Business Process Frameworks

Constantin Houy, Peter Fettke, and Peter Loos

Abstract In Business Process Management (BPM) research as well as in practice, a whole host of different Business Process Frameworks supporting various tasks connected with BPM in organizations have been introduced and further developed. However, the term Business Process Framework is ambiguous and has been used for different BPM-related systemization approaches concerning BPM methods and techniques. Against the background that so far no attempt to systemize the different meanings and understandings of the term Business Process Framework is known, this article aims at clarifying this term by analyzing and systemizing its different facets giving an overview of available understandings and usages of the term. The identified facets are investigated and several different classes of Business Process Frameworks are described and explained in more detail. In this context, one predominant class of Business Process Frameworks summarizing business process reference models is presented in more detail.

1 Introduction

Business Process Management (BPM) gains more and more importance for practice and an increasing number of organizations use BPM methods and techniques in order to support their operations (Fettke 2009). This makes BPM a highly relevant object of study and development for researchers and practitioners who strive for designing new and innovative BPM approaches and, furthermore, investigate their effects in real world application. In this context, BPM research and practice has created a whole host of so called Business Process Frameworks supporting different tasks connected with BPM in organizations. However, the term Business Process

C. Houy (✉)
Institute for Information Systems (IWi), German Research Center for Artificial Intelligence (DFKI) and Saarland University, Campus, Building D3.2, Saarbrücken, 66123, Germany
e-mail: constantin.houy@iwi.dfki.de

J. vom Brocke and M. Rosemann (eds.), *Handbook on Business Process Management 2*, International Handbooks on Information Systems, Second Edition,
DOI 10.1007/978-3-642-45103-4_6,

Framework is ambiguous and has been used to denominate different BPM-related systemization approaches, BPM methods and techniques etc. The term has not been consistently defined and various understandings can be identified in literature until now. This word sense ambiguity has already been mentioned before, e.g. by Harmon (2014) and process frameworks have been identified an important element of strategic alignment in BPM (Rosemann and vom Brocke 2014). However, so far no attempt to systemize the different meanings and understandings of the term Business Process Framework is currently known and so the term has remained ambiguous.

Against this background, this article aims at further clarifying the term Business Process Framework by means of an investigation and systemization of its different facets and an overview of a selection of different understandings and usages of this term in literature shall be given. Another goal of this article is to clarify the various facets of the term Business Process Framework and the different classes of Business Process Frameworks by means of a more detailed description and explanation of several Business Process Framework instances.

In order to reach the goal of further clarifying the term Business Process Framework, a review and investigation of selected articles referring to Business Process Frameworks is our research approach. We report on different usages and understandings of the term Business Process Framework in literature and systemize different identifiable instances into consistent classes of Business Process Frameworks.

This article is structured as follows: after this introduction, the second section analyses the ambiguity of the term Business Process Framework in more detail based on an investigation of frameworks in the context of BPM research and the clarification of different possible facets of the term *business process* as well as the term *framework*. A classification of identified understandings of the term Business Process Framework is given. In Sect. 3, each of the different Business Process Framework classes are described in more detail and explained by means of according framework instances. In this context, we especially focus on some Business Process Framework instances *in the sense of business process reference models* and also report on empirical insights concerning real world effects of using reference models in practice. Section 4, discusses the findings of our investigation before the article is summarized and concluded in Sect. 5.

2 Business Process Frameworks: An Ambiguous Term

2.1 Frameworks in Business Process Management Research

Frameworks in general are highly relevant in the context of Information Systems (IS) research as they commonly provide a systemization or overview of relevant objects or phenomena in a certain domain of interest. The general term *framework* has, furthermore, quite often been used in the context of BPM research addressing a

whole host of different aspects of BPM, e.g. Rosemann and vom Brocke (2014) develop a framework for the description of Six Core Elements of BPM which supports structuring BPM as a holistic approach; Tregear (2014) introduces a *Global BPM framework* for process standardization supporting BPM in globalized organizations; Bhat et al. (2014) differentiate several classes of *Business Process Management Frameworks*, e.g. maturity models with according assessment tools as well as BPM lifecycle methodologies (pp. 333f.) and use a specific *Business Process Management Adoption Framework* in order to investigate Business Process Outsourcing effects. In summary, frameworks play an important role in BPM research and the term *Business Process* Management *Framework* has been used for the description of many different aspects of BPM.

This plurality of meaning can also be observed for the term *Business Process Framework*. In literature, the term Business Process Framework is used very differently, e.g. Harmon (2014) mentions this ambiguity but predominantly understands Business Process Frameworks as reference process models or organizational best practices like the *IT Infrastructure Library* (ITIL) or the *Enhanced Telecom Operations Map* (eTOM), while Scheer (1998) uses the term Business Process Frameworks in the sense of methodical engineering approaches for business processes and process-oriented IS addressing technical infrastructure, organizational aspects as well as existing business objects. Table 1 gives an exemplary overview of different usages and understandings of the term Business Process Framework in literature.

This exemplary enumeration of different usages of the term Business Process Framework illustrates the mentioned term ambiguity in literature. We assume that this ambiguity is related to two different aspects: the ambiguity of the term *business process* as well as the ambiguity of the term *framework*.

2.2 Term Clarification "Business Process"

According to the Cambridge Dictionary[1] a *process* in general is "a series of actions that you take in order to achieve a result". The term *business process* can accordingly be understood as a sequence of actions carried out in a business context for the creation of goods and services. In common speaking as well as in literature the term business process can occur in different contexts. For the clarification of its meaning it is important to ask, whether (a) a business process in the *real world* or in the *model world* is addressed and, furthermore, (b) if we are talking about a business process *instance* or a business process *schema*. The influence of these two dimensions will be explained in more detail in the following.

As already mentioned, the term business process can address both sequences of executions which can be observed in the *real world* and sequences of intended

