Communications of the Association for Information Systems

Volume 28 Article 25

5-2011

Current and Future Issues in BPM Research: A European Perspective from the ERCIS Meeting 2010

Jan vom Brocke
University of Liechtenstein, jan.vom.brocke@uni.li

Jörg Becker
University of Muenster, Germany

Alessio Maria Braccini
LUISS University, Rome, Italy

Rimantas Butleris
Kaunas University of Technology, Lithuania

Birgit Hofreiter
University of Liechtenstein

See next page for additional authors

Current and Future Issues in BPM Research: A European Perspective from the ERCIS Meeting 2010

Authors
Jan vom Brocke, Jörg Becker, Alessio Maria Braccini, Rimantas Butleris, Birgit Hofreiter, Kęstutis Kapočius, Marco De Marco, Günter Schmidt, Stefan Seidel, Alexander Simons, Tomáš Skopal, Armin Stein, Stefan Stieglitz, Reima Suomi, Gottfried Vossen, Robert Winter, and Stanislaw Wrycza

Communications of the Association for Information Systems

CAIS

Current and Future Issues in BPM Research: A European Perspective from the ERCIS Meeting 2010

Jan vom Brocke
University of Liechtenstein, jan.vom.brocke@uni.li

Jörg Becker
University of Muenster, Germany

Alessio Maria Braccini
LUISS University, Rome, Italy

Rimantas Butleris
Kaunas University of Technology, Lithuania

Birgit Hofreiter
University of Liechtenstein

Kęstutis Kapočius
Kaunas University of Technology, Lithuania

Marco De Marco
Catholic University of Milan, Italy

Günter Schmidt
Saarland University, Germany

Stefan Seidel
University of Liechtenstein

Alexander Simons
University of Liechtenstein

Tomáš Skopal
University of Prague, Czech Republic

Armin Stein
University of Muenster, Germany

Stefan Stieglitz
University of Muenster, Germany

Reima Suomi
University of Turku, Finland

Gottfried Vossen
University of Muenster, Germany

Robert Winter
University of St.Gallen, Switzerland

Stanislaw Wrycza
University of Gdansk, Poland

Abstract:

Business process management (BPM) is a still-emerging field in the academic discipline of Information Systems (IS). This article reflects on a workshop on current and future issues in BPM research that was conducted by seventeen IS researchers from eight European countries as part of the 2010 annual meeting of the European Research Center for Information Systems (ERCIS). The results of this workshop suggest that BPM research can meaningfully contribute to investigating a broad variety of phenomena that are of interest to IS scholars, ranging from rather technical (e.g., the implementation of software architectures) to managerial (e.g., the impact of organizational culture on process performance). It further becomes noticeable that BPM researchers can make use of several research strategies, including qualitative, quantitative, and design-oriented approaches. The article offers the participants' outlook on the future of BPM research and combines their opinions with research results from the academic literature on BPM, with the goal of contributing to establishing BPM as a distinct field of research in the IS discipline.

Keywords: business process management, research agenda, European Research Center for Information Systems

Volume 28, Article 25, pp. 393-414, May 2011

Communications of the Association for Information Systems

I. INTRODUCTION

The relevance of business process management (BPM) is widely recognized in both industry and academia. The Gartner Group [2010], for example, identified the improvement of business processes as a top issue on the agenda of CIOs for the sixth year in a row. At the same time, BPM has emerged as an important subfield of IS research [Rosemann et al., 2006; Rosemann and vom Brocke, 2010; Seethamraju, 2010]. IS research has been framed as the study of "(1) how IT artifacts are conceived, constructed, and implemented, (2) how IT artifacts are used, supported, and evolved, and (3) how IT artifacts impact (and are impacted by) the contexts in which they are embedded" [Benbasat and Zmud, 2003, p. 186]. Over recent years it has become apparent that business processes are executed in a socio-technical context that cannot be separated from the involved information technology (IT). As such, we believe that the study of business processes is at the core of IS research as long as it pertains to the immediate nomological net of the IT artifact, which has been framed to include IT capabilities, the IT artifact, and its usage and impact, as well as IT managerial, methodological, and operational practices [Benbasat and Zmud, 2003]. Accordingly, IS researchers have been targeting a broad variety of BPM-related topics, ranging from the conceptual design of business processes [Recker et al., 2006] to business process automation [van der Aalst and ter Hofstede, 2005] and management-oriented issues such as governance [Indulska et al., 2006] or culture [Zairi, 1997; vom Brocke and Sinnl, 2010].

Not only, however, does BPM research cover a broad range of topics, it also applies a multitude of different research methods. While much work is conceptual in nature [e.g., Rosemann and van der Aalst, 2007], there are also examples of empirical work, including case studies [Bandara et al., 2005], focus groups [Raduescu et al., 2006], semi-structured interviews [Recker et al., 2006], and Delphi studies [de Bruin and Rosemann, 2007]. BPM research, however, is not only characterized by an abundance of conceptual work—it also features little theory development [Rosemann et al., 2006; Seidel and Recker, 2009].

Against this background, a workshop on current and future issues in BPM research was conducted at the annual ERCIS meeting held in Vaduz (Liechtenstein) in March 2010. Seventeen IS researchers from eight different countries discussed contemporary BPM issues and the challenges they deemed most relevant for the IS domain. This article summarizes their experiences and opinions and combines them with the academic literature on BPM. Each workshop participant contributed to this article by detailing his or her thoughts and ideas regarding one out of ten seminal BPM research areas, which were identified and discussed during the workshop.

The remainder of the article is structured as follows. Section II provides an overview of BPM as an emergent and, until today, predominantly conceptual and design-oriented domain of IS research and summarizes works related to the topic. This is followed by a description of the ten BPM research areas that were identified during the workshop, including potential research problems and questions to be explored by fellow IS researchers and suitable research methods they may apply. Section IV then discusses these findings in the light of existing research in the IS domain. Section V concludes the article and acknowledges limitations.

II. BACKGROUND

Notions such as *BPM* and *business process* are open to many interpretations. To make the following explanations as clear as possible, some terms shall thus be introduced first. BPM as a holistic management approach has its roots in practices such as Kaizen [Masaaki, 1986], Business Process Reengineering [Davenport and Stoddard, 1994; Hammer, 1996; Hammer and Champy, 1993], Total Quality Management [Powell, 1995], and Process Innovation [Davenport, 1993]. The Australian Community of Practice [2004] defines BPM as "a structured, coherent and consistent way of understanding, documenting, modeling, analyzing, simulating, executing and continuously changing end-to-end business processes and all involved resources in light of their contribution to business success." A business process represents a series of tasks or activities that need to be carried out in order to collectively realize an organizational objective or policy goal, and a set of conditions that determine the order of the tasks [Becker and Kahn, 2010; Hammer, 1990; van der Aalst and van Hee, 2002]. The relevance of BPM-related issues has been reinforced by a number of high-impact studies. In a 2010 global study, for example, the Gartner Group [2010] identified the improvement of business processes as a top issue on the agenda of CIOs for the sixth year in a row. Consequently, BPM has been addressed by IS researchers from various perspectives, including, but not limited to, process modeling [Rosemann and van der Aalst, 2007], process design [Janson and Wrycza, 1996], process automation [van der Aalst and ter Hofstede, 2005], and process optimization [Reijers and Mansar, 2005].

Work in such areas, however, has been predominantly conceptual, focusing on the design of specific BPM artifacts. This can be illustrated with the example of process modeling, where a variety of grammars, tools, and methods have been developed and evaluated during the past years.

For example, in her review in the field of business process modeling, Aguilar-Savén [2004] describes several modeling grammars (e.g., flow charts, role activity diagrams [RAD], role interaction diagrams [RID], Gantt charts, or Petri nets). Abeysinghe and Phalp [1997] study two exemplar modeling grammars (Hoare's Communicating Sequential Processes [CSP] and a subset of RAD) and illustrate how they can be combined into a new approach to process modeling. Damij [2007] uses comparative analysis to analyze two groups of modeling grammars, namely diagrammatic and tabular techniques, and van der Aalst [1999] maps event-driven process chains (EPC) onto Petri nets, thus providing formal semantics to the EPC grammar. Existing research on process modeling tools and methods draws a similarly colorful picture: Georgakopoulos et al. [1995], for instance, provide an overview of several workflow management methodologies and software products. Picking up on the large number of available process modeling methods and tools, Luo and Tung [1999] propose a framework for selecting adequate methods on the basis of modeling objectives. Giaglis [2001] presents an approach for evaluating process modeling grammars based on the work by Curtis [1992], and Mentzas et al. [2001] study the pros and cons of adopting alternative techniques for workflow representation in process modeling.

In conclusion, it appears as if much of the past IS research on process modeling is rather advocative in nature [Moody, 2005]; many works "propose new artifacts, make claims on benefits and performance, and advocate adoption in practice based on an illustrative example" [Recker, 2008, p. 44]. Consequently, some IS authors in the field have already lamented the relatively small number of empirical and theoretical studies on process modeling [Eikebrokk et al., 2008; Indulska et al., 2009; Sedera et al., 2004].

The example of process modeling representatively demonstrates that the emergent area of BPM is characterized by an abundance of conceptual work. While it has been argued that there is a general lack of foundational theory in BPM research [de Bruin, 2007; Seidel and Recker, 2009], some empirical studies have been conducted nevertheless. For example, Rosemann et al. [2006] develop a theory of BPM progression in organizations, Recker [2008] builds and tests a model of process modeling standard adoption, and Bandara et al. [2005] propose a theoretical model of critical success factors in process modeling. Consequently, there is a certain diversity in BPM research regarding research approaches. Recent studies in the field, however, also suggest that BPM research further exhibits and demands topic-related diversity. It has been argued, for example, that BPM maturity requires development in a number of different capability areas, including strategic alignment, governance, methods, IT, people, and culture [de Bruin and Rosemann, 2007].

As it is the case for the IS discipline as a whole [Benbasat and Weber, 1996], BPM can thus be considered a multifaceted field of research regarding both research topics and methods. While existent BPM models [e.g., Rosemann and vom Brocke, 2010] can set the frame for IS researchers, they do not offer many insights into the actual problems and questions that BPM research should be focusing on, let alone any prioritization of research methods. The majority of related works in the field of BPM discuss the importance of themes regarding specific BPM-related areas. Indulska et al. [2009], for example, investigate current issues and future challenges in the area of business process modeling (as perceived by academics, practitioners, and tool vendors). In our literature analysis, we found only the works by Bandara et al. [2007] and Indulska et al. [2006] that aim at identifying a broader research agenda for BPM. Indulska et al. [2006] conducted a series of focus groups with Australian organizations and separate major issues in BPM, as perceived by the participants, into strategic, tactical, and operational level issues. Examples include change management, lack of governance (strategic level), lack of expertise, lack of coordination (tactical level), or lack of tools for holistic BPM and lack of technology capability (operational level). Bandara et al. [2007] conducted a series of fourteen expert interviews and likewise identified issues at the three levels. Examples include lack of governance, lack of employee buy-in (strategic level), lack of standards, weaknesses in process specification (tactical level), or lack of tool support for process visualization, and perceived gaps between process design and process execution (operational level). As BPM can be regarded an applied discipline, the practitioners' viewpoints and opinions presented in these articles are certainly of high importance. Yet, we also deem it relevant to learn about the current and future areas of inquiry that IS researchers are interested in. We believe that such knowledge becomes crucial when it comes to setting up a future research agenda for the area of BPM. With the present article, we aim to contribute to this discussion by providing a European researchers' perspective onto relevant topics in the area of BPM for future inquiry.

