

Catchword: Business Process Management in the Large

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1. Increasing Complexity of Business Processes

In recent years Business Process Management (BPM) attracted considerable attention, both in academia and practice. A growing research community is designing and investigating BPM approaches and techniques which are meanwhile widely-used in private and public organizations. The quantity and quality of literature concerning BPM, the existence of specialized conferences (e.g. the International BPM Conference in the ninth year) as well as dedicated journals (e.g. the Business Process Management Journal) illustrate that BPM has become an established discipline. Despite the growing maturity of the BPM discipline, many approaches have problems dealing with the challenges posed by real-life BPM applications. Corporate reality is often more challenging than assumed by contemporary BPM approaches. This situation is similar to the situation of modeling enterprise data (Scheer und Hars 1992). Common enterprise-wide data

models tend to be complex, difficult to maintain and mostly lack in supporting flexible and decentralized organizational structures. In order to be able to maintain the different subareas of an enterprise-wide data model and to reduce the maintenance complexity, adequate abstraction concepts are needed. The same applies to BPM which also necessitates adequate abstraction concepts to handle real-life complexity. Large organizations have hundreds of different processes in place. Well-established reference process models like Scheer's Reference Model for Industrial Enterprises (Scheer 1994) as well as the SAP reference model are often disconnected from reality; real-life companies' actual business processes are often poorly documented and relationships between different process types are not clearly denoted. While conventional BPM research often seems to concentrate on single processes or scenarios comprising a few isolated processes, the upcoming challenge for BPM is to cope with large sets of interdependent inter-organizational processes in our globalized and interconnected world. This situation mainly originates from the possibilities created by technical innovations enabling ubiquitous computing, like mobile devices, sensor technologies or RFID. However, these possibilities also result in increasing complexity and dynamicity of business processes. Since existing BPM techniques and tools cannot handle this well, current research activities focus on new approaches for *Business Process Management in the Large* (BPM-in-the-Large).

2. Business Process Management in the Large

The above described development is comparable to different other fields of IS research which have developed dedicated approaches for complexity handling mostly relating to the concept of "Programming-in-the-Large" (DeRemer und Kron 1975). Such approaches are e.g. "Software Engineering in the Large" (Chiang 1987), "Megaprogramming" (Wiederhold et al. 1992), "Process Modelling in-the-Large" for Software Development Processes (Bandinelli et al. 1993), "Data Modeling in the Large" (Bertram 1994), "Process Management In-the-Many" (Graw und Gruhn 1995) and "Modeling in the large (MODILA)" for Business Processes (Raduescu et al. 2006). In addition, well known concepts like "Very Large Databases (VLDB)" and "Very Large Business Applications (VLBA)" (Grabski et al. 2007) support very similar ideas of handling increasing complexity in different application areas. Recently, more and more BPM approaches and techniques, started to focus on handling complexity and dynamicity throughout the whole BPM life cycle. Collaborative modeling, configurable process models, and process mining are examples of approaches which can be summarized under the term "BPM-in-the-Large" (Houy et al. 2010b). In comparison with "BPM-in-the-Small" these approaches support a better complexity handling in real-life BPM scenarios, both tapping automation potentials arising from the vast amount of event data generated by the Internet of Things as well as assisting human actors in

designing and coordinating complex real-life business processes. Table 1 summarizes important characteristics and contours of BPM-in-the-Small and BPM-in-the-Large.

| Characteristic | BPM-in-the-Small | BPM-in-the-Large |
|---|---|---|
| 1. Temporal and spatial extent of process definitions | focus on one or few cooperating organizations | focus on comprehensive supply chains and ecosystems containing lots of organizations |
| 2. Structuring of processes | often a priori fixed process structure | more flexible process structures which have to be adapted to changing situations |
| 3. Number of different process types | often a priori fixed number of defined core and support processes | increasing number of processes through configurable process models and large process portfolios |
| 4. Dependency between processes | often few dependencies | many dependencies |
| 5. Number of process stakeholders | low number of stakeholders in single processes | high number of stakeholders in inter-organizational processes |
| 6. Dynamics of process change | often stable and seldom changed process structures | often adapted and flexibly configured process structures |
| 7. Heterogeneity of applied modeling notations | low heterogeneity | high heterogeneity |
| 8. Number of different coordinating institutions of cooperative processes | low | high |
| 9. Dominant planning direction | often central organization, top-down | decentralized organization, bottom-up |
| 10. Architecture for BPM systems | often monolithic | loosely coupled BPM services |

Table 1: Characteristics of BPM-in-the-Small and BPM-in-the-Large, inspired by (Vanderhaeghen et al. 2010)

Topics related to BPM-in-the-Large are gaining importance. This is illustrated by dedicated workshops such as the “Process in the Large” workshop at the 8th BPM Conference in 2010. Against the background of the practical and scientific relevance, there exist many application areas and numerous research endeavors related to designing and investigating techniques for BPM-in-the-Large.