[1] http://dictionary.cambridge.org

Table 1 Different usages of the term *Business Process Framework*

Source	Underlying understanding of the term *Business Process Framework*	Given examples
Scheer (1998, pp. 109ff.)	Engineering approaches for process-oriented IS adressing technical infrastructure (e.g. workflow systems), organizational aspects (systemization of relevant domains) as well as existing business objects	Architecture of Integrated Information Systems (ARIS), Zachman Framework, CIMOSA
Otto and Wäsch (2003, pp. 427ff.)	Standardized technical interchange infrastructures for inter-organizational business process models supporting reduction of complexity and costs of process modeling	ebXML, RosettaNet, WSCI, BizTalk, WSFL, BPEL4WS
Pickering and Wynn (2004, pp. 377ff.)	Reference business processes and relevant views and functions for the support of team collaboration and project management in organizations. The term describes a systemization of processes in a domain	Business Process Framework for Global Team Collaboration
Barros (2007, pp. 47ff.)	The term *Business Process Frameworks* appears in this article's title. However, in the text, the author mostly uses the term *business process pattern* or *structure*. Nevertheless, Business Process Frameworks in the sense of best practice process models or reference models are mentioned	Supply Chain Operations Reference (SCOR) Model, enhanced Telecom Operations Map (eTOM)
Hrastnik et al. (2007)	The term *Business Process Framework* is used as a synonym for a *Business Process Knowledge Framework*. This framework represents a systemization of relevant knowledge for different central roles and perspectives in a business process	A new Business Process Knowledge Framework
Yuan and Shen (2007, p. 676)	The term *Business Process Frameworks* appears in this article's title. It is not clearly defined in the text but can be interpreted based on the context. It is used in the sense of a technical infrastructure for the management of workflows	SwinDeW, SwinDeW-B as decentralized workflow management systems
Boukhebouze et al. (2009, pp. 502ff.)	Technical infrastructure for business integration and the support of flexible and reliable workflows	Business Process Framework for Agility of Modelling and Analysis (BP-FAMA)
Harmon (2014, pp. 60ff.)	"Business Process Frameworks (also called Operation Reference Frameworks) [. . .] provide a quick way for a company to establish a high-level process architecture"; best practice process models or reference models	SCOR Model, Information Technology Infrastructure Library (ITIL)

(continued)

Table 1 (continued)

Source	Underlying understanding of the term *Business Process Framework*	Given examples
Karagiannis and Woitsch (2014, pp. 466ff.)	"A set of assumptions, concepts, values, and practices that constitute a way of viewing BPM" referring to four concepts: (1) business models, (2) regulations, (3) domain and (4) model processing	Detailed explanations and many examples for the four concepts are given
Vo et al. (2011, p. 990)	Technical and organizational reference structure (technical infrastructure and business processes) for a certain domain in organizations (asset management)	RFID-based business process framework for asset management

executions documented in the form of a process model (*model world*). A clear differentiation between the term *business process* related to the real world on the one hand and related to the model world on the other hand seems highly important as this term indeed has different meanings depending on the context. As far as the *model world* is concerned, a business process can be represented in different ways and using different types of methods and techniques (Desel and Juhás 2001). In literature, a common classification differentiates (I.) *informal*, (II.) *semi-formal* and (III.) *formal* representations of business processes. However, there are also different opinions in literature concerning how these classes of representations can be distinguished in detail and what the exact criteria for this differentiation are.

The mentioned (I.) *informal* representations are typically considered to comprise business process description in free prose (Markovic 2010), e.g. a transcript of an interview with an employee concerning the sequences of executions commonly performed at her workplace for the documentation of as-is processes.

As natural language can be ambiguous and is likely to be interpreted differently, there have been several initiatives towards the development of formalized business process representations. A first step towards a more formal and standardized representation of business processes has been the introduction and usage of graphical elements and symbols with a standardized meaning in graphical business process models. This resulted in methods and techniques which support – besides several other tasks – the development of technical drawings of processes, e.g. *Event-driven Process Chains* (EPCs), the *Business Process Model and Notation* (BPMN) or *UML Activity diagrams*. In literature, such representations are often considered to be (II.) *semi-formal*. One important purpose of these modeling techniques is the graphical representation of business processes.

However, in the meanwhile several of these business process representation techniques have been further developed and stronger formalizations have been proposed in order to have a (III.) *formal* representation of business process models, e.g. for EPCs by van der Aalst (1999) or Nüttgens and Rump (2002). In this context, two different types of formalizations can be distinguished: (*a*) formal

representations by means of mathematical expressions and structures based on set theory or first-order logic, and (*b*) formal representations by means of a formal language in the sense of the field of theoretical computer science. A formal language in the sense of theoretical computer science is a finite set of strings of symbols (Davis et al. 1994). In this context, formal languages can support several different purposes: (1) the provision of a machine-readable representation of a process model in order to make them interchangeable, e.g. the *Event-driven Process Chain Markup Language* (EPML) or the *ARIS markup language* (AML) for EPC models, and (2) the provision of a machine-readable representation of a process model in order to make them executable by means of a process engine (*execution semantics*).

Furthermore, as already mentioned above the exact meaning of the term business process also depends on the differentiation between process *instances* (tokens) or process *schemata* (types). This results in the following classes of business processes (represented in Fig. 1):

1. According to the above definition of a business process, a *business process instance* in the *real world* describes a unique and singularly happening sequence of executions in a business context, e.g. production process #1111 concerning article #2222 performed on the 1th of July 2013 in the Example Company's plant #15. Its existence is actually independent of the existence of a process model or an information system.
2. A *business process schema* in the *real world* is the common schema of execution steps which all the production processes in an organization typically follow, e.g. concerning the article #2222 produced by the Example Company. This schema does not necessarily have to be documented by means of a process model and is actually also independent of an IS.
3. A *business process instance* in the *model world* is the unique graphical or informal representation (e.g. EPC diagram or a textual description printed on one particular sheet of paper), or a formal representation (EPML code running on one particular computer) of a sequence of executions in a business context. The latter example typically represents a process instance in the real world, e.g. a currently running workflow instance. However, as already mentioned above, a process model can exist independently of a business process in the real world and vice versa.
4. A *business process schema* in the *model world* is a graphical (e.g. EPC diagram), a formal (e.g. EPML code) or an informal (e.g. prose) representation of a documented, intended or suggested sequence of executions, e.g. a business process model which is contained in the SAP reference model.

In conclusion, it can be stated that the term business process can have several different meanings. Thus, the underlying understanding of business process is likely to influence intended meanings of the term Business Process Framework, which will also be indicated in the following sections in more detail.

	Model world	Real world
Type	graphical, formal or informal representation of an intended sequence of executions, e. g. business process reference model	common execution steps which all the production processes in an organization follow
Token	unique graphical, formal or informal representation of a sequence of executions, e. g. an EPC diagram printed on one particular sheet of paper	unique and singularly happening sequence of executions in a business context

Fig. 1 Different meanings of the term *business process*

2.3 Term Clarification "Framework"

As already mentioned, the development of frameworks plays an important role in IS research. However, the term *framework* is generally used in many different senses in IS research and, as has been shown, especially in the context of BPM research. This is probably also related to the fact that the general English term *framework* has several different meanings. Besides other meanings which are probably less important for IS research, e.g. *the parts of a building or an object that support its weight and give it shape*, framework – according to the Cambridge Dictionary[2] as well as the Oxford Advanced Learner's Dictionary[3] – can have the following meanings:

1. *a set of beliefs, ideas or rules that is used as the basis for making judgements, decisions, etc.* and
2. *the structure of a particular system.*

Both interpretations are valid for BPM research compared to the different usages and understandings of the term Business Process Framework which we have seen in Table 1. This will also be shown in more detail after the introduction of our classification of the usages and understandings of the term Business Process Framework in literature by means of a mapping of these two meanings of the term *framework* onto our Business Process Framework classes in the following section.