III. IDENTIFYING ISSUES FOR FUTURE BPM RESEARCH

The Workshop Setting

We conducted a workshop with seventeen IS researchers from eight European countries, namely Czech Republic, Finland, Germany, Italy, Liechtenstein, Lithuania, Poland, and Switzerland. The participating scholars, all of whom are authors of this article, have diverse IS-related backgrounds, ranging from technical to managerial. As a consequence, not only do their research interests vary, but also the methods they apply. At the outset of the workshop, each participant presented three BPM research issues that he or she deemed most relevant for the IS domain, which were then grouped into a set of ten rather broad themes in an open discussion. These themes were then further discussed and detailed. In the following sections, for each topic that was identified, we discuss its relevance for the IS discipline, related research problems and questions, and research methods that can be used for their study.

Reuse in Business Process Modeling

Conceptual process models are a means to capture, document, and analyze business processes, and they are, for example, used in business process (re)engineering or business change projects [Fettke and Loos, 2007; Rosemann and van der Aalst, 2007; vom Brocke et al., 2010]. While process models can improve the quality of IS implementations [Scheer and Nüttgens, 2000], their design is complex, error-prone, and time-consuming [e.g. Becker et al., 2009]. In contrast to ad-hoc models that are typically used in specific application contexts, reference process models (hereafter reference models) are developed with the intention to provide common or best practice processes for a certain domain. The users of reference models are provided with both a generic view on this domain and a common vocabulary. The practical relevance of the topic finds its expression in a large number of reference models that are used in day-to-day business. Examples include supply chain management [SCC, 2009], retail [Becker and Schütte, 2007], and production processes [Scheer, 1994]. At the same time, a large number of academic publications on reference modeling can be found in the European IS literature.

Reference models typically serve as blueprints for a number of organizations and they are thus designed at relatively high levels of abstraction. At the same time, however, the models must allow organizations to easily adapt them to individual requirements [Fettke and Loos, 2004; Scheer, 1994]. This adaptation requires the use of techniques that adequately support the design of reusable reference models [vom Brocke, 2006]. While some reference models address very similar topics and requirements, they frequently differ with regard to coverage, level of detail, or applied modeling language [Fettke and Loos, 2003]. Common failures related to the development of reusable reference models are (a) nonrigorous design processes, (b1) the disregard of formal modeling languages, and (b2) the use of overly complex modeling languages. Future research on the development and adoption of reference models should accordingly focus on (a) the design and evaluation of guidelines for the rigorous development of reference models that are still relevant to practitioners, and (b) the development of modeling languages that not only allow for adequate representations of real world scenarios at different levels of abstraction, but also provide the means for efficiently adapting the reference models to individual, company-specific requirements. An example is building block-based modeling, where model elements can provide process semantics or even represent entire sets of process patterns. It is our belief that such research can lead to the development of reference models that are more comparable, linkable, and hence reusable.

Research on reference modeling typically follows the design science paradigm [Hevner et al., 2004]. A reference model can be considered an IT artifact just like the applied modeling language or method and the constituting model elements [March and Smith, 1995]. Design science research is an iterative process that builds on, and extends, the existing knowledge base for constructing and evaluating artifacts that are both innovative and purposeful [Hevner et al., 2004]. Regarding the evaluation of reference models, researchers can make use of a variety of qualitative strategies and methods, including interviews, case studies, or action research. At the same time, the design of reference models should be informed by existent theory in order to ensure the development of reference models that have not only been rigorously designed but also address contemporary business needs.

Value-Orientation in BPM

While BPM essentially seeks to generate value for customers [Hammer, 2010], surprisingly little research has been conducted on value creation through BPM (i.e., on the concept of BPM value). Much of the related research revolves around the field of process analytics, including research on process simulation [Gregoriades and Sutcliffe, 2008], process mining [van der Aalst, 2005], or the Balanced Scorecard [Kaplan and Norton, 1991]. While these and related approaches tend to focus on evaluating the performance of processes at run-time, few insights have been gained on evaluating alternative process designs at build-time. The design of a business process, however, typically requires several important decisions, for example, regarding its control flow or the involved technologies and organizational resources. These decisions significantly impact the potential value contribution of a process [vom Brocke et al., 2010].

One major challenge for future research accordingly is to better understand the economic consequences of decisions made during the design of a process. While one of the most important questions is "What is the Return on Investment of process change?" this challenge obviously exceeds financial considerations. The stakeholder theory [Rappaport, 1986], for example, suggests that BPM value can be analyzed from very different perspectives, and, according to recent work in the field of sustainability-aware BPM, ecological and social responsibilities constitute additional value dimensions of BPM [Seidel et al., 2010b]. Another emerging stream of research on networked processes [Grefen et al., 2009] illustrates the challenges that are associated with assessing BPM value. Networks turn out to be crucial organizational forms in the globalized market, and in this context, process innovations not only influence the value a particular organization creates, but also the global value of the network(s) the organization is embedded in. It is our belief that research should thus be grounded in a better understanding of BPM value and related concepts in order to further theorize about how BPM creates value in different contexts.

As opposed to prior research on IS value assessment that mainly evolved around the so called "productivity paradox" [Brynjolfsson, 1993], a rather decision-oriented approach to the above challenge appears promising. The idea, then, is not to answer the question whether value may be created [Carr, 2004], but rather to inform decision makers how to assess the value of a process design in a specific organizational context [vom Brocke et al., 2009]. Hence, lessons learned from method engineering [Brinkkemper, 1996] are of high interest to fellow researchers. A wide set of theories from organization and decision science can well inform the design process. At the same time, little empirical research has been conducted on the adoption of these methods in practice. Hence, an iterative approach to design and evaluation appears promising [Markus et al., 2002]. It will be interesting to see how such methods can influence the decision practices of business process experts. This, in turn, may then provide the ground for further empirical research.

Collaboration in BPM

Since distributed work and virtual teams are getting more and more important, most business processes involve several collaborating individuals [Ho et al., 2009]. The fluctuation of employees is also accelerating, which requires the generation of BPM theories and instruments that consider the increasing complexity of collaborative work. In addition, collaborative tools in the domain of Internet social networking [Richter et al., 2009; Richter et al, 2010], such as wikis, social networking sites, or blogs, can be used to support the design, execution, and management of business processes.

There are at least two major related problems: model-reality divide and lost innovation [Erol et al., 2010]. The notion of model-reality divide refers to differences between process modeling and execution. Even if business processes are adequately designed, there is a tendency that, over time, the modeled processes and the real processes fall apart. The notion of lost innovation considers the high transaction costs that are associated with the transfer of improvement ideas between different process stakeholders (e.g., users, managers, and IT professionals). Employees often cease to communicate innovations, because it either takes them too much time and effort, they do not know whether their ideas will finally be realized, or they are unsure about the associated reward [Stieglitz, 2008]. Social software can help tackle both problems [Koschmider et al., 2008]. For example, research in the field has shown that a managed usage of social software tools can lead to increased efficiency in knowledge transfer [Jeppesen and Frederiksen, 2006]. Such findings also suggest the usage of social software in BPM. The following proposition can be put forward: The use of social software in BPM lowers the threshold when information is passed, because it allows employees to continuously inform themselves about process updates. The transactions costs that are associated with the transmitting of innovations may further be lowered significantly [compare Erol et al., 2010].

We believe that future research in this area must extend existing frameworks of BPM. Except for a few examples, collaborative work seems to be insufficiently represented in both current BPM research and practice [Niehaves and Plattfaut, 2011]. First, the application of design science research seems promising in order to fill this gap and learn more about the way business processes can be designed collaboratively. The analysis of best practices may well inform the iterative search process underlying any design science study [Hevner et al., 2004]. Some software products have already integrated social software applications into their BPM suites (e.g., ARISalign) and may thus constitute a good starting point for related research. At the individual level in particular, there are a number of more specific issues that fellow IS researchers should consider. Employees are, for instance, typically not modeling experts. Empirical studies, both of qualitative and quantitative nature, can help to better understand the enablers and barriers of collaborative process modeling from both an employee's and decision maker's perspective. Besides, methods are required that allow for the measurement of the costs and benefits associated with collaborative business process modeling [e.g., Lattemann et al., 2010].

Software Architectures

The last decade has seen a wide-reaching success of process-oriented approaches toward managing enterprises and their IT landscapes. What started with Hammer and Champy's [1993] seminal reengineering book has turned into an approach that today is common to all areas of IT and its development [Vossen, 2006a]. In particular, this applies to software architectures, software development and deployment, and enterprise application integration. A promising paradigm in this area has been service orientation along with service-oriented architectures (SOAs). SOAs are based on the idea of organizing IT functionality as a collection of services that can easily be specified and composed via common standards and well-defined interfaces [Leymann, 2003]. SOAs typically provide answers to the questions of which services are currently available (e.g., within an enterprise), which ones need to be newly implemented, and which ones need to be obtained from a suitable (external) provider. With the help of process models, organizations can clarify and formalize what goals and procedures a client wants to see supported by services (or a collection of clients within the enterprise). This provides the basis for identifying parts of the overall "process map" that can be grouped and supported by the same (set of) service(s), which may result in an SOA that fixes the composition and integration details at a conceptual level and thus exceeds service and departmental borders. In essence, this is similar to what has led to domain-specific reference models, which typically capture the core processes of an entire branch and which can be customized to fit the specifics of a particular enterprise [Vossen, 2006b].

To date, the concept of SOA has not been very successful, with one reason being the overwhelming amount of "standards" around [compare, e.g., Hagemann et al., 2007; Leymann et al., 2010]. Other reasons are to be seen in the amount of reorganization involved in replacing a traditional, more or less monolithic software architecture by a service-oriented one and the significant changes that need to be made in the way people think [e.g., Moore, 2006; Sebor, 2008]. The implementation of an SOA requires appropriate consideration of the underlying business processes as well as agreement among, and support of, all involved parties. From all that has been learned about business process modeling and reengineering, as well as about workflow management and process automation, it has become clear over the last fifteen years of IS research that process views are important and relevant and that a process view of an enterprise is an appropriate way of capturing what the enterprise is or should be doing. Besides, it is also clear that an SOA will hardly ever be introduced into a business environment where no IT exists at all. In other words, it makes perfect sense to assume the presence and availability of a number of operational systems that will prevail and that will still be around after the SOA has been introduced. Generally accepted methodologies for either view are missing and thus mark directions for future BPM research to facilitate software reuse, proper documentation, and maintainability, just to name a few.

Fellow IS researchers should, in the first instance, study SOA success stories, which are very rare today. To this end, we recommend an approach described by Schönthaler et al. [2011], whose foundation is deep experience in practical BPM projects. Generally, such studies would have to determine the impact that BPM can have on SOA development and would most likely reveal that SOA development without an appropriate approach to BPM is infeasible. Another current line of research has been investigating Web-oriented architectures (WOAs), trying to adopt the service idea to the Web. According to Thies and Vossen [2008], a WOA is situated between service-oriented and resource-oriented architectures and uses technological standards of both sides wherever applicable. Due to their simplicity, WOAs have the potential of finally making the SOA concept successful, and this has not yet been investigated to its full extent; what remains to be seen is their interaction with BPM.