3. Application Areas and Current Techniques Supporting BPM-in-the-Large

Relevant application areas and currently investigated techniques for BPM-in-the-Large can be systemized based on the BPM life cycle, as approaches for each of its phases are investigated. In the following, a selection of relevant ideas and research interests contributing to BPM-in-the-Large are described and positioned in the BPM life cycle (figure 1). The following ideas can partly also contribute to BPM-in-the-Small or pick up ideas from the context of other current BPM trends; e.g. BPM 2.0 which applies social software concepts for BPM (Kurz 2011). However, they address the aforementioned characteristic requirements concerning large and complex process scenarios in the first place.

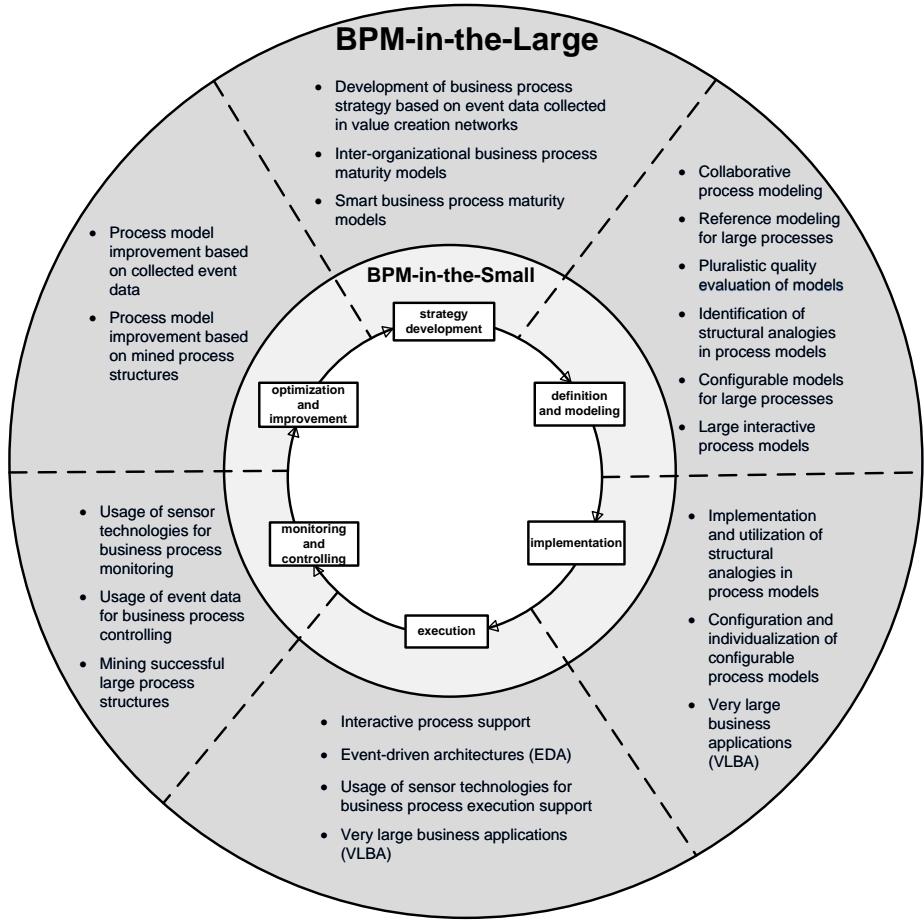


Figure 1 Current related work on BPM-in-the-Large systemized by the BPM life cycle, based on Houy et al. (2010a)

In the process *strategy development* phase of the BPM life cycle, business strategy and strategic partnerships identify inter-organizational core business processes and inform the modeling phase for the development of large scale process models. Such models offer the possibility to improve the steering of large inter-organizational value creation networks. Typically, information quality for strategy development gets better during the process of continuous process improvement. Based on event data gathered during the process life cycle with sensors (Houy et al. 2010c) and process mining approaches (van der Aalst et al. 2007), crucial organizational structures can be identified and strategic decisions be based on real historic data (“evidence-based BPM”). Furthermore, business process maturity models (BPMMs) support the strategic improvement of process organization and can take cross-organizational process management into account (van Looy 2010). Moreover, smart solutions for automated business process maturity assessment are currently developed which can serve for adapting maturity levels in strategic alliances between different organizations.