[2] http://dictionary.cambridge.org

[3] http://oxfordlearnersdictionaries.com

2.4 A Classification of Business Process Frameworks

As we have already seen, several different classes of Business Process Frameworks can be identified in literature. During our investigation, we discovered that in some of the contributions the term Business Process Framework has been used as a shorter form for unique and specific frameworks in the context of BPM like the Business Process Knowledge Framework by Hrastnik et al. (2007) or the Business Process Framework in the sense of a set of assumptions, concepts, values, and practices for BPM by Karagiannis and Woitsch (2014). Moreover, we found characteristic usages and understandings of the term Business Process Framework which can be identified significantly more often than others in literature. In the following, these serve as our Business Process Framework classes. Figure 2 summarizes these characteristic classes.

The first major class of Business Process Frameworks in our classification subsumes methodical business process engineering approaches, e.g. the *Architecture of Integrated Information Systems* (ARIS) (Scheer 1998), the *Zachman Framework* (Zachman 1987), the *Computer Integrated Manufacturing Open System Architecture* (CIMOSA) (AMICE 1993) etc. Such engineering approaches support the development of process-oriented IS, the definition of process models and not only propose the structure of such IS but sometimes also provide according procedure models and according software implementations supporting BPM in practice. For such Business Process Frameworks the second meaning of the general term *framework* given above (*structure of a system*) is relevant in the first place as these business process engineering approaches basically provide systemizations of underlying structures of process-oriented IS. However, they also provide certain beliefs, ideas and rules for taking decisions for the design of such systems. Thus, also the second given meaning of frameworks applies for this Business Process Frameworks class.

The second Business Process Frameworks class summarizes technical infrastructures for process integration and for the interchange of business process models, e.g. XML-based approaches like the *XML Process Definition Language* (XPDL) or the *ebXML Business Process* (ebBP) OASIS standard. These technical infrastructures provide the basis for formal representations of business process models (*model world*) and the execution of singular process instances in the real world by means of workflow systems. Concerning this Business Process Frameworks class, the second meaning of *framework* which is related to structural aspects of a system is relevant.

The third major class which also represents the most common understanding of the term Business Process Framework summarizes so called business process reference models which are often representations of best practice processes, e.g. the *Supply Chain Operations Reference Model* (SCOR), the *Information Technology Infrastructure Library* (ITIL) or the *Control Objectives for Information and Related Technology* (COBIT). Reference models are process descriptions (*model world*) which can provide the basis for real world process instances.

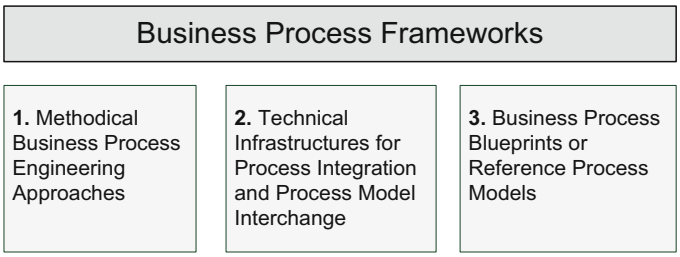

Fig. 2 An overview of different types of Business Process Frameworks

Looking at the interpretation of Business Process Frameworks in the sense of reference models, both of the above meanings of the term *framework* are relevant. Reference models are often interpreted as prescriptions of *how* a real world business processes could or should be conducted. They contain certain *believes* and *ideas* aiming at the improvement of a process-oriented organization. Furthermore, the structural aspects of reference process models are especially important as business process models represent a structure of work in an organizational system or sub-system.

In the following section, these different classes of Business Process Frameworks and selected instances of Business Process Frameworks are presented in more detail. We first introduce exemplary Business Process Frameworks in the sense of business process engineering approaches, then some exemplary technical infrastructures for process integration and process model interchange before we put a stronger focus on established business process reference models.

3 Description of Exemplary Business Process Frameworks

3.1 Methodical Business Process Engineering Approaches

A whole host of methodical engineering approaches for process-oriented IS have been presented in literature. Furthermore, several according software prototypes exist. Therefore, we can only introduce a selection of Business Process Frameworks in this sense in the following. However, these frameworks have in common that they typically provide a systemization of domain-independent approaches, methods and techniques for the development of process-oriented IS considering different views and perspectives on involved systems and business processes.

The *Architecture of Integrated Information Systems* (ARIS) is a comprehensive methodical framework for the design of process-oriented IS. It provides a holistic view on business processes comprising the *organizational view*, the *data view*, the *function view*, the *output view* and the *control view* (Scheer 1998). In addition, the ARIS phase model defines several consecutive development phases (*requirements*

definition, *IS concept* and *implementation description*) which are relevant for each view and, furthermore, necessary for a structured development of integrated IS. Besides offering an architecture for process-oriented IS, the ARIS concept provides the basis for several concrete modeling methods and techniques as well as software implementations for business process modeling. The ARIS platform offers comprehensive functionality in the context of BPM in general, e.g. the development of the business process strategy, business process implementation, business process monitoring or business process controlling.[4]

The *Zachman Framework* was initially developed in the late 1980s as a domain-independent approach providing guidelines and a systemization of roles and perspectives as well as and their specific requirements which should be considered during the development of IS (Zachman 1987). Based on the insight that the size and complexity of IS implementations as well as enterprises in general keep increasing and, furthermore, that individual perspectives on a complex system matter ("Architecture is relative. What you think architecture is depends on what you are doing", Zachman 1987, p. 291) this systemization of relevant roles (*planer*, *owner*, *designer*, *builder*, *programmer* and *user*, p. 284ff.) and perspectives (*data*, *function*, *network*, *people*, *time* and *motivation*) for individual IS development has been proposed as a two-dimensional framework and further developed into a comprehensive multi-dimensional Enterprise Architecture Framework.[5]

The *Computer Integrated Manufacturing Open System Architecture* (CIMOSA) has been developed in the early 1990s (AMICE 1993). Although the underlying research projects of this initiative focussed on the development of an open system architecture for CIM, the CIMOSA can support enterprise modeling in general and has some similarities compared with ARIS (Scheer 1998). The CIMOSA architecture (*the CIMOSA cube*) is represented by three dimensions: the "stepwise generation" dimension (*function view*, *information view*, *resource view* and *organization view*) which is comparable to the views in ARIS, "stepwise derivation" (*requirements definition*, *design specification*, *implementation description*) which is comparable to the ARIS phase concept and "stepwise instantiation" which describes the necessary individualization of concepts during the development from basic requirements (*generic*), to industry specific requirements (*partial*) to enterprise specific requirements (*particular*) (Scheer 1998). Former and current research on CIMOSA as well as software implementations supporting enterprise modeling according to the CIMOSA approach can be accessed via the website of the CIMOSA Association.[6]

Additionally, we would like to mention further examples of Business Process Frameworks in the sense of methodical business process engineering approaches which are of relevance for Enterprise Modeling and BPM such as *Multi-Perspective Enterprise Modelling* (MEMo) by Frank (1994), the *Semantic Object Model* (SOM)

[4] http://www.softwareag.com/de/products/aris/default.asp

[5] Zachman (2008): http://www.zachman.com/about-the-zachman-framework

[6] http://www.cimosa.de/

by Ferstl and Sinz (1995), *ProMet* by Österle (1995) or *The Open Group Architecture Framework* (TOGAF).[7] In the following section Business Process Frameworks in the sense of technical infrastructures for process integration and process model interchange will be treated.