Enterprise Content Management

The management of enterprise content refers to "the strategies, tools, processes and skills an organization needs to manage all its information assets (regardless of type) over their lifecycle" [Smith and McKeen, 2003, p. 648]. ECM can be considered an integrated approach to information management [Päivärinta and Munkvold, 2005] that covers and aligns several related concepts, which, for quite some time already, are the core of IS research; among them are document management [Sprague, 1995], content management [Gupta et al., 2002], Web content management [Vidgen et al., 2001], and records management [Sprehe, 2005]. Given the ever-increasing digital information flood that is challenging industry at present, it is not surprising that ECM has evolved into a relevant topic for the IS domain [Tyrväinen et al., 2006]. IS researchers can study the concept from a variety of perspectives, including technologies, people, and processes [Tyrväinen et al., 2006]. The study of ECM-related business processes marks a particularly relevant research topic [vom Brocke et al., 2011]: It has already been noted that the boundaries between BPM and ECM are becoming increasingly blurred in practice [Chambers, 2007]; ECM systems make extensive use of work flow components and BPM solutions, in turn, often build upon similar components as ECM systems [Allen, 2007].

The relevance of ECM in BPM research is due to the fact that an ECM implementation can significantly affect the execution of business processes [Salminen et al., 2006; as cited in Tyrväinen et al., 2006], since employees are

required to get used to new ways of creating, storing, and publishing content [Pullman and Gu, 2008]. However, the relationships between the concepts of ECM and BPM have rarely been investigated empirically. In particular, the actual impacts of ECM implementation on business process efficiency have not been studied in sufficient depth. At the same time, there is a lack of knowledge on how to redesign affected business processes when implementing ECM [vom Brocke et al., 2011]. Relevant research questions thus include, but are not limited to: What is the role of business processes in ECM implementation? How does the implementation of ECM impact business process performance? To what extent does the implementation of ECM require the redesign of business processes?

Due to the absence of a well-established theory on the role of business processes in ECM, such questions may require the researcher to make use of inductive research strategies, in particular, qualitative case-study research. Design-oriented research would, in contrast, focus on the development of ECM systems, technologies, and standards. Such research should be complemented with studies that evaluate the performance of ECM artifacts and, through this evaluation, further contribute to the development of theory. Provided a theoretically sound approach to the role of business processes in ECM can be developed, quantitative, theory-testing research could also come into the focus of IS researchers.

Operations Management

BPM is also closely related to operations management (OM). Differences between the two disciplines stem mainly from the granularity of their basic models. While OM traditionally looks into processes in great detail, aiming at the development of models for optimizing operations given a certain set of premises, BPM typically considers processes in the large, following a socio-technical and often also interpretive perspective. While the focus of BPM is on the design of business process types using aggregated data, OM focuses on business process instances using very detailed problem data. The relationship between the two concepts of process type and process instance [compare Schmidt and Braun, 2005] can be illustrated in analogy to data models and databases. While BPM would design and analyze entity relationship models, OM would focus on the level of tables and database operations. Obviously, there are many overlaps between the two disciplines and the two are complementary. While BPM research typically investigates process-related phenomena from a broad variety of perspectives, leveraging both qualitative and quantitative methods, OR is rather quantitative in nature and focuses on mathematical optimizations under given constraints.

OM is, for example, closely related to business process modeling, an important subfield of BPM. Because conceptual business process models restrict the solution possibilities of OM models, both are typically designed interdependently. Alternatively, however, the problems of BPM and OM can be formalized in only one single model. Fellow IS researchers should thus investigate which of the two alternatives is preferable based on both solution quality and computational effort in order to identify “best possible” solutions. It is very likely that this will require research at the interface between both concepts: To what extent do typical BPM problems and solutions set a frame for model-based analysis in OM? How can, likewise, BPM decisions be informed by the results from analytical calculations in OM?

To find answers to the above issues, heuristic methods, coupled with simulation and mathematical programming, can be applied. The idea, then, is to give a mathematical programming formulation for the single model approach and try to solve it to optimality. The solution is then compared to the two-model approach that aims at solving BPM and OM questions interdependently. Both results are finally compared on the basis of their solution time and quality.

Standards for BPM

The growing number of BPM methods has led to increasing standardization efforts. The most important contributions were made by OMG (Object Management Group), BPMI (Business Process Management Initiative), INCOSE (International Council on Systems Engineering), OASIS (Organization for Advancement of Structured Information Standards), and WfMC (Workflow Management Coalition). Among the most established BPM standards of today are the Business Process Modeling Notation [BPMN, 2010], the Unified Modeling Language [UML, 2009], the Systems Modeling Language [SysML, 2008], and the Service oriented architecture Modeling Language [SoaML, 2009]. The development of standards for managing business processes, however, is not a completely new idea. Electronic data interchange (EDI) [Schatz, 1988], for example, very early aimed at facilitating data exchange between the information systems of collaborating business partners.

The exchange of data, however, is only one part of the solution. Inter-organizational systems further require the participating partners to harmonize their business processes. More recently, we see efforts describing the orchestration and/or choreography of business processes [Barros et al., 2006; Peltz, 2003]. Orchestration deals with the sequence and conditions in which a business process calls its components in order to achieve a business goal.

Choreography describes business processes in a peer-to-peer collaboration, that is, the flow of interaction between collaborating partners that interlink their processes.

Inter-organizational business processes need to be described from different perspectives in order to realize business partnerships. Evidently, the different perspectives of a global choreography, a local choreography, and an orchestration of one and the same business process are highly dependent on each other [Bussler, 2002; van der Aalst and Weske, 2001]. Changes to the global choreography must be propagated downwards in a top-down approach. Similarly, changes to an orchestration must be propagated upwards in a bottom-up approach. Thus, the consistent alignment of global and local choreographies as well as orchestrations [e.g., Wombacher, 2009] is an important research challenge. Because inter-organizational business processes have to be described in platform-independent conceptual models by means of a graphical syntax, conceptual modeling languages are needed that not only consider the different perspectives [e.g., Hofreiter, 2009; Hofreiter et al., 2006] but also guarantee consistency among them. While many of today's modeling languages, for example, NIAM (Natural language Information Analysis Method), ERD (Entity Relationship Diagram), MDA (Model Driven Architecture), or UML, mainly focus on only one of these perspectives, hardly any language can adequately express their interdependencies. It will be interesting to see how fellow IS researchers can explain the reasons for the relatively low acceptance of these standards, which should lead to both their improvement and/or gradual replacement.

Research toward BPM standards and inter-organizational business processes should combine constructive, formal, and empirical elements. A particularly promising approach to studying inter-organizational processes is design science research. Examples for IT artifacts that can be developed in such endeavors include constructs, models, and methods that allow for describing the different perspectives on inter-organizational systems, their interdependencies, their change management, and their accessibility in registries. Feasibility should be shown by means of prototype implementations, and we further suggest that IS researchers empirically study the process of standardization. Related research questions particularly concern the enablers and barriers to standardization processes, for example, leveraging case-study research [Eisenhardt, 1989].

Vertical Integration

From a systemic perspective, BPM phenomena have to be studied, and innovative artifacts have to be designed, "business-to-IT," that is, on a strategic layer (what to do), an organizational layer (how to do it), and an IT implementation layer (how to support/automate it) [Bucher and Winter, 2009]. Although every layer has its own goals, the overall analysis/design needs to be consistent and to follow generalized principles. Recent research in this field concentrates on enterprise architectures (EA) [The Open Group, 2009] and model-driven software development (MDSD) [Bézivin, 2005; Kent, 2002] in particular, suggesting that business or enterprise models have to be developed first and later transformed into platform-independent IS software models, platform-specific models, and executable code. The most notable initiative is the MDA by OMG [Miller and Mukerji, 2003], which allows for long-term flexibility of implementation, as well as the integration, maintenance, testing, and simulation of IS. The stages of enterprise modeling and user requirements engineering, however, are not sufficiently covered. In a networked economy, key components of a model-driven approach are business vocabularies, ontologies, and business rules, which do not exist in isolation but serve to support business processes. From a global perspective of the enterprise, "vertical integration" needs to ensure that business processes are not only implemented correctly, but also correctly implement strategic goals and measures. Consequently, vertical integration of MDSD phases and artifacts can be achieved by aligning business vocabularies, ontologies, processes, data, and rules on the basis of business goals. The analysis of pragmatic, semantic, and dynamic dependencies, and normalization as well as orderliness of models may serve this purpose [Gustas, 1997; Nemuraite et al., 2002; Pakalnickienė et al., 2007]. In addition, many enterprises are (or are trying to get) involved in the adoption of process modeling and rule modeling languages and tools, or to develop their own software for that purpose [e.g., Kapočius and Butleris, 2006; Motiejunas and Butleris, 2007; Skersys, 2006; Skersys, 2008]. Nevertheless, there are several challenges that have to be addressed in future research.

Zur Muehlen and Indulska [2010] recently stated that the synergies and overlaps between business process modeling and business rule modeling languages are still under-researched, making it impossible to gain maximum value out of the overall modeling effort. While this problem is explored in the area of MDSD [e.g., Goedertier and Vanthienen, 2007; Marinos and Krause, 2009a, 2009b; Milanović et al., 2009], another challenge is that many business process modeling languages (e.g., BPMN and BPMN 2) do not sufficiently allow for the modeling of data flows. While SoaML, for example, includes message models, it does not prescribe a methodology for defining these models or their underlying data models. Data modeling is thus largely omitted from business process modeling, which can lead to data anomalies in the execution of business processes [e.g., Decker and Weske, 2010]. Conversely, business rule modeling solutions such as Semantics of Business Vocabulary and Business Rules [SBVR, 2008] are heavily based on both ontologies and conceptual data models. Moreover, SBVR applies structured natural language and deserves in-depth research as it theoretically allows combining enterprise business

rules with ontologies and Semantic Web rules, as well as transforming business vocabularies and business rules into MDA platform-independent models [e.g., Cabot et al., 2010; Ceponiene et al., 2009; Demuth and Liebau, 2007; Marinos and Krause, 2009a, 2009b; Nemuraite et al., 2010]. In particular, SBVR (and its possible extensions) can contribute to solving problems that relate to the verbalization of business rules and software models [Butkienė, 2008; Cabot et al., 2010]. The problem of business rules modeling could be addressed by investigating decomposition/ composition principles for separating/integrating dynamic and structural aspects in communicative action loops. While the pragmatic and semantic normalization of communicative action loops across business transactions is under-researched, an equally interesting issue is how to produce a commonly accepted ontology that links strategy modeling to process modeling and process modeling to software engineering. We propose investigating possible extensions and enhancements to previously developed model-driven transformations (e.g., SBVR to UML/OCL or OWL2 to RDB). A somewhat parallel problem, as suggested by Arlow and Neustadt [2009], is that although we know quite a lot about the *what* and *when* issues of modeling, research on the question of *how* is still lacking. Researchers in the field tend to focus on the needs and views of BPM and IS experts in general, but to dismiss broader economical, psychological, and social aspects of modeling and IS development, which can result in inefficient practices and systems that do not meet user expectations. Arlow [2010], for example, writes that there is still relatively little work on the human-to-human communication issues that analysts and developers face every day.

