papers published in the BPM conference series.

Following on from the work in (van der Aalst 2013), this special issue aims to further structure the BPM discipline and show some recent developments. Specifically, the BPM Use Cases served as a starting point for the call-for-papers, which attracted papers covering the whole BPM lifecycle. After a careful reviewing process, six papers were selected, which are briefly described below.

- The paper "The State of the Art of Business Process Management Research as Published in the BPM conference: Recommendations for Progressing the Field", by Jan Recker and Jan Mendling, offers a detailed analysis of the contributions of the BPM conference series, focusing on the research methods adopted, the type of contribution, and the impact generated. From this, the authors distill some research directions to consolidate and further develop the BPM discipline.
- Fredrik Milani, Marlon Dumas, Raimundas Matulevicius, Naved Ahmed and Silva Kasela, in their paper "Criteria and Heuristics for Business Process Model Decomposition: Review and Comparative Evaluation", empirically evaluate different types of heuristics for decomposing process models, in view of increasing model understandability and maintainability. Here, the perspective taken is not that of proposing yet another technique for process model decomposition, but rather that of assessing the relative strengths of existing techniques.
- The paper "Mixed-Paradigm Process Modeling with Intertwined State Spaces" by Johannes De Smedt, Jochen De Weerdt, Jan Vanthienen and Geert Poels, contributes a stepwise approach to blend, for the first time, the procedural and declarative paradigms for business process modeling. In doing so, the paper attempts to find a trade off between the strengths and disadvantages of both paradigms, by performing an in-depth study of the scenarios where such a mixed paradigm is useful.
- Martin Berner, Jino Augustine and Alexander Maedche, in "The Impact of Process Visibility on Process Performance: A Multiple Case Study of Operations Control Centers in ITSM", empirically evaluate the benefits of monitoring critical business processes in the context of Operations Control Centers for IT Service Management (ITSM). This multiple case study measures the impact of process visibility (achieved through monitoring) on improving process performance, and determines its mediating factors.
- In their paper "The Use of Process Mining in Business Process Simulation Model Construction: Structuring the Field", Niels Martin, Benoît Depaire and An Caris study how existing process mining techniques can be used to increase the reliability of various aspects of a business process simulation model, through information extracted from event data. This study distils a number of research challenges still to be addressed in order to bridge the gap between these two areas of BPM.
- The paper "A Critical Evaluation and Framework of Business Process Improvement Methods", by Rob Vanwersch, Khurram Shahzad, Irene Vanderfeesten, Kris Vanhaecht, Paul Grefen, Liliane Pintelon, Jan Mendling, Frits van Merode and Hajo Reijers, provides a systematic review of approaches for business process improvement. This review leads to a classification framework aiming to support analysts in determining which approach is most suited for their specific improvement needs.

The special issue concludes with an interview of Michael Rosemann, conducted by Marcello La Rosa, on the role of BPM in modern organizations.

6 Conclusion

In this paper we stressed the importance of BPM research to focus on improving business processes rather than improving the artifacts produced by BPM techniques and tools, such as process models. We did so by reflecting on the contributions of the BPM research community, followed by a short history of the BPM discipline, to highlight, among others, its roots in Office Information and Workflow Management systems. Next, we defined what it means to build better processes in terms of process performance, as captured by KPIs and their target values. Finally, we sketched two possible research directions for bringing BPM research closer to the original BPM goal of process improvement, and concluded with an overview of the papers presented in this special issue.

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