3.2 Technical Infrastructures for Process Integration and Process Model Interchange

The second major class of Business Process Frameworks summarizes technical infrastructures for process integration and process model interchange. In this area, several different specifications have been developed based on the specific tasks which are supposed to be supported, e.g. process model interchange between different modeling or workflow tools, inter-organizational process integration or web service orchestration. In the following, some examples of such technical infrastructures will be presented in order to further clarify this specific interpretation of the term Business Process Framework.

The *XML Process Definition Language* (XPDL) is an XML-based standard for the exchange of business process models and has been developed and advanced by the *Workflow Management Coalition* (WfMC) since 1993. The current version 2.2 has been released in 2012 and supports a graphical representation of XPDL specifications by means of the *Business Process Model and Notation* (BPMN) 2.0 standard.[8] Furthermore, XPDL facilitates the interchange of BPMN diagrams in general, also for earlier versions of the BPMN up to version 1.2.[9] This distinguishes XPDL from similar XML-based standards like the *Web Services Business Process Execution Language* (WS-BPEL) which mainly focusses on business process execution and not so much on graphical representation aspects. WS-BPEL is a description language for business processes comprising functions and activities which are implemented as web services.[10] The WS-BPEL has been extended by the so called *WS-BPEL Extension for People* (BPEL4People) specification which additionally considers process activities conducted by humans in BPEL processes.[11]

The *ebXML Business Process* (ebBP) OASIS standard is another XML-based standard for the technical specification of business processes.[12] It especially aims at supporting inter-organizational business process integration and is based on the former process integration standard *eBusiness Extensible Markup Language*

[7] http://www.togaf.org/

[8] http://www.wfmc.org/xpdl.html

[9] http://www.xpdl.org/

[10] http://docs.oasis-open.org/wsbpel/2.0/OS/wsbpel-v2.0-OS.html

[11] http://docs.oasis-open.org/bpel4people/bpel4people-1.1-spec-cd-06.pdf

[12] http://ebxml.xml.org/bp

(ebXML) which has also been developed by the *Organization for the Advancement of Structured Information Standards* (OASIS).[13]

Besides these quite current business process integration approaches, many other technical infrastructures and approaches exist – some of them meanwhile obsolete – like *Workflow-XML* (Wf-XML) by the WfMC[14] or the *Business Process Modeling Language* (BPML) by the *Business Process Management Initiative* (BPMI).[15] In the following section, we present several Business Process Frameworks in the sense of business process reference models in more detail.

3.3 Business Process Reference Models

3.3.1 What Is a Business Process Reference Model?

The term business process reference model has not been consistently defined and there is still a lively discussion which aspects this term comprises. This discussion shall not be comprehensively recapitulated in this contribution. In general, business process reference models can be understood as business process models which should fulfil certain criteria and offer certain features. These criteria are still under discussion, e.g. in (vom Brocke 2003; Thomas 2006; Fettke and Loos 2007). Referring to Fettke and Loos (2007) and Ardalani et al. (2013), we consider the following features as important:

1. **Reusability**: Business process reference models represent business process blueprints for the development of process-oriented IS which can be reused in different IS development projects (vom Brocke 2007).
2. **Exemplary practices**: Business process reference models can provide common, good or even best practices describing how business processes are actually designed in practice or how they could or should be designed and executed in order to reach certain goals. In this context, a descriptive as well as a prescriptive or even normative connotation of business process reference models becomes apparent depending on their interpretation.
3. **Universal applicability**: Business process reference models do not only represent business processes of one particular organization but aim at providing universally applicable business process representations which are valuable for different organizations in a certain domain.

Reference models can provide benefits for both theory and practice. Besides the provision of general descriptions of enterprises, which is especially interesting from a theoretical point of view, practice profits, e.g. from decreases in modeling costs,

[13] https://www.oasis-open.org/

[14] http://www.wfmc.org/wfmc-wf-xml.html

[15] http://www.bpmi.org/

modeling time and modeling risk as reference models can represent proven solutions (Becker and Meise 2011). Moreover, increases in model quality based on the reuse and adaption of already validated process models can be expected.

Prominent examples for reference models which have been extensively used in practice in order to profit from these advantages are, e.g. the *Y-CIM Model* by Scheer for industrial enterprises (Scheer 1994) or the *SAP reference model* as a basis for the SAP R/3 system which has been partly published in (Keller and Teufel 1998). An overview of a collection of reference models is provided by the Reference Modeling Catalogue hosted by the Institute for Information Systems (IWi) at the DFKI and Saarland University, Saarbrücken.[16] In the following, we present a selection of relevant Business Process Frameworks in the sense of business process reference models: the SCOR Model, ITIL, eTOM and the APQC Process Classification Framework^{SM} (PCF).

3.3.2 Supply Chain Operations Reference (SCOR) Model

The *Supply Chain Operations Reference* (SCOR) *Model* is a process-oriented reference model for supply chain management which has been introduced in 1996 and further developed by the Supply Chain Council.[17] After several revisions, the SCOR model has been available in version 10 since August 2011. While at first only the 69 founding members were part of the Supply Chain Council, the Council now comprises almost 1,000 companies and research institutions.[18]

The SCOR model defines five different types of processes in organizations. Their relationship is visualized by means of a multi-stage supply chain in Fig. 3:

1. **Plan**: includes the planning and management of supply and demand for goods.
2. **Source**: comprises the purchase of goods, the goods receipt, pre-delivery check, storage and method of payment for any goods.
3. **Make**: covers all stages of production processing.
4. **Deliver**: comprises all the steps of the ordering and delivery of goods to the customers.
5. **Return**: includes all the steps for handling returned goods, both repairs and maintenance are taken into account.