In most cases, vertical integration in BPM requires the design (or adaptation) of methods or models and can thus be addressed by design research or design science [Winter, 2008]. Fellow researchers can focus on the analysis of existing phenomena, the development of new artifacts, and the supplementation of the knowledge base [Hevner et al., 2004]. Needless to say, experimental evaluation of method implementations should be especially emphasized in order to validate correctness and applicability of new artifacts for the vertical integration of business and IS models. Besides, insufficient knowledge about human-to-human aspects of BPM and IS development is the reason why interdisciplinary research should also be prioritized. Researchers from the fields of economics, psychology, or sociology should be involved. Better understanding of behavioral and social aspects of business process analysis, IS requirements specification, and similar activities should, in our opinion, bring positive changes to how we view and perform BPM and IS development.

Organizational and Managerial Issues

As indicated earlier, prior work has identified governance, strategic alignment, methods, IT, culture, and people as defining dimensions of BPM [de Bruin and Rosemann, 2007]. As such, BPM is a topic that involves a broad variety of organizational and managerial issues. While the previous sections have mainly discussed issues pertaining to methods (e.g., value orientation and reuse) and technology (e.g., architectures and applications), we also see organizational challenges of BPM. Generally, management is required to understand how the organizational context impacts on BPM and vice versa. Related issues have already been discussed under the label of context-awareness [Rosemann et al. 2008]. We argue that relevant studies have to consider the role of the IT artifact and its immediate nomological net [Benbasat and Zmud, 2003] as the investigated phenomena are socio-technical in nature. Corresponding knowledge becomes crucial when BPM practitioners seek to understand the potentials and consequences of BPM initiatives at the organizational level.

While there is a considerable amount of work on topics such as strategic alignment [de Bruin and Rosemann, 2006] or governance [Braganza and Lambert, 2000], for example, little research has investigated the role of people and culture in the context of BPM. Culture, however, constitutes an important aspect of the socio-technical context that sets the frame for BPM [vom Brocke and Sinnl, 2010]. Organizational culture has been defined as “a pattern of shared basic assumptions that was learned by a group as it solved its problems of external adaption and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel” [Schein, 2004, p. 17]. We argue that IS researchers need to develop a thorough understanding of how culture shapes the conduct of BPM, and how BPM and its related technologies, in turn, impact organizational culture. Correspondingly, research questions will be about the reciprocal interactions between organizational culture and business processes, for example: (1) How does (static or evolving) organizational culture impact business process change and the use of technology? (2) How does (static or evolving) organizational culture impact business process performance? (3) What is the impact of process orientation and the use of process-oriented technology on organizational culture?

Organizational issues of BPM can be investigated by applying methods of both theory building and testing. Due to the awareness that there has been little thorough theory development in the field of BPM [Rosemann et al., 2006], however, we would like to encourage fellow researchers to focus on methods that can be leveraged for the generation of novel theory, including the grounded theory method [Glaser and Strauss, 1967] and case-study research [Benbasat et al., 1987]. Such methods are often applied within an interpretive paradigm [Walsham, 1995] and have gained popularity in the IS discipline. We argue that these methods in particular can be used in order to understand the complex socio-technical context in which the phenomenon of BPM unfolds. Moreover, design-

oriented research may be leveraged in order to establish and evaluate managerial principles and guidelines on how to conduct BPM and how IT can be applied in this context.

New Application Fields for BPM

With the dissemination of IS in various parts of our professional and private lives, several new application fields for BPM arise. BPM has initially been adopted by industries in which processes are most visible. Process industries such as paper mills are prime examples. Modern assembling industries, for instance, the automotive or electronics sector, are further users of BPM. In addition, business process thinking has arrived in the service industries, where areas that feature highly standardized, and frequently repeated, processes again have been the early adopters (e.g., banking and insurance). BPM is further gaining importance in public sectors that have been slow in innovation during the last decades. The still existing development backlog in the public sector [European Commission, 1999; White, 2000] bears the potential of big productivity gains. One prominent example is that of healthcare; while some professionals in the field still dislike the image of health care as a set of processes, many of them, together with various business managers and IT professionals, have already adopted the idea. Another emergent application area of BPM can be identified at the intersection between social media and business processes. At the most basic level, the idea of social media is rampant innovation and case development orchestrated by the user masses. Organizations are challenged to harness these interactions to productive processes [Abrahamson and Fairchild, 1999]. Besides, we believe that process thinking is not only limited to well-structured business areas such as the above ones. On the contrary, BPM is becoming increasingly important to business areas that do not demand work to comply with given, timely logical structures, for example, creativity-intensive processes [Seidel et al., 2010a].

One of the research questions waiting for an answer concerns the limitations and restrictions of process thinking, that is, “Can all organizational activities be improved through process thinking or not?” Unplanned and unforeseen interactions are at the core of many current IS trends, such as social media or peer-to-peer computing, and it must be understood that rigid processes might harm the value added that can be gained. A good example of the problems that are associated with process thinking is e-democracy. Political discussions are always associated with some kind of opposition, which provides alternatives and opens up new issues and potencies. Viewing democratic actions just as rigid processes could thus be disastrous [Moreno-Jiménez and Polasek, 2003; Päivärinta and Sæbø, 2006]. It is well-known that business processes are strongly related to information systems: touching upon one is seldom of use without also considering the other. Even less discussed and studied is the interplay between governance structures at the intersections of organizations, IT, and processes. BPM activities thus always require the rigorous analysis of the underlying governance structures the processes will be embedded in [Van Belle and Van Grembergen, 1997].

The application of process thinking to new areas is by no means a purely technological issue. It rather requires multidisciplinary teams, involving both the management and the workforce [Rubin and Babbie, 2009]. Experimenting with public services or health care systems, for example, bears tremendous risk, and the role of the researcher is to be seen in supporting the planning and assessment of processes than to implement the same. Case studies and action research are viable research methods in order to seek answers to the above research problems. Key to success is most likely interdisciplinary research that fits into the traditions of other disciplines.

Synopsis of Main Results

For each of the above described research areas, Table 1 summarizes the identified research problems/questions and suggested research strategies/methods.

IV. DISCUSSION

The results of the workshop show that IS researchers are interested in a broad variety of BPM-related topics, ranging from rather technical issues to organizational and managerial ones. It thus becomes apparent that BPM research can meaningfully contribute to investigating a variety of phenomena that are of interest to the IS discipline. We contend that BPM, indeed, is an important yet still emergent field within our academic discipline. With regard to research strategies and methods, the participants highlighted the future role of design-oriented research, conceptual work, heuristic and mathematical programming, as well as a number of empirical methods, including case-study research, action research, grounded theory, and experiments.

There are different explanations for this plurality of methods and topics. First, the field can still be characterized as pre-paradigmatic or multi-paradigmatic. Vaishnavi and Kuechler [2008] write that the IS discipline as a whole can be likewise characterized as it draws “research questions, methodologies, and grounding philosophies from multiple fields that are loosely united under a common interest in understanding the way in which human-computer systems are developed, produce and process information, and influence the organizations in which they are embedded” (p. 2). Without any doubt, this also holds true for the domain of BPM research, which is reinforced by Hammer [2010],

Table 1: A Research Agenda for BPM		
Research Area	**Selected Research Problems/Questions**	**Selected Research Strategies/Methods**
Model reuse in BPM	How can building block-based modeling techniques contribute to overcoming syntactic and semantic differences of reference models?	Design science research, including qualitative approaches like case-study research or action research
	How to unify the wide range of available modeling languages to a common or at least de-facto standard?	
	What are the factors that influence "design with reuse" and "design for reuse"?	Theory development on the design process, including qualitative and quantitative approaches
Value-orientation in BPM	How to characterize the concept of value in the context of BPM?	Conceptual research
	How to design evaluation methods that support BPM-related decision-making?	Design science research
	To what extend does value assessment influence decision-making practices in BPM?	Action research
Collaboration in BPM	How to formalize collaborative work in business process models?	Design science research; case-study research
	What methods and instruments are needed to support collaborative business process modeling?	
Software architectures	Why has the SOA approach been less successful than anticipated?	Case studies of success stories; conceptual research
	How can BPM help to make SOAs fly?	
	Can WOAs be seen as a valuable alternative?	
Enterprise content management	What is the role of business processes in ECM implementation?	Case-study research; conceptual research
	How does the implementation of ECM impact business process performance?	Case-study research
	To what extent does the implementation of ECM require the redesign of business processes?	Case-study research; design-oriented research
	How to implement an ECM system with regard to business processes?	
Operations management	How to model the interface between OM and BPM?	Heuristic and mathematical programming methods
Standards for BPM	How to adapt BPM standards to the business processes of specific industry sectors?	Conceptual research; design research; action research; case-study research; prototypical implementations; experiments
	How to propagate (downwards, upwards) changes in global choreographies, local choreographies, and orchestrations?	
	How to achieve consistent alignment of global and local choreographies, as well as orchestrations?	
Vertical integration	How to describe business rules in natural language and model them so that they are aligned with business goals and ready for change and, finally, implementation?	Design research or design science; studying existing phenomena; case-study research
	How to transform and trace enterprise business models and platform-independent software models, implemented services, and data components?	
	How to produce industry or problem type specific reference models or architecture principles and supporting solutions?	
	How to deliver efficient modeling practices and techniques?	Interdisciplinary experimental research (psychology, sociology, economics); conceptual and case-study research
Organizational and managerial issues	How does (static or evolving) organizational culture impact on business process change?	Grounded theory method; case-study research; design-oriented research
	How does (static or evolving) organizational culture impact on business process performance?	
	What is the impact of process orientation onto organizational culture?	
New application fields for BPM	How to transfer process thinking to new areas such as government, health care, and social media?	Interdisciplinary research; action research; case-study research
	What are the limits and risks of process thinking?	
	What is the interplay between innovation and possibly rigid business processes?	
	How to better integrate governance issues into BPM?	

who concludes that “even the basic aspects of process management—designing processes, developing metrics, training performers, and all the rest—are far from settled issues” (p. 16). In this line of thinking, Benbasat and Zmud [2003] argue that “a dominant design for the IS discipline has yet to be realized” (p. 185). Second, BPM must be considered multidisciplinary. As the variety of identified research topics shows, the phenomenon of business processes can be investigated from very different angles.

Very roughly, we can distinguish between research that aims at generating or testing theory and research that aims at designing and evaluating novel artifacts to solve practical problems. While the former typically leverages social science methods, such as case-study research, the grounded theory method, action research, surveys, or experiments, the latter applies design-oriented approaches that often draw on methods from computer science and mathematics, such as heuristics or mathematical programming. It becomes apparent that there is a clear tendency of the involved IS researchers toward the use of design-oriented approaches. The objective of design research in the IS discipline has been described as “to develop technology-based solutions to important and relevant business problems” [Hevner et al., 2004, p. 83]. As such, it considers both the managerial and the technical perspectives and can be characterized as being highly relevant to practitioners. We contend that this also reflects the nature of BPM in general, which can be framed as being of high practical relevance [Gartner, 2010].

With regard to future design research in the domain of BPM, two aspects deserve further attention: the participants recognized (a) the role of theories in the development of artifacts (e.g., in order to determine their relevance and requirements) and (b) the necessity of their rigorous evaluation. (a) Considering the above identified lack of foundational theory in the field of BPM, this also nurtures the awareness that our discipline is challenged to further contribute to the intellectual core of BPM in order to enable the design of innovative and purposeful artifacts. Walls et al. [1992] and Gregor [2007] have shaped the role of design theories as prescriptive theories and have also highlighted the role of kernel theories that can inform the design of IT artifacts. (b) The need to rigorously evaluate novel artifacts has been discussed by Hevner et al. [2004], who state that the “utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods” [Hevner et al., 2004, p. 83]. In this line of thought, we argue that only the rigorous evaluation of artifacts will raise the confidence the scientific community has in the usefulness and applicability of a construct, method, model, or instantiation. As abstract theoretical statements cannot be proven true [Popper, 1961], the same holds for the utility of a certain design like that of a novel process modeling grammar. While it may be applicable in a certain context, it may not apply in another one. But only if the process modeling grammar can be used in a variety of settings will it eventually be accepted by the scientific community and become part of its knowledge base.