Many research initiatives contributing to BPM-in-the-Large concentrate on the process *definition and modeling* phase as process models provide the basis for the whole BPM life cycle. In inter-organizational scenarios, approaches for collaborative process modeling play an important role as they can support a collective understanding of inter-organizational business processes (Rittgen

2009; Dollmann et al. 2011). Reference modeling is also of importance in BPM-in-the-Large. Reference models aim at describing best practice process structures (Fettke und Loos 2004) and can also be formulated for and significantly affect large process scenarios. Especially in large scenarios different dimensions of process quality have an important impact on process performance and organizational success (Krogstie et al. 2006). In order to be able to assess the different quality types, models have to be evaluated from different perspectives. Thus, capable methods and measurement concepts of pluralistic model quality evaluation are currently investigated, e.g. in the research project “PluralistiQue” conducted at the IWI at the DFKI funded by the German Research Foundation (DFG). Another interesting approach supporting effective design and implementation of processes is concerned with the identification of structural analogies in process models expressing similarity of model constructs which can be useful for the reduction of complexity by providing “common parts” of business process models (Houy et al. 2010b).

Besides the implementation of identified structural analogies, concepts like configurable models (www.processconfiguration.com) (Gottschalk et al. 2008) as well as interactive process models (Jørgensen und Krogstie 2008) are of special importance during the *implementation* and *execution* phase. Both concepts support flexible process implementation and execution and thus a more agile BPM. High agility and fast reactions on changing situations are important for process performance. In this context event-driven architectures (EDA) based on sensors collecting event data play an important role as they can facilitate interactive process support. Especially in large process scenarios lots of event data are collected and can be used to improve process performance and the agility of reactions on changing business situations (Houy et al. 2010c). Research on Very Large Business Applications (VLBA) is concerned with an effective and efficient implementation and execution of a large number of interdependent processes in internal and inter-organizational contexts (Grabski et al. 2007).

Event data collected during process execution in large EDA also serves for process *monitoring* and *controlling*. Detailed monitoring information principally supports the following process improvement phase. Based on long-term monitoring data, those process instances can be identified which have been most successful based on process mining methods (van der Aalst 2011) which can, furthermore, support reference modeling in particular areas. Moreover, valuable information on anomalies or critical points in inter-organizational process definitions can be put together and serve for the following *optimization and improvement* phase as well as for strategic decisions.

Besides the topics concerning the phases of the life cycle, there are *superordinated concepts* which are relevant for different phases. Process mining approaches and tools such as ProM

(www.processmining.org) can support process modeling and improvement, the monitoring of executed process instances as well as the development of new process strategies based on information extracted from log files (van der Aalst et al. 2007). Furthermore, the idea of large process repositories for the management and coordination of many different types of process models is of great relevance for following life cycle phases, especially for similarity search (Kunze und Weske 2010) and process model analysis (Niemann et al. 2010). Large repositories containing reference models offer interesting possibilities for best practice analysis and benchmarking initiatives. Regarding large process repository management, some innovative approaches and tools exist, e.g. APROMORE (<http://code.google.com/p/apromore>) which offers advanced possibilities of large repository management for process models based on different modeling languages (La Rosa et al. 2011). Another interesting concept concerning BPM-in-the-Large is the idea of BPM-as-a-Service as an innovative architecture approach for BPM systems (BPMS) which aims at providing flexibly composable BPM services, e.g. services for the transformation of models into different languages, for model evaluation, process mining or process related telecommunication services organized in service-oriented architectures (SOA) (Houy et al. 2010c). BPM-as-a-Service offers the potential to run highly scalable BPMS in practice and is thus a promising architecture approach for future BPM initiatives.

4. Significance for Business and Information Systems Engineering (BISE)

Both BPM research and applications of BPM technology are characterized by a design-orientation and focus on the interplay between organizations and information systems. This fits well with the general scope and focus of BISE. Furthermore, BPM methods, techniques and tools are meanwhile widely-used and crucial for the success of many organizations. The practical relevance of these methods, techniques and tools as well as the presented current challenges concerning the increasing complexity of real-life BPM makes BPM-in-the-Large a highly significant topic for future BISE research. Design-oriented research initiatives should address these current challenges and develop relevant approaches for handling complexity in BPM practice.

5. Conclusion

In this article, we have given pointers to current topics and research initiatives concerning BPM-in-the-Large as an umbrella term for the description of approaches for complexity handling in real-life BPM scenarios. In this context, BPM-in-the-Large should not be understood as a new method or tool but as a research stream focusing on relevant challenges of current BPM practice. Promising approaches that assist in making BPM-in-the-Large a reality are currently developed and investigated by the BISE community.

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