In the study of Fettke (2008) the real world effects of using the SCOR model have been investigated based on different theoretical perspectives, such as the market-based view, the resource-based view and network theory. Moreover, the hypothesis saying that the application of the SCOR model comes with positive effects on typical supply chain management goals is supported by an empirical

[16] http://rmk.iwi.uni-sb.de/

[17] http://supply-chain.org/scor

[18] http://supply-chain.org/about/history

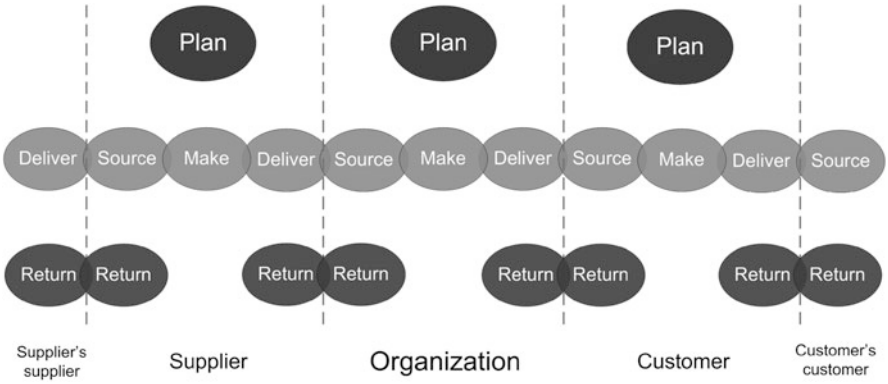

Fig. 3 SCOR model process types in a supply chain (According to: http://supply-chain.org/)

study which has addressed all members of the Supply Chain Council. Furthermore, Bolstorff et al. (2007, p. 27) report on additional experiences with the SCOR model:

1. Increase of total income by three per cent after a SCOR project through the reduction of costs and the improvement of customer services;
2. Two to six fold return on capital within 12 months after completion of the SCOR project;
3. Lower operating costs for information technology;
4. One to three per cent increase in annual operating profit.

Besides these findings, a recent survey identified positive impacts of using the SCOR model on *customer-facing supply chain quality performance* and *internal-facing business performance* (Li et al. 2011). Another survey could also confirm several positive influences of using the SCOR model on supply chain management performance (Zhou et al. 2011).

3.3.3 Information Technology Infrastructure Library (ITIL)

The *Information Technology Infrastructure Library* (ITIL) represents a business process framework for IT service management (ITSM) which is widely accepted and applied in professional IT service organizations.[19] The current version ITILv3 has been published in 2007 and updated in 2011. ITIL is considered a de-facto standard for ITSM and describes standardized *key processes*, *key concepts and principles, key roles and responsibilities* as well as according KPIs and checklists in five different areas of ITSM. Concerning ITILv3, for each of these areas one separate volume with detailed process descriptions in the following areas has been published: (1) *ITIL Service Strategy* which supports the definition of an

[19] http://www.itil-officialsite.com/

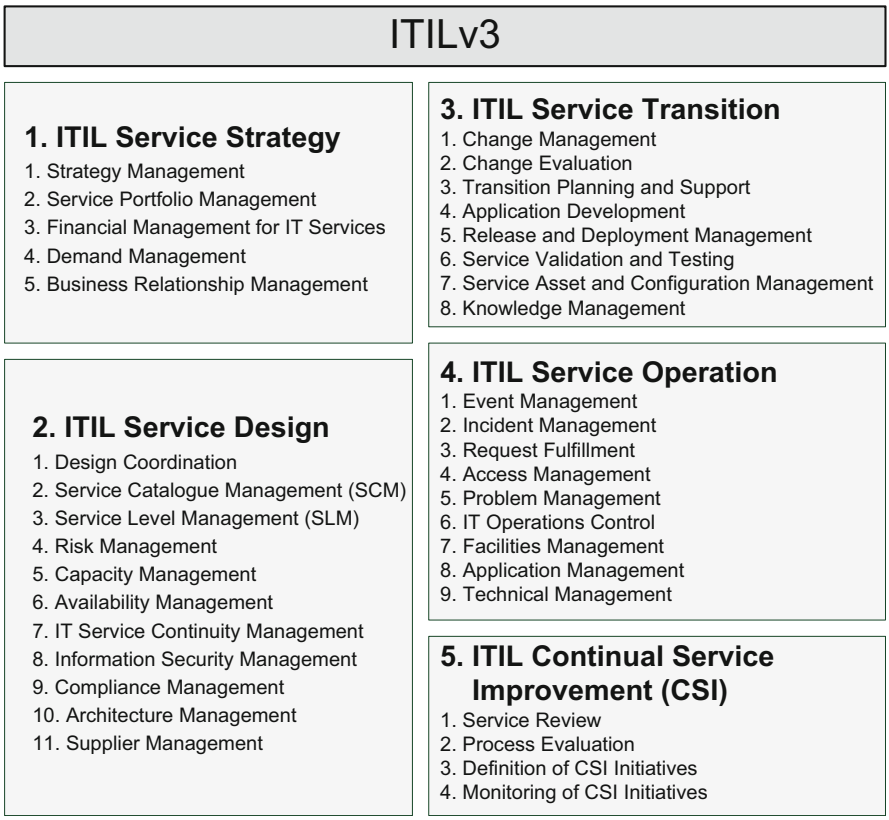

Fig. 4 ITILv3 core processes

adequate IT service strategy in the sense of a longer term development of IT service skills under special consideration of the customer requirements, (2) *ITIL Service Design* which supports the development of new IT services and solutions as well as the further development of existing services based on the service strategy, (3) *ITIL Service Transition* which supports the coordination of the IT services' development and deployment, (4) *ITIL Service Operation* which supports an effective and efficient IT service fulfillment and (5) *ITIL Continual Service Improvement (CSI)* which uses methods of quality management in order to continuously learn from success and failure to improve IT services. Figure 4 visualizes these five areas of the ITILv3 and the according core processes within these areas.

As ITIL represents the de-facto standard for ITSM, a large amount of experience with the usage of ITIL in practice exists. Furthermore, there is quite an amount of empirical studies conducted by scholars reporting on the positive effects of ITIL usage on IT service organizations' performance, e.g. Henson and Geray (2010) or Meziani and Saleh (2010) in the context of service management in public administration settings or Lapão et al. (2009) in the context healthcare environments.