In summary, we contend that IS research can meaningfully contribute to the future of BPM in at least two ways. First, our discipline can help to solve contemporary and IT-related problems through the application of design-oriented work, resulting in novel constructs (e.g., design patterns), methods (e.g., for process analysis), models (e.g., reference models), and instantiations (e.g., novel tools for process automation). Such development will be informed by existent theories. Second, IS research can contribute to the intellectual core of BPM by generating novel theory; generally, BPM research can be characterized by the absence of rigorous and mature theoretical foundations [Rosemann et al., 2006]. While it is not the case that no theoretical work has been conducted [e.g., Bandara et al., 2005; Indulska et al., 2009; Raduescu et al., 2006], existent works are largely conceptual or analytical in nature.

Finally, one point must be made here. We deem both design-oriented research and theory development and testing as highly complementary [Hevner et al, 2004]. The generation of novel theory will be informed by the deliberate design processes and can then, in turn, allow for better design processes and better artifacts. As indicated by Vaishnavi and Kuechler [2008], Rossi and Sein [2003], and Puaro [2002], the outcome of design science research can be “better theories.” It will be interesting to see how both behavioral and design-oriented research in the academic discipline of IS will contribute to the field of BPM in the future.

V. CONCLUSION

This article reflected on a workshop on current and future issues in BPM research that was held at the 2010 annual ERCIS meeting. The results suggest that IS researchers are interested in a broad variety of BPM-related topics, and for their study they make use of several research strategies, including qualitative, quantitative, and design-oriented approaches. It further becomes noticeable that BPM research can meaningfully contribute to investigating different phenomena that are of interest to the IS discipline, ranging from rather technical (e.g., SOA implementation) to managerial (e.g., the impact of organizational culture on business process performance). The article combined the participants’ viewpoints with the academic literature on this matter, and it is hoped that it can thus contribute to establishing BPM as a distinct field of IS research. The article complements related works in this area in at least three ways. First, it offers a European perspective to the current and future state of BPM research, thus supplementing earlier, predominantly Australasian, studies. Second, the article summarizes opinions from IS

researchers, thus exceeding former studies that often focus on practitioners' viewpoints. Third, while many of the existing models in BPM research do not offer many insights into the actual problems and questions that BPM research should be focusing on (let alone any prioritization of research methods), this article not only highlighted important areas of research, but—for each of them—also contemporary research problems and questions as well as suitable strategies and methods to explore them.

This article has one main limitation. It reports the positions of only seventeen individuals. As such, it is not representative. Our claim, however, is not to present *the* research agenda for future BPM research, but *a* research agenda, and we thus contend that this article makes an immediate contribution. By positing actual research questions along with potential research methods, we hope we could open up fruitful avenues for future BPM research. Most notably, we have argued for a dichotomy of design-oriented research that produces tangible and immediate results of high practical relevance on the one hand, and the further development of the intellectual core of BPM research through theory building and testing on the other. When conducted rigorously, design research in the domain of BPM can benefit from existing theory and can also contribute to further theory building. We have further argued for the rigorous evaluation of the designed artifacts, also leveraging social sciences methods.

REFERENCES

Editor's Note: The following reference list contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their word processor or are reading the article on the Web, can gain direct access to these linked references. Readers are warned, however, that:

1. These links existed as of the date of publication but are not guaranteed to be working thereafter.
2. The contents of Web pages may change over time. Where version information is provided in the References, different versions may not contain the information or the conclusions referenced.
3. The author(s) of the Web pages, not AIS, is (are) responsible for the accuracy of their content.
4. The author(s) of this article, not AIS, is (are) responsible for the accuracy of the URL and version information.

Abeysinghe, G. and K. Phalp (1997) "Combining Process Modelling Methods", *Information and Software Technology* (39)2, pp. 107–124.

Abrahamson, E. and G. Fairchild (1999) "Management Fashion: Lifecycles, Triggers, and Collective Learning Processes", *Administrative Science Quarterly* (44)4, pp. 708–740.

Aguilar-Savén, R.S. (2004) "Business Process Modelling: Review and Framework", *International Journal of Production Economics* (90)2, pp. 129–149.

Allen, D. (2007) "Cost/Benefit Analysis for Implementing ECM, BPM Systems", *Information Management Journal* (41)3, pp. 34–41.

Arlow, J. (2010) "Communication Problems in Software Engineering", *Proceedings of the 16th International Conference on Information and Software Technologies (IT 2010)*, Kaunas, Lithuania.

Arlow, J. and I. Neustadt (2009) *Secrets of Object Oriented Analysis*, New York, NY: John Wiley and Sons.

Australian Community of Practice (2004) "BPM Round Table", http://www.bpm-roundtable.com (current Sept. 4, 2006).

Bandara, W., G.G. Gable, and M. Rosemann (2005) "Factors and Measures of Business Process Modelling: Model Building Through a Multiple Case Study", *European Journal of Information Systems* (14)4, pp. 347–360.

Bandara, W. et al. (2007) "Major Issues in Business Process Management: An Expert Perspective", *Proceedings of the 15th European Conference on Information Systems (ECIS 2007)*, St. Gallen, Switzerland.

Barros, A., M. Dumas, and P. Oaks (2006) "Standards for Web Service Choreography and Orchestration: Status and Perspectives", *Proceedings of the Business Process Management Workshops*, Nancy, France.

Becker, J. et al. (2009) "Formalizing Linguistic Conventions for Conceptual Models", *Proceedings of the 28th International Conference on Conceptual Modeling*, Gramado, Brazil.

Becker, J. and D. Kahn (2010) "The Process in Focus", in Becker, J., M. Kugeler, and M. Rosemann (eds.) *Process Management: A Guide for the Design of Business Processes, 2nd edition*, Berlin/Heidelberg, Germany: Springer, pp. 1–11.

Becker, J. and R. Schütte (2007) "A Reference Model for Retail Enterprises", in Fettke, P. and P. Loos (eds.) *Reference Modeling for Business Systems Analysis*, Hershey, PA: Idea Group Publishing.

Benbasat, I., D.K. Goldstein, and M. Mead (1987) "The Case Research Strategy in Studies of Information Systems", *MIS Quarterly* (11)3, pp. 368–386.

Benbasat, I. and R. Weber (1996) "Research Commentary: Rethinking Diversity in Information Systems Research", *Information Systems Research* (7)4, pp. 389–399.

Benbasat, I. and R.W. Zmud (2003) "The Identity Crisis Within the IS Discipline: Defining and Communicating the Discipline's Core Properties", *MIS Quarterly* (27)2, pp. 183–194.

Bézivin, J. (2005) "On the Unification Power of Models", *Software and System Modeling (SoSym)* (4)2, pp. 171–188.

BPMN (2010) "Business Process Model and Notation (BPMN)", Object Management Group, http://www.omg.org/cgi-bin/doc?dtc/10-06-04 (current Nov. 10, 2010).

Braganza, A. and R. Lambert (2000) "Strategic Integration: Developing a Process–Governance Framework", *Knowledge and Process Management* (7)3, pp. 177–186.

Brinkkemper, S. (1996) "Method Engineering: Engineering of Information Systems Development Methods and Tools", *Information and Software Technology* (38)4, pp. 274–280.

Brynjolfsson, E. (1993) "The Productivity Paradox of Information Technology", *Communications of the ACM* (36)12, pp. 66–77.

Bucher, T. and R. Winter (2009) "Geschäftsprozessmanagement—Einsatz, Weiterentwicklung und Anpassungsmöglichkeiten aus Methodik-Sicht", *HMD—Praxis Der Wirtschaftsinformatik* (46)266, pp. 5–16.

Bussler, C. (2002) "The Application of Workflow Technology in Semantic B2B Integration", *Distributed and Parallel Databases* (12)2, pp. 163–191.

Butkienė, R. (2008) "Towards a Verbalization of the Conceptual Model Expressed in Lithuanian Language", *Proceedings of the 14th International Conference on Information and Software Technologies (IT 2008)*, Kaunas, Lithuania.

Cabot, J., R. Pau, and R. Raventós (2010) "From UML/OCL to SBVR Specifications: A Challenging Transformation", *Information Systems* (35)4, pp. 417–440.

Carr, N. (2004) *Does IT Matter? Information Technology and the Corrosion of Competitive Advantage,* Boston, MA: Harvard Business School Press.

Ceponiene, L., L. Nemuraite, and G. Vedrickas (2009) "Semantic Business Rules in Service Oriented Development of Information Systems", *Proceedings of the 15th International Conference on Information and Software Technologies (IT 2009),* Kaunas, Lithuania.

Chambers, B. (2007) "BPM: How Does It Fit into an ECM Strategy?" *AIIM E-DOC Magazine* (2), pp. 36–39.

Curtis, B., M.I. Kellner, and J. Over (1992) "Process Modeling", *Communications of the Association for Computing Machinery* (35)9, pp. 75–90.

Damij, N. (2007) "Business Process Modelling Using Diagrammatic and Tabular Techniques", *Business Process Management Journal* (13)1, pp. 70–90.

Davenport, T.H. (1993) *Process Innovation: Reegnineering Work Through Information Technology,* Boston, MA: Harvard Business School Press.

Davenport, T.H. and D.B. Stoddard (1994) "Reengineering: Business Change of Mythic Proportions?" *MIS Quarterly* (182), pp. 121–127.

de Bruin, T. (2007) "Insights into the Evolution of BPM in Organisations", *Proceedings of the 18th Australasian Conference on Information Systems,* Toowoomba, Australia.

de Bruin, T. and M. Rosemann (2006) "Towards Understanding Strategic Alignment of Business Process Management", *Proceedings of the 17th Australasian Conference on Information Systems,* Adelaide, Australia.

de Bruin, T. and M. Rosemann (2007) "Using the Delphi Technique to Identify BPM Capability Areas", *Proceedings of the 18th Australasian Conference on Information Systems*, Toowoomba, Australia.

Decker, G. and M. Weske (2010) "Interaction-Centric Modeling of Process Choreographies", *Information Systems* (36)2, pp. 292–312.

Demuth, B. and H.-B. Liebau (2007) "An Approach for Bridging the Gap Between Business Rules and the Semantic Web", in Paschke, A. and Y. Biletskiy (eds.) *Advances in Rule Interchange and Applications,* vol. 4824, Berlin/Heidelberg, Germany: Springer, pp. 119–133.

Eikebrokk, T.R. et al. (2008) “Exploring Process-Modelling Practice: Towards a Conceptual Model”, *Proceedings of the 41st Hawaii International Conference on System Sciences (HICCS'08)*, Big Island, HI.

Eisenhardt, K.M. (1989) “Agency Theory: An Assessment and Review”, *The Academy of Management Review* (14)1, pp. 57–74.

Erol, S. et al. (2010) “Combining BPM and Social Software: Contradiction or Chance?” *Journal of Software Maintenance and Evolution: Research and Practice* (22)6–7, pp. 449–476.

European Commission (1999) “Public Sector Information: A Key Resource for Europe”, Green Paper on Public Sector Information in the Information Society, ftp://ftp.cordis.europa.eu/pub/econtent/docs/gp_en.pdf (current Jan. 11, 2011).

