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Critical Success Factors of Business Process Management: Investigating the Coverage of Business Process (Management) Maturity Models

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Abstract

Business Process Management (BPM) aims to improve the quality of business processes by consolidating the concepts of modelling, reengineering, automation, management, and innovation. Tailoring multi-faceted BPM to specific contexts of organizations on the ground of fast-growing information technology is the challenge of the current decade. A considerable number of critical success factors (CSFs) for BPM has been proposed by various studies in the scientific literature to provide insight into the process of achieving BPM. However, only few of these studies propose guidelines/practices for addressing the CSFs. This study is intended to provide a state-of-the-art of CSFs of BPM by a systematic review of scientific literature and to investigate content coverage of business process maturity models as a potential enabler of realization of these CSFs. We searched the studies between the years 2000 and 2015 in established digital libraries and identified 14 CSF categories from 18 studies out of 242 studies retrieved initially. Following that, we searched for evidence on the existence of each CSF category in five maturity models, namely Business Process Management Capability Framework (BPM-CF), Business Process Orientation Maturity Model (BPO-MM), Business Process Orientation Maturity Framework (BPO-MF), Business Process Maturity Model (OMG-BPMM), and Process and Enterprise Maturity Model (PEMM). The findings from our investigation show that, despite the variance in degree of coverage of CSF categories by selected BPMMs, maturity models stand as a promising reference for organizations to start their BPM efforts.

Keywords: Business process orientation, critical success factor, CSFs, business process maturity, maturity model, systematic literature review.

1   Introduction

The discipline of organizing and maintaining work activities to ensure delivery of high-quality outputs has come a long way in the last century, specifically in the last thirty years (Owen et al., 2003). The popularity of management concepts like Total Quality Management (TQM) in 1980s and introduction of information technology (IT) innovations like Workflow Management Systems (WMS) in 1990s have put management of work in various domains into a new, process-oriented perspective. Business Process Re-engineering (BPR), Business Process Management (BPM), and Business Process Orientation (BPO) are the terms that emerged and/or evolved within this perspective since then.

Despite reported benefits of process-oriented approach in business management (Kohlbacher, 2010), the adoption of these terms by organizations is an ongoing challenge (vom Brocke et al., 2014). A number of critical success factors of BPM has been proposed by several studies in scientific literature (Hajiheydari & Dabaghkashani, 2011; Trkman, 2010) to provide insight into the process of achieving BPM. *Critical success factors (CSFs)* are defined as "*the handful of key areas where an organization must perform well on a consistent basis to achieve its mission*" (Gates, 2010). When these key areas of performance are made explicit, they provide a common point of reference for the entire organization

(Caralli, 2004). However, the number of studies that suggest or validate a methodological approach for realizing the CSFs as a foundation for achieving BPM is scarce (King & Burgess, 2006).

Given the success stories of some domain specific maturity models (e.g. Capability Maturity Model in system and software engineering (CMU/SEI, 2010)), maturity models in the BPM field have gained considerable attention in research in the last decade. A maturity model is a conceptual model that consists of a sequence of discrete maturity levels for a class of processes in one or more business domains, and represents an anticipated, desired, or typical evolutionary path for these processes (Becker, Knackstedt & Poeppelbuss, 2009). Maturity models can be used as an instrument to achieve higher product and service quality (Bandara et al., 2007; Indulska et al., 2009; Lodhi et al., 2011). When approached from the viewpoint of purpose, there is a link between maturity models and critical success factors (Rosemann & vom Brocke, 2010). Recognizing this link would help us better understand the business process maturity models and their potential. CSFs can also serve as a common ground where BPMMs can be mapped and compared to.

In this study, we investigate the content coverage of business process maturity models (BPMMs) as a potential enabler for realizing the CSFs of BPM. We performed a systematic review of critical success factors, and identified 127 CSFs from 18 studies (out of 242 retrieved initially) and grouped these under 14 CSF categories. We selected five BPMMs that are mostly referred to in the scientific literature (Tarhan, Turetken & Reijers, 2015; Tarhan et al., 2016), namely Business Process Management Capability Framework (Rosemann & de Bruin, 2005), Business Process Orientation Maturity Model (McCormack & Johnson, 2001), Business Process Orientation Maturity Framework (Willaert & Bergh, 2007), Business Process Maturity Model (OMG, 2008), and Process and Enterprise Maturity Model (Hammer, 2007). We then investigated the existence of evidence for the CSF categories in content items of the BPMMs.

The remainder of the paper is organized as follows. Section 2 overviews related work on literature reviews of CSFs, selected BPMMs, and methodological support for realizing CSFs. Section 3 outlines research method including systematic review of CSFs and mapping of BPMMs to CSF categories. Section 