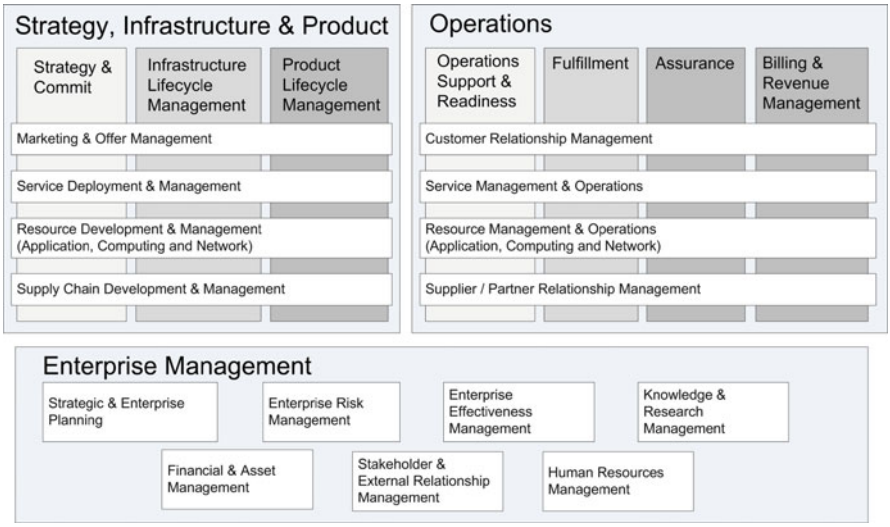

Fig. 5 eTOM architecture (Level 0 and 1) (According to: http://www.tmforum.org/Overview/13763/home.html)

Furthermore, there are some recent studies on factors influencing ITIL adoption, e.g. the contribution of Cater-Steel et al. (2009) or the comprehensive international survey by Marrone and Kolbe (2011) which reports on the ever-increasing ITIL adoption and the increasing realized operational benefits caused by the usage of ITIL.

3.3.4 Enhanced Telecom Operations Map (eTOM)

The *enhanced Telecom Operations Map* (eTOM) represents a business process reference model for the telecommunications industry which has been introduced by the TM forum as their Business Process Framework.[20] It provides a detailed description of relevant business processes for service providers based on a four-level-hierarchy. Figure 5 shows Level 0 and Level 1 within the eTOM process hierarchy.

Level 0 represents the overall enterprise level and defines the three major sections: a. *Strategy, Infrastructure & Product,* b. *Operations* and c. *Enterprise Management*. Level 1 "contains seven end-to-end vertical Level 1 process groupings in the areas of Strategy, Infrastructure and Product and Operations. These vertical groupings of processes focus on end-to-end activities [...] and each grouping includes processes involving customers, supporting services, resources and suppliers/partners. [...] The horizontal groupings represent major programs or

[20] http://www.tmforum.org/

functions that cut horizontally across an enterprise's internal business activities."[21] More detailed process definitions exist on level 2 and level 3 of the eTOM specification.

In practice, a certain amount of experience with the application of eTOM exists as it is one of the most popular standards for managing business processes in the telecommunications industry (Tanovic and Androulidakis 2011). However, so far there are only few empirical studies driven by scholars concerning the real world effects of eTOM; e.g. Chou et al. (2008) report on a successful application of eTOM especially in the context of trouble management operations in the largest Taiwan telecommunications corporation resulting in an improved performance and improved user satisfaction.

3.3.5 APQC Process Classification Framework[SM]

The *APQC Process Classification Framework*[SM] (PCF) provides a comprehensive taxonomy of operating processes as well as management and support processes. The PCF supports benchmarking of organizational performance within one or among organizations "regardless of industry, size or location" of the compared organizations by means of a common terminology to describe and compare business processes.[22] It has been developed by the *American Productivity & Quality Center* (APQC) since the early 1990s and the current version 6 comprises more than 1,000 relevant business processes. Besides the cross-industry version, several industry-specific versions of the PCF exist, e.g. for retail, automotive, telecommunications, education. The content of the PCF is organized into the following five levels[23]:

- **Level 1**: *Category,* represents the highest level of processes in enterprises such as financial organization, human resources etc. One example of a category in PCF version 6 is "*1.0 Develop Vision and Strategy (10002)*".
- **Level 2**: *Process Group,* represents connected groups of business processes within one category. One example of a process group in PCF version 6 is "*1.1 Define the business concept and long-term vision (10014)*".
- **Level 3**: *Process,* represents a sequence of interrelated activities converting input into output. One example of a process in PCF version 6 is "*1.1.1 Assess the external environment (10017)*".
- **Level 4**: *Activity,* comprises key events performed during the execution of a process. One example of an activity in PCF version 6 is "*1.1.1.1 Analyze and evaluate competition (10021)*".

[21] http://www.tmforum.org/Overview/13763/home.html

[22] http://www.apqc.org/process-classification-framework

[23] According to the framework description on: http://www.apqc.org/knowledge-base/documents/apqc-process-classification-framework-pcf-cross-industry-pdf-version-600

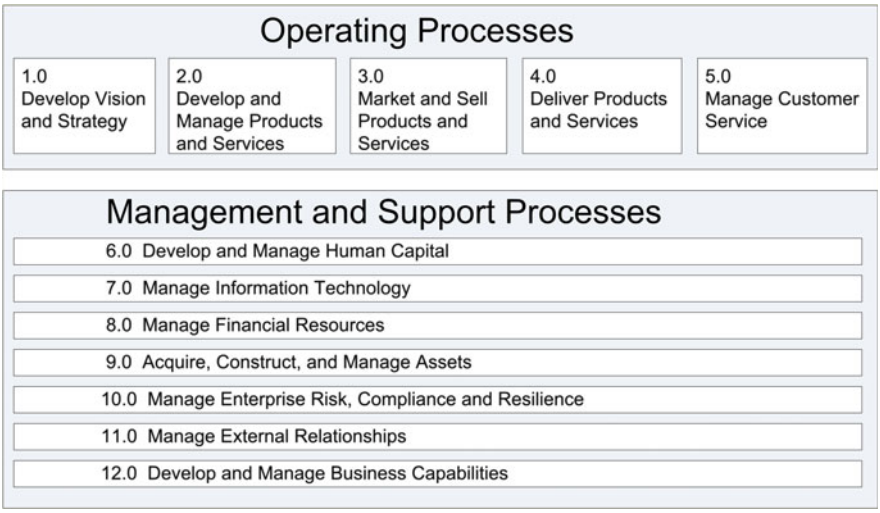

Fig. 6 Overview of categories in the APQC Process Classification Framework[SM]

- **Level 5**: *Task,* next level of decomposition after activities, more fine-grained. One example of a task in PCF version 6 is "*12.2.3.1.1 Identify project requirements and objectives (11117)*".

Figure 6 gives an overview of the process categories contained in the PCF.

According to the APQC reporting, the PCF has been used for business process management and benchmarking in many different businesses in the last two decades worldwide and several practical case studies providing detailed experiences with the PCF in renowned companies from different industries exist.[24] Furthermore, the PCF has been used as a systemization approach for business processes as a fundament for scientific empirical studies and surveys, e.g. concerning IT and business process alignment (Cragg et al. 2007; Cragg and Mills 2011) and in the context of comparing service offerings in business transformation projects (Srivastava and Mazzoleni 2010).