Fettke, P. and P. Loos (2003) “Classification of Reference Models: A Methodology and its Application”, *Information Systems and E-Business Management* (1)1, pp. 35–53.

Fettke, P. and P. Loos (2004) “Referenzmodellierungsforschung“, *Wirtschaftsinformatik* (46)5, pp. 331–340.

Fettke, P. and P. Loos (2007) “Perspectives on Reference Modeling”, in Fettke, P. and P. Loos (eds.) *Reference Modeling for Business Systems Analysis*, Hershey, PA: Idea Group Publishing, pp. 1–20.

Gartner (2010) “Leading in Times of Transition”, *The 2010 CIO Agenda,* Stamford, CT.

Georgakopoulos, D., M. Hornick, and A. Sheth (1995) “An Overview of Workflow Management: From Process Modeling to Workflow Automation Infrastructure”, *Distributed and Parallel Databases* (3)2, pp. 119–153.

Giaglis, G.M. (2001) “A Taxonomy of Business Process Modeling and Information Systems Modeling Techniques”, *The International Journal of Flexible Manufacturing Systems* (13)2, pp. 209–228.

Glaser, B.G. and A.L. Strauss (1967) *The Discovery of Grounded Theory: Strategies for Qualitative Research*, Chicago, IL: Aldine Publishing Company.

Goedertier, S. and J. Vanthienen (2007) “Declarative Process Modeling with Business Vocabulary and Business Rules”, *Proceedings of the 2007 OTM Confederated International Conference on the Move to Meaningful Internet Systems,* vol. I, Vilamoura, Portugal.

Grefen, P. et al. (2009) “Dynamic Business Network Process Management in Instant Virtual Enterprises”, *Computers in Industry* (60)2, pp. 86–103.

Gregor, S. and D. Jones, (2007) “The Anatomy of a Design Theory”, *Journal of the Association for Information Systems* (8)5, pp. 313–335.

Gregoriades, A. and A.G. Sutcliffe (2008) “A Socio-Technical Approach to Business Process Simulation”, *Decision Support Systems* (45)4, pp. 1017–1030.

Gupta, V.K., S. Govindarajan, and T. Johnson (2002) “Overview of Content Management Approaches and Strategies”, *Electronic Markets* (11)4, pp. 281–288.

Gustas, R. (1997) *Semantic and Pragmatic Dependencies of Information Systems*, Habilitation, Kaunas University of Technology, Kaunas, Lithuania.

Hagemann, S., C. Letz, and G. Vossen (2007) “Web Service Discovery—Reality Check 2.0”, *International Journal of Web Service Practices* (3)1, pp. 42–47.

Hammer, M. (1990) “Reengineering Work: Don't Automate, Obliterate”, *Harvard Business Review* (68)4, pp. 104–112.

Hammer, M. (1996) *Beyond Reengineering. How the Process-Centered Organization Is Changing Our Work and Our Lives*, New York, NY: HarperCollins Publishers.

Hammer, M. (2010) “What Is Business Process Management?” in vom Brocke, J. and M. Rosemann (eds.) *Handbook on Business Process Management 1: Introduction, Methods and Information Systems*, Berlin/Heidelberg, Germany: Springer, pp. 3–16.

Hammer, M. and J. Champy (1993) *Reengineering the Corporation. A Manifesto for Business Revolution*, New York, NY: Harper Business.

Hevner, A.R. et al. (2004) “Design Science in Information Systems Research”, *MIS Quarterly* (28)1, pp. 75–105.

Ho, D.T.-Y., Y. Jin, and R. Dwivedi (2009) “Business Process Management: A Research Overview and Analysis”, *Proceedings of the 15th Americas Conference on Information Systems (AMCIS)*, San Francisco, CA.

Hofreiter, B. (2009) “Extending UN/CEFACT’s Modeling Methodology by a UML Profile for Local Choreographies”, *Information Systems and E-Business Management* (7)2, pp. 251–271.

Hofreiter, B., C. Huemer, and J.-H. Kim (2006) “Choreography of ebXML Business Collaborations”, *Information Systems and E-Business Management* (4)3, pp. 221–243.

Indulska, M. et. al. (2006) “Major Issues in Business Process Management: An Australian Perspective”, *Proceedings of the 17th Australasian Conference on Information Systems (ACIS 2006)*, Adelaide, Australia.

Indulska, M., J. Recker, and M. Rosemann (2009) “Business Process Modeling: Current Issues and Future Challenges”, in van Eck, P., J. Gordijn, and R. Wieringa (eds.) *Advanced Information Systems Engineering,* vol. 5565, Berlin/Heidelberg: Springer, pp. 501–514.

Janson, M. and S. Wrycza (1996) “Information Technology as an Enabler of Business Processes Designing During Macroeconomic Transformation”, in Scholz-Reiter, B. and E. Stickel (eds.) *Business Process Modelling*, New York, NY: Springer, pp. 207–217.

Jeppesen, L.B. and L. Frederiksen (2006) “Why Do Users Contribute to Firm-Hosted User Communities? The Case of Computer-Controlled Music Instruments”, *Organization Science*, (17)1, pp. 45–63.

Kaplan, R.S. and D.P. Norton (1991) “The Balanced Scorecard: Measures That Drive Performance”, *Harvard Business Review* (70)1, pp. 71–79.

Kapočius, K. and R. Butleris (2006) “Repository for Business Rules Based IS Requirements”, *Informatica* (17)4, pp. 503–518.

Kent, S. (2002) “Model Driven Engineering”, *Proceedings of the Third International Conference on Integrated Formal Methods,* Turku, Finland.

Koschmider, A., M. Song, and H.A. Reijers (2008) “Social Software for Modelling Business Processes”, *Proceedings of the 6th International Conference on Business Process Management (BPM 08)*, Milan, Italy.

Lattemann, C. et al. (2010) “A Framework to Measure Benefits and Costs of Virtual Communities—The Case of the Berlin Stock Exchange”, *Proceedings of the 43rd Hawaii International Conference on System Sciences (HICSS 2010)*, Kauai, HI.

Leymann, F. (2003) “Web Services. Distributed Applications without Limits”, *Proceedings of the BTW 2003*, *Lecture Notes in Informatics*, vol. P-26, Bonn, Germany: Gesellschaft fuer Informatik (GI).

Leymann, F., D. Karastoyanova, and M. Papazoglou (2010) “Business Process Management Standards”, in vom Brocke, J. and M. Rosemann (eds.) *Handbook on Business Process Management 1: Introduction, Methods and Information Systems*, Berlin/Heidelberg, Germany: Springer, pp. 513–542.

Luo, W. and Y.A. Tung (1999) “A Framework for Selecting Business Process Modeling Methods”, *Industrial Management and Data Systems* (99)7, pp. 312–319.

March, S.T. and G. Smith (1995) “Design and Natural Science Research on Information Technology”, *Decision Support Systems* (15)4, pp. 251–266.

Marinos, A. and P. Krause (2009a) “Using SBVR, REST and Relational Databases to Develop Information Systems Native to Digital Ecosystems”, *Proceedings of the 3rd IEEE International Conference on Digital Ecosystems and Technologies (DEST '09)*, Istanbul, Turkey.

Marinos, A. and P. Krause (2009b) “An SBVR Framework for RESTful Web Applications”, in Governatori, G., J. Hall, and A. Paschke (eds.) *Rule Interchange and Applications,* vol. 5858, Berlin/Heidelberg, Germany: Springer, pp. 144–158.

Markus, M.L., A. Majchrzak, and L. Gasser (2002) “A Design Theory for Systems That Support Emergent Knowledge Processes”, *MIS Quarterly* (26)3, pp. 179–212.

Masaaki, I. (1986) *Kaizen: The Key to Japan's Competitive Success*, New York, NY: McGraw-Hill.

Mentzas, G., C. Halaris, and S. Kavadias (2001) “Modelling Business Processes with Workflow Systems: An Evaluation of Alternative Approaches”, *International Journal of Information Management* (21)2, pp. 123–135.

Milanović, M. et al. (2009) “Modeling Service Orchestrations with a Rule-Enhanced Business Process Language”, *Proceedings of the 2009 Conference of the Center for Advanced Studies on Collaborative Research*, Ontario, Canada.

Miller, J. and J. Mukerji (2003) “MDA Guide Version 1.0.1”, Object Management Group, http://www.omg.org/cgi-bin/doc?omg/03-06-01.pdf (current Jan. 22, 2011).

Moody, D.L. (2005) “Empirical Research in Conceptual Modeling–A Theoretical and Practical Imperative”, *Wirtschaftsinformatik* 47(2), pp. 154–155.

Moore, J. (2006) “SOA Success: Five Actions CIOs Say You Should Take”, http://www.cioinsight.com/c/a/Technology/SOA-Success-Five-Actions-CIOs-Say-You-Should-Take/ (current Sept. 2, 2010).

Moreno-Jiménez, J.M. and W. Polasek (2003) “E-Democracy and Knowledge. A Multicriteria Framework for the New Democratic Era”, *Journal of Multi-Criteria Decision Analysis* (12)2–3, pp. 163–176.

Motiejunas, L. and R. Butleris (2007) “Business Rules Manipulation Model”, *Information Technology and Control* (36)3, pp. 295–301.

Nemuraite, L., B. Paradauskas, and L. Salelionis (2002) “Extended Communicative Action Loop for Integration of New Functional Requirements”, *Information Technology and Control* (2)23, pp. 18–26.

Nemuraite, L. et al. (2010) “VETIS Tool for Editing and Transforming SBVR Business Vocabularies and Business Rules into UML and OCL Models”, *Proceedings of the 16th International Conference on Information and Software Technologies (IT 2010),* Kaunas, Lithuania.

Niehaves, B. and R. Plattfaut (2011) “Collaborative Business Process Management: Status Quo and Quo Vadis”, *Business Process Management Journal*, forthcoming.

Päivärinta, T. and B.E. Munkvold (2005) “Enterprise Content Management: An Integrated Perspective on Information Management”, *Proceedings of the 38th Hawaii International Conference on System Sciences (HICSS'05)*, Big Island, HI.

Päivärinta, T. and Ø. Sæbø (2006) “Models of E-Democracy”, *Communications of the Association for Information Systems* (17) Article 37, pp. 818–840.

Pakalnickienė, E., L. Nemuraiteand, and B. Paradauskas (2007) “The Orderliness and Precision in Conceptual Modeling”, *Proceedings of the 11th Panhellenic Conference in Informatics*, Patras, Greece.

Peltz, C. (2003) “Web Services Orchestration and Choreography”, *IEEE Computer* (36)10, pp. 46–52.

Popper, K. (1961) *The Logic of Scientific Discovery*, New York, NY: Routledge.

Powell, T.C. (1995) “Total Quality Management as Competitive Advantage: A Review and Empirical Study”, *Strategic Management Journal* (16)1, pp. 15–37.

Puaro, S. (2002) “Design Research in the Technology of Information Systems: Truth or Dare”, GSU Department of CIS Working Paper, http://purao.ist.psu.edu/working-papers/dare-purao.pdf (current Jan. 2, 2011).

Pullman, G. and B. Gu (2008) “Guest Editors' Introduction: Rationalizing and Rhetoricizing Content Management”, *Technical Communication Quarterly* (17)1, pp. 1–9.