4 Discussion

Our investigation showed that the term Business Process Framework is ambiguous and that quite a number of different understandings and usages of this term exist. However, on the basis of our underlying definitions of *business process* and *framework* and the commonly identified understandings an expedient systemization of Business Process Frameworks could be developed. Presenting several instances

[24] http://www.apqc.org/apqcs-process-classification-framework-case-studies

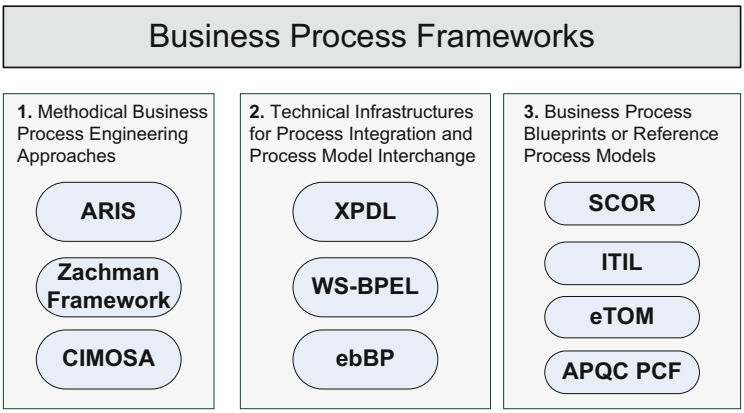

Fig. 7 Business Process Framework classes and instances

of each understanding of the term Business Process Framework could further clarify the specific subtleties of each framework class.

During our investigation, several quite similar Business Process Frameworks within the different classes have been identified, e.g. ARIS and CIMOSA as methodical business process engineering approaches, XML-based process model interchange and process integration infrastructures like XPDL and ebBP or ITIL and eTOM as reference models. Figure 7 gives an overview of Business Process Frameworks within the according classes which have been presented in this contribution.

The similarity of these Business Process Frameworks makes the topic of mapping frameworks which belong to the same class an interesting subject-matter. In the above mentioned cases there are several intersections and considerable overlapping of addressed content of Business Process Frameworks e.g. comparing ITIL and the COBIT framework, another valuable IT governance framework. In this comparison also several differences in content between such Business Process Frameworks are observable. In practice, this can lead to severe problems when both frameworks could provide important functionality for an organization. In such a context, the mapping of the Business Process Frameworks in terms of terminology, procedure models etc. is highly desirable in order to be able to profit from a combination of functionalities. Such mapping initiatives exist for several Business Process Frameworks, e.g. ITIL and COBIT[25] or ITIL and eTOM.[26] Furthermore, the mapping of Business Process Frameworks in order to combine functionality and to profit from the strengths of every single approach also seems promising for the other classes of frameworks.

[25] https://www.isaca.org/

[26] http://www.tmforum.org/RelationshiptoITIL/11744/home.html

Investigating Business Process Frameworks in the sense of reference models, we found that empirical research concerning the real world effects and relevant characteristics like factors influencing the adoption of a Business Process Framework has so far only been conducted to a moderate extent. In order to assess these empirically observable effects in more detail, more empirical research into this seems to be desirable besides the design of new and innovative Business Process Frameworks.

5 Conclusion

Business Process Frameworks are of considerable importance in Business Process Management practice and research. In this contribution, we investigated the research community's underlying understanding and usage of the term Business Process Framework which showed to be an ambiguous term with different meanings. We introduced a systemization of common understandings and presented several Business Process Frameworks which have been relevant for BPM research and practice in recent years. Thereafter, we discussed our results.

Our assumption that the two central terms *business process* and *framework* seem to influence the Business Process Frameworks term ambiguity seems plausible to a certain extent. In our investigation we found that important aspects and meanings of these underlying terms can be found in the different interpretations of the term Business Process Framework and in the content dimensions of the presented frameworks.

Future work concerning Business Process Frameworks should – besides the design and further development of innovative frameworks – concentrate on the empirical assessment of the effects of existing Business Process Frameworks in the real world. A further-going investigation of the possibilities of mapping similar Business Process Frameworks could support a better understanding of how valuable functionalities could be combined and, thus, made accessible for practice. However, in this context it has to be further investigated how engineering challenges concerning the maintenance of framework mappings could be faced in order to have consistent and at the same times flexible Business Process Frameworks.

Acknowledgements The research described in this paper was partly supported by a grant from the German Research Foundation (DFG), project name: "Pluralistische Beurteilung der Qualität von Unternehmensmodellen – Qualitätsdiskurse und Diskursqualität innerhalb der Wirtschaftsinformatik (PluralistiQue)", support code LO 752/4-1, and partly supported by a grant from the German Research Foundation (DFG), project name: "Konzeptionelle, methodische und technische Grundlagen zur induktiven Erstellung von Referenzmodellen (Reference Model Mining)", support code GZ LO 752/5-1.