Raduescu, C. et al. (2006) “A Framework of Issues in Large Process Modeling Projects”, *Proceedings of the 14th European Conference on Information Systems (ECIS 2006)*, Goeteborg, Sweden.

Rappaport, A. (1986) *Creating Shareholder Value: The New Standard for Business Performance,* New York, NY: The Free Press.

Recker, J. (2008) “Understanding Process Modelling Grammar Continuance: A Study of the Consequences of Representational Capabilities.” Unpublished Ph.D. Thesis, Queensland University of Technology, Brisbane, Australia, http://eprints.qut.edu.au/16656/1/Jan_Recker_Thesis.pdf (current Jan. 22, 2011).

Recker, J. et al. (2006) “How Good Is BPMN Really? Insights from Theory and Practice”, *Proceedings of the 14th European Conference on Information Systems (ECIS 2006)*, Goeteborg, Sweden.

Reijers, H.A. and S.L. Mansar (2005) “Best Practices in Business Process Redesign: An Overview and Qualitative Evaluation of Successful Redesign Heuristics”, *Omega* (33)4, pp. 283–306.

Richter, D. et al. (2009) “Internet Social Networking—Distinguishing the Phenomenon from Its Manifestations”, *Proceedings of the 17th European Conference on Information Systems (ECIS 2009)*, Verona, Italy.

Richter, D., K. Riemer, and J. vom Brocke (2010) “Social Transactions on Social Network Sites: Can Transaction Cost Theory Contribute to a Better Understanding of Internet Social Networking?” *Proceedings of the 23rd Bled eConference*, Bled, Slovenia.

Rosemann, M., T. de Bruin, and B. Power (2006) “BPM Maturity”, in Jeston, J. and J. Nelis (eds.) *Business Process Management: Practical Guidelines to Successful Implementations, 3rd edition,* Oxford, England: Butterworth-Heinemann, pp. 299–315.

Rosemann, M. and W. van der Aalst (2007) “A Configurable Reference Modelling Language”, *Information Systems*, 32(1), pp. 1–23.

Rosemann, M., J. Recker, and C. Flender (2008) “Contextualization of Business Processes”, *International Journal of Business Process Integration and Management* (3)1, pp. 47–60.

Rosemann, M. and J. vom Brocke (2010) “The Six Core Elements of Business Process Management”, in vom Brocke, J. and M. Rosemann (eds.) *Handbook on Business Process Management 1: Introduction, Methods and Information Systems*, Berlin/Heidelberg, Germany: Springer, pp. 107–122.

Rossi, M. and M. Sein (2003) “Design Research Workshop: A Proactive Research Approach”, Presentation delivered at IRIS 26, Aug. 9–12, 2003, http://www.cis.gsu.edu/~emonod/epistemology/Sein%20and%20Rossi%20-%20design%20research%20-%20IRIS.pdf (current Dec. 1, 2010).

Rubin, A. and E. Babbie (2009) *Essential Research Methods for Social Work, 2nd edition,* Belmont, CA: Brooks/Cole Publishing.

Salminen, A. et al. (2006) “Content Production Strategies for E-Government”, in Anttiroiko, A.-V. and M. Mälkiä (eds.) *Encyclopedia of Digital Government*, Hersley, PA: IDEA Group Publishing, pp. 224–230.

SBVR (2008) “Semantics of Business Vocabulary and Business Rules (SBVR) Version 1.0”, Object Management Group, http://www.omg.org/docs/formal/08-01-02.pdf (current July 30, 2010).

SCC (2009) “SCOR—Supply-Chain Operations Reference-Model Version 9.0”, http://www.supply-chain.org/filemanager/active?fid=24 (current Sept. 29, 2009).

Schatz, W. (1988) “EDI: Putting the Muscle in Commerce and Industry”, *Datamation* (34)6, pp. 56–68.

Scheer, A.-W. and M. Nüttgens (2000) “ARIS Architecture and Reference Models for Business Process Management”, in van der Aalst, W., J. Desel, and A. Oberweis (eds.) *Business Process Management: Models, Techniques, and Empirical Studies*, Berlin/Heidelberg, Germany: Springer, pp. 376–389.

Scheer, A.W. (1994) *Business Process Engineering—Reference Models for Industrial Enterprises,* Berlin/Heidelberg, Germany: Springer.

Schein, E.H. (2004) *Organizational Culture and Leadership, 3rd edition,* San Francisco, CA: Jossey-Bass.

Schmidt, G. and O. Braun (2005) “How to Model Business Processes with GPN” in Bernus, P. and M. Fox (eds.) *Knowledge Sharing in the Integrated Enterprise: Interoperability Strategies for the Enterprise Architect*, Berlin: Springer, pp. 289–302.

Schönthaler, F. et al. (2011) *Geschäftsprozesse für Business Communities: Modellierungssprachen, Methoden, Werkzeuge*, München, Wien: R. Oldenbourg Verlag.

Sebor, J. (2008) “7 Steps to SOA Success”, *CRM Journal*, May, http://www.destinationcrm.com/Articles/Editorial/Magazine-Features/7-Steps-to-SOA-Success-48782.aspx (current Sept. 2, 2010).

Sedera, W. et al. (2004) “A Success Model for Business Process Modeling: Findings from a Multiple Case Study”, *Proceedings of the 8th Pacific Asia Conference on Information Systems (PACIS 2004)*, Shanghai, China.

Seethamraju, R. (2010) “Business Process Management—A Missing Link in Business Education”, *Proceedings of the 16th Americas Conference on Information Systems (AMCIS 2010)*, Lima, Peru.

Seidel, S., F. Müller-Wienbergen, and M. Rosemann (2010a) “Pockets of Creativity in Business Processes”, *Communications of the Association for Information Systems* (27) Article 23, pp. 415–436.

Seidel, S. and J. Recker (2009) “Using Grounded Theory for Studying Business Process Management Phenomena”, *Proceedings of the 17th European Conference on Information Systems (ECIS 2009)*, Verona, Italy.

Seidel, S., J. Recker, and J. vom Brocke (2010b) “Enablers and Barriers to the Organizational Adoption of Sustainable Business Practices”, *Proceedings of the 16th Americas Conference on Information Systems (AMCIS 2010)*, Lima, Peru.

Skersys, T. (2008) “Business Knowledge-Based Generation of the System Class Model”, *Information Technology and Control*, 37(2), pp. 145–153.

Skersys, T. and S. Gudas (2006) “Class Model Development Using Business Rules”, in Nilsson, A. G. et al. (eds.) *Advances in Information Systems Development. Bridging the Gap Between Academia and Industry*, New York, NY: Springer, pp. 203–215.

Smith, H.A. and J.D. McKeen (2003) “Developments in Practice VIII: Enterprise Content Management”, *Communications of the Association for Information Systems* (11) Article 33, pp. 647–659.

SoaML (2009) “Service Oriented Architecture Modeling Language”, Object Management Group, http://www.omg.org/spec/SoaML/1.0/Beta1/ (current Oct. 21, 2010).

Sprague, R H. (1995) “Electronic Document Management: Challenges and Opportunities for Information Systems Managers”, *Management Information Systems Quarterly* (19)1, pp. 29–49.

Sprehe, J.T. (2005) “The Positive Benefits of Electronic Records Management in the Context of Enterprise Content Management”, *Government Information Quarterly* (22)2, pp. 297–303.

Stieglitz, S. (2008) *Steuerung Virtueller Communities: Instrumente, Mechanismen, Wirkungszusammenhänge*, Wiesbaden, Germany: Gabler.

SysML (2008) “OMG Systems Modeling Language (OMG SysML)”, Version 1.1, Object Management Group, http://www.sysmlforum.com/docs/specs/OMGSysML-v1.1-08-11-01.pdf (current Nov. 11, 2010).

The Open Group (2009) *TOGAF Version 9—The Open Group Architecture Framework (TOGAF),* The Open Group.

Thies, G. and G. Vossen (2008) “Web-Oriented Architectures: On the Impact of Web 2.0 on Service-Oriented Architectures”, *Proceedings of the Asia-Pacific Services Computing Conference (APSCC 2008),* Yilan, Taiwan.

Tyrväinen, P. et al. (2006) “Guest Editorial: Characterizing the Evolving Research on Enterprise Content Management”, *European Journal of Information Systems* (15)6, pp. 627–634.

UML (2009) “OMG Unified Modeling Language (OMG UML), Superstructure”, Version 2.2, Object Management Group, http://www.omg.org/spec/UML/2.2/Superstructure/PDF (current Nov. 11, 2010).

Vaishnavi, V. and W. Kuechler (2008) *Design Science Research Methods and Patterns: Innovating Information and Communication Technology*, New York, NY: Auerbach Publications.

van Belle, J.-I. and W. Van Grembergen (1997) “The Holistic Approach to Re-Engineering: A Government Case”, *Proceedings of the Fifth European Conference on Information Systems (ECIS 1997)*, Cork, Ireland.

van der Aalst, W. (1999) “Formalization and Verification of Event-Driven Process Chains”, *Information and Software Technology* (41)10, pp. 639–650.

van der Aalst, W. (2005) “Business Alignment: Using Process Mining as a Tool for Delta Analysis and Conformance Testing”, *Requirements Engineering* (10)3, pp. 198–211.

van der Aalst, W. and A.H.M. ter Hofstede (2005) “YAWL: Yet Another Workflow Language”, *Information Systems* (30)4, pp. 245–275.

van der Aalst, W. and K. van Hee (2002) *Workflow Management: Models, Methods, and Systems*, Cambridge, MA: MIT Press.

van der Aalst, W. and M. Weske (2001) “The P2P Approach to Interorganizational Workflows”, *Proceedings of the 13th International Conference on Advanced Information Systems Engineering (CAiSE'01)*, Interlaken, Switzerland.

Vidgen, R., S. Goodwin, and S. Barnes (2001) “Web Content Management”, *Proceedings of the 14th Bled eConference*, Bled, Slovenia.

vom Brocke, J. (2006) “Design Principles for Reference Modelling: Reusing Information Models by Means of Aggregation, Specialisation, Instantiation, and Analogy”, in Fettke, P. and P. Loos (eds.) *Reference Modelling for Business Systems Analysis*, Hershey, PA: Idea Group Publishing, pp. 47–75.

vom Brocke, J., C., Sonnenberg, and A. Simons (2009) “Value-Oriented Information Systems Design: The Concept of Potentials Modeling and Its Application to Service-Oriented Architectures”, *Business and Information Systems Engineering* (1)3, pp. 223–233.

vom Brocke, J., J. Recker, and J. Mendling (2010) “Value-Oriented Process Modeling: Integrating Financial Perspectives into Business Process Re-Design”, *Business Process Management Journal* (16)2, pp. 333–356.

vom Brocke, J. and T. Sinnl (2010) “Culture in Business Process Management: A Literature Review”, *Business Process Management Journal*, forthcoming.

vom Brocke, J., A. Simons, and A. Cleven (2011) “Towards a Business Process-Oriented Approach to Enterprise Content Management: The ECM-Blueprinting Framework”, *Information Systems and e-Business Management (ISeB)*, forthcoming.

Vossen, G. (2006a) “From Processes Via Workflows To Services: An Overview”, *Journal of Integrated Design and Process Science*, 10(4), pp. 3–11.

Vossen, G. (2006b) “Have Service-Oriented Architectures Taken a Wrong Turn Already?” in Min, A., X. Li, and C. Sohail (eds.) *Research and Practical Issues of Enterprise Information Systems: IFIP TC 8 International Conference on Research and Practical Issues of Enterprise Information Systems (CONFENIS 2006),* Apr. 24–26, Vienna, Austria, New York, NY: Springer, pp. 23–29.

Walls, J.G., G. R. Widmeyer, and O.A. El Sawy (1992) “Building an Information System Design Theory for Vigilant EIS”, *Information Systems Research* (3)1, pp. 36–59.

Walsham, G. (1995) “Interpretive Case Studies in IS Research: Nature and Method”, *European Journal of Information Systems* (4)2, pp. 74–81.

White, L. (2000) “Changing the Whole System in the Public Sector”, *Journal of Organizational Change Management* (13)2, pp. 162–177.

Winter, R. (2008) “Design Science Research in Europe”, *European Journal of Information Systems* (17)5, pp. 470–475.

Wombacher, A. (2009) “Alignment of Choreography Changes in BPEL Processes”, *Proceedings of the 2009 IEEE International Conference on Services Computing (SCC 2009)*, Bangalore, India.

Zairi, M. (1997) “Business Process Management: A Boundaryless Approach to Modern Competitiveness”, *Business Process Management Journal* (3)1, pp. 64–80.

zur Muehlen, M. and M. Indulska (2010) “Modeling Languages for Business Processes and Business Rules: A Representational Analysis”, *Information Systems* (35)4, pp. 379–390.

ABOUT THE AUTHORS

Prof. Dr. **Jan vom Brocke** holds the Hilti Chair in Business Process Management at the University of Liechtenstein. He is Director of the Institute of Information Systems and President of the Liechtenstein Chapter of the AIS. Jan has more than ten years of experience in BPM projects and has published more than 170 refereed papers in the proceedings of internationally perceived conferences and established IS journals, including the *Business Process Management Journal (BPMJ)* and *Management Information Systems Quarterly (MISQ)*. He is author and co-editor of fifteen books, including Springer’s *International Handbook on Business Process Management*. He is an invited speaker on BPM at a number of universities, such as the Queensland University of Technology in Brisbane, the LUISS University in Rome, the University of St. Gallen, the University of Turku, and the University of California at Berkeley.

Prof. Dr. **Jörg Becker** is Director of the Department of Information Systems, University of Muenster, Germany, where he holds the Chair in Information Management. He is also Academic Director of the European Research Center for Information Systems (ERCIS). His areas of research include information management, information modeling, data management, and retail information systems. His work has appeared in proceedings of major conferences, including the *International Conference on Information Systems (ICIS)* and the *European Conference on Information Systems (ECIS)* as well as major journals, including *Business & Information Systems Engineering (BISE)* and the *Information Systems Journal (ISJ)*. He is editor for several IS journals and member of the program committees of several IS conferences. Furthermore, he is involved in strategic IT consulting and projects with industrial, service, and trade companies.

Dr. **Alessio Maria Braccini** is Research Fellow at the Research Center on Information Systems of the LUISS Guido Carli University in Rome, where he is actively involved in research and training activities. He holds a PhD in Management of Information Systems from LUISS Guido Carli University. His main research interests include the assessment of IT value and knowledge management. His research has appeared in *VINE: The Journal of Knowledge Management Systems* and the *International Journal of Global Management Studies* as well as in international conferences including the *European Conference on Information Systems (ECIS)* and the *International Conference on Business Information Systems (BIS)*.

Prof. Dr. **Rimantas Butleris** is Head of the Department of Information Systems at Kaunas University of Technology (KTU), Lithuania. In 1988, Rimantas achieved his doctoral degree in technical sciences specializing in management information systems. He has been Associated Professor at the Information Systems Department since its establishment in 1993 and Full Time Professor since 2006. His main research interests include requirements engineering and business rules modeling, information systems and databases design, CASE tools, and IS development environments. In recent years, Rimantas headed the organizing committees of six international scientific conferences that featured the subjects of information systems, including *BIR ‘2006* and *I3E ‘2011*.

Dr. **Birgit Hofreiter** is Assistant Professor at the University of Liechtenstein. Before she worked as a Post Doctoral Research Fellow at the University of Technology Sydney (2006–2008). Her research interests are methodologies for modeling e-business transactions as well as model-driven approaches to service-oriented architectures. Birgit has a long time working experience in business-to-business and e-government interoperability by working for UN/CEFACT to develop standards and recommendations for interoperability used in inter-organizational projects. Birgit has been involved in national and international projects, both governmental and industry funded. She is on the PC committee of several major e-business related conferences. Birgit is member of the steering committee of the *IEEE Conference on Commerce and Enterprise Computing* and editorial board member of the Springer *Journal on Service Oriented Computing and Applications*.

Dr. **Kęstutis Kapočius** is Associated Professor and Researcher at the Department of Information Systems at Kaunas University of Technology, Lithuania. In 2006, he has defended his thesis on the subject of business rules structuring during the development of information systems. In 2007/2008, he also spent a year as a post-doc researcher on the same subject at the Vilnius University. His research interests include business rules based requirements engineering methodologies as well as human-computer interaction issues in information systems development.

Prof. **Marco De Marco** is Full Professor of Organization and Information Systems at the Università Cattolica in Milan. He also teaches the business organization course at the LUISS Guido Carli University in Rome and in the last years he held lectures at the University of Liechtenstein. He is the author of four books and numerous essays and articles, mainly on the development of information systems and the impacts of technology on organizations. Marco has worked as a consultant for a wide range of important public institutions, such as the Venice City Council, the Lombardy Regional Government, the Hospital Administration Authority, and the Ministry of Justice as well as the Italian Parliament. At *ICIS 2010*, he received the AIS fellow award that recognizes individuals that have given significant contributions to the Information Systems discipline.

Prof. Dr. **Günter Schmidt** holds the Chair in Information and Technology Management at Saarland University, Germany. He is also Visiting Professor at University of Liechtenstein covering the areas of operations research and financial information systems. Günter has published extensively in international peer reviewed journals including *Acta Informatica*, *Discrete Applied Mathematics*, *EJOR*, *IPL*, *Mathematical Methods of Operations Research*, *Parallel Computing* and *SIAM Journal of Computing*. He is Editor-in-Chief of the *International Handbooks of Information Systems* series published by Springer.

Dr. **Stefan Seidel** is Assistant Professor at the Institute of Information Systems at the University of Liechtenstein. Stefan holds a doctorate from the University of Muenster. Since 2007 he is an Associated Researcher to the BPM Group at Queensland University of Technology and to the ARC funded Center of Excellence for Creative Industries and Innovation (CCI). His main research interests include creativity in IS research as well as Green IT. His research has appeared in the *Communications of the Association for Information Systems*, *Information Systems and e-Business Management*, as well as various international conferences, including the *European Conference on Information Systems (ECIS)* and the *International Conference on Advanced Information Systems Engineering (CAiSE)*.

Alexander Simons is Research Assistant and Ph.D. Candidate of Information Systems at the University of Liechtenstein. He received his B.S. and M.S. in Information Systems from the University of Muenster. Alexander has published in international journals (e.g., *Business and Information Systems Engineering, Information Systems and e-Business Management*) and presented at international conferences (e.g., *Hawaii International Conference on System Sciences*, *European Conference on Information Systems*).

Dr. **Tomáš Skopal** is Associate Professor at Charles University in Prague, Faculty of Mathematics and Physics, School of Computer Science, Department of Software Engineering. He has published, among others, in *ACM Transactions on Database Systems* and *Information Systems*. His fields of interest include similarity search in metric spaces, metric access methods, similarity modeling, database indexing, multimedia databases (image retrieval, content-based retrieval), and information retrieval.

Dr. **Armin Stein** works at the Department for Information Systems at the University of Muenster, from which he holds a doctorate. Also from the University of Muenster, he holds his B.S. and his Diploma in Information Systems. Since 2010 he works as Managing Director of the ERCIS. His research mainly comprises conceptual modeling and supply chain management. His research has appeared in *Enterprise Modelling and Information Systems Architectures* as well as various international conferences, including the *European Conference on Information Systems (ECIS)* and the *International Conference on Conceptual Modeling (ER)*.

Dr. **Stefan Stieglitz** is Assistant Professor at the Department of Information Systems at the University of Muenster. He is Head of the Research Group for Communication and Collaboration Management. Stefan is founder and Academic Director of the Competence Center Smarter Work at the ERCIS. He formerly worked as a project manager in the financial industry and in the Internet economy. His research focuses on economic and social aspects of collaboration software such as the adoption of social media by companies as well as methodologies of social media intelligence. He has published more than forty peer-reviewed articles in international journals such as the *Journal of E-Business (JEB)* as well as at reputable international conferences (e.g. *ECIS, AMCIS, HICSS, IEEE CEC*).

Prof. Dr. **Reima Suomi** is Professor of Information Systems Science at University of Turku, and part-time Professor at Huazhong Normal University, Wuhan, Hubei, China. Currently, he concentrates on topics around the management of networked activities, including issues such as management of telecommunication networks, electronic and mobile commerce, virtual organizations, and telework and competitive advantage through telecommunication-based information systems. The application of IS-enabled governance structures to the management of IS also belongs to his research agenda, as well as the application of information systems in health care.

Prof. Dr. **Gottfried Vossen** is Professor of Computer Science in the Department of Information Systems at the University of Muenster in Germany. He received his master's and Ph.D. degrees as well as the German habilitation all from RWTH Aachen in Germany. He has held visiting positions at UC San Diego, HPI in Potsdam, Karlstad University in Sweden and The University of Waikato in Hamilton, New Zealand. Gottfried is the European Editor-in-Chief of Elsevier's *Information Systems—An International Journal*. In 2008, he additionally became the Scientific Director of Deutsche Informatik-Akademie, the oldest institution for executive IT and computer science education in Germany. Gottfried is author or co-author of more than 200 publications and of more than twenty-five books on databases, business process modeling, the Web, e-commerce, and computer architecture.

Prof. Dr. **Robert Winter** is Full Professor of Business & Information Systems Engineering at University of St. Gallen (HSG), Director of HSG's Institute of Information Management and founding Academic Director of HSG's Executive Master of Business Engineering programme. His primary research interests are consortial projects in the areas of information logistics management (since 1999), enterprise architecture management (since 2000), integration management (since 2002), healthcare networking (since 2005) and corporate controlling systems (since 2006). He is Department Editor of *Business & Information Systems Engineering* (aka *Wirtschaftsinformatik*) as well as Associate Editor of the *European Journal of Information Systems*, *Information Systems and e-Business Management*, *Enterprise Modelling and Information Systems Architectures* and *AIS Transactions on Enterprise Systems*.

Prof. Dr. **Stanislaw Wrycza** is Head of Department of Business Informatics at University of Gdansk, Poland. He was Vice President of the Information Systems Academic Heads International ISAHI (2007-2010) as well as the initiator and President of the Polish Chapter of Association for Information Systems PLAIS (2006–2010). His main areas of research and teaching activities are: business informatics, information system analysis and design, BPM, UML, SysML, databases, e-business, and e-learning. He has written or edited forty books and published over 200 articles in English and Polish in professional journals and international conference proceedings. Stanislaw has published (in Polish) the bestseller manuals entitled *Business Informatics* and *UML2.0 in IS Modelling* as well as co-edited the book *Systems Analysis and Design for Advanced Modeling Methods. Best Practices* in IGI Global, New York, 2009.

Communications of the Association for Information Systems

ISSN: 1529-3181

Communications of the Association for Information Systems