References

AMICE EC (ed) (1993) CIMOSA – open systems architecture for CIM. Springer, Berlin
Ardalani P, Houy C, Fettke P, Loos P (2013) Towards a minimal cost of change approach for inductive reference model development. In: Proceedings of the 21st European conference on information systems (ECIS 2013). AIS, Utrecht
Barros O (2007) Business process patterns and frameworks: reusing knowledge in process innovation. Bus Process Manage J 13(1):47–69
Becker J, Meise V (2011) Strategy and organizational frame. In: Becker J, Kugeler M, Rosemann M (eds) Process management. A guide for the design of business processes. Springer, Berlin, pp 91–132
Bhat JM, Fernandez J, Kumar M, Goel S (2014) Business process outsourcing: learning from cases of a global offshore outsourcing provider. In: vom Brocke J, Rosemann M (eds) Handbook on business process management, vol 2, 2nd edn. Springer, Heidelberg, pp 443–470
Bolstorff PA, Rosenbaum RG, Poluha RG (2007) Spitzenleistungen im Supply Chain Management – Ein Praxishandbuch zur Optimierung mit SCOR. Springer, Berlin
Boukhebouze M, Amghar Y, Benharkat A-N, Maamar Z (2009) Towards self-healing execution of business processes based on rules. In: Filipe J, Cordeiro J (eds) Enterprise information systems, LNBIP, vol 24, Springer, Berlin, pp 501–512
Cater-Steel A, Tan W-G, Toleman M (2009) Using institutionalism as a lens to examine ITIL adoption and diffusion. In: 20th Australasian conference on information systems (ACIS 2009), Melbourne, pp 321–330
Chou T-H, Seng J-L, Lin B (2008) eTOM and e-services based trouble-management operations: a large scale telecom case study. Int J Technol Manage 43(4):383–403
Cragg P, Mills A (2011) IT support for business processes in SMEs. Bus Process Manage J 17 (5):697–710
Cragg P, Tagliavini M, Mills A (2007) Evaluating the alignment of IT with business processes in SMEs. In: 18th Australasian conference on information systems (ACIS 2007), Toowoomba, pp 38–48
Davis M, Sigal R, Weyuker EJ (1994) Computability, complexity, and languages: fundamentals of theoretical computer science, 2nd edn. Academic Press, San Diego
Desel J, Juhás G (2001) What is a Petri net? – Informal answers for the informed reader. In: Ehrig H, Juhás G, Padberg J, Rozenberg G (eds) Unifying Petri Nets-Advances in Petri nets. Springer, Berlin, pp 1–25
Ferstl OK, Sinz EJ (1995) Das Ansatz des Semantischen Objektmodells (SOM) zur Modellierung von Geschäftsprozessen. Wirtschaftsinformatik 37(3):209–220
Fettke P (2008) Empirisches Business Engineering. Grundlegung und ausgewählte Ergebnisse. Fakultät Rechts- und Wirtschaftswissenschaften. Universität des Saarlandes, Saarbrücken
Fettke P (2009) How conceptual modeling is used. Commun Assoc Inform Syst (CAIS) 25 (43):571–592
Fettke P, Loos P (eds) (2007) Reference modeling for business systems analysis. Idea, Hershey
Frank U (1994) Multiperspektivische Unternehmensmodellierung – Theoretischer Hintergrund und Entwurf einer objektorientierten Entwicklungsumgebung. Oldenbourg, München
Harmon P (2014) The scope and evolution of business process management. In: vom Brocke J, Rosemann M (eds) Handbook on business process management, vol 1, 2nd edn. Springer, Heidelberg, pp 37–80
Hesson M, Geray O (2010) ITIL-based service management empirical case study. International multi-conference of engineers and computer scientists (IMECS 2010), Hong Kong, pp 729–734
Hrastnik J, Cardoso J, Kappe F (2007) The business process knowledge framework. In: The ninth international conference on enterprise information systems 2007 (ICEIS 2007), Funchal, 2007

Karagiannis D, Woitsch R (2014) Knowledge engineering in business process management. In: vom Brocke J, Rosemann M (eds) Handbook on business process management, vol 2, 2nd edn. Springer, Heidelberg, pp 623–648

Keller G, Teufel T (1998) SAP R/3 process oriented implementation - iterative process prototyping. Addison-Wesley, Harlow

Lapão LV, Rebuge Á, Silva MM, Gomes R (2009) ITIL assessment in a healthcare environment: the role of IT governance at hospital São Sebastião. In: Adlassnig K-P, Blobel B, Mantas J, Masic I (eds) Medical informatics in a united and healthy Europe (MIE 2009). IOS Press, Amsterdam, pp 76–80

Li L, Su Q, Chen X (2011) Ensuring supply chain quality performance through applying the SCOR model. Int J Prod Res 49(1):33–57

Markovic I (2010) Semantic business process modeling. Institut für Angewandte Informatik und Formale Beschreibungsverfahren (AIFB), Karlsruher Institut für Technologie (KIT), Karlsruhe

Marrone M, Kolbe LM (2011) Uncovering ITIL claims: IT executives' perception on benefits and business-IT alignment. Inf Syst e-Bus Manage 9(3):363–380

Meziani R, Saleh I (2010) E-government: ITIL-based service management case study. In: Proceedings of the 12th international conference on information integration and web-based applications & services (iiWAS2010), ACM, New York, pp 509–516

Nüttgens M, Rump FJ (2002) Syntax und Semantik Ereignisgesteuerter Prozessketten (EPK). In: Desel J, Weske M (eds) Prozessorientierte Methoden und Werkzeuge für die Entwicklung von Informationssystemen (Promise 2002). GI, Bonn, pp 64–77

Österle H (1995) Business Engineering – Prozeß- und Systementwicklung – Band 1: Entwurfstechniken, 2nd edn. Springer, Berlin

Otto B, Wäsch J (2003) A Model for Inter-Organizational Business Process Integration. In: Uhr W, Esswein W, Schoop E (eds) Wirtschaftsinformatik 2003, vol 1, Medien – Märkte – Mobilität. Physica, Heidelberg, pp 425–445

Pickering C, Wynn E (2004) An architecture and business process framework for global team collaboration. Intel Technol J 8(4):373–382

Rosemann M, vom Brocke J (2014) The six core elements of business process management. In: vom Brocke J, Rosemann M (eds) Handbook on business process management, vol 1, 2nd edn. Springer, Heidelberg, pp 105–122

Scheer A-W (1994) Business process engineering – reference models for industrial enterprises, 2nd edn. Springer, Berlin

Scheer A-W (1998) ARIS- business process frameworks, 3rd edn. Springer, Berlin

Srivastava B, Mazzoleni P (2010) An APQC-PCF based framework to compare service offerings in business transformation projects. In: Shin SY, Ossowski S, Schumacher M, Palakal MJ, Hung C-C (eds) 25th annual ACM symposium on applied computing (SAC 2010). ACM, Sierre, pp 73–78

Tanovic A, Androulidakis I (2011) Producing a new model for the eTOM standard through an empirical study. 19th Telecommunications Forum (TELFOR 2011), Belgrade, pp 94–97

Thomas O (2006) Understanding the term reference model in information systems research: history, literature analysis and explanation. In: Bussler C, Haller A (eds) Business process management workshops: BPM 2005, LNCS, vol 3812, Springer, Berlin, pp 484–496

Tregear R (2014) Business process standardization. In: vom Brocke J, Rosemann M (eds) Handbook on business process management, vol 2, 2nd edn. Springer, Heidelberg, pp 421–442

van der Aalst WMP (1999) Formalization and verification of event-driven process chains. Inf Softw Technol 41:639–650

Vo CC, Chilamkurti N, Loke SW, Torabi T (2011) Radio-Mama: an RFID based Business Process Framework for asset management. J Netw Comput Appl 34(3):990–997

vom Brocke J (2003) Referenzmodellierung – Gestaltung und Verteilung von Konstruktionsprozessen. Logos, Berlin

vom Brocke J (2007) Design principles for reference modelling. Reusing information models by means of aggregation, specialisation, instantiation, and analogy. In: Fettke P, Loos P (eds) Reference modelling for business systems analysis. Idea Group Publishing, Hershey, pp 47–75

Yuan S, Shen J (2007) QoS-Aware service selection in P2P-based Business Process Frameworks. In: The 4th IEEE international conference on enterprise computing, E-Commerce and E-Services (EEE 2007), Tokyo, pp 675–682

Zachman JA (1987) A framework for information systems architecture. IBM Syst J 26(3):276–292

Zhou H, Benton WC Jr, Schilling DA, Milligan GW (2011) Supply chain integration and the SCOR model. J Bus Log 32(4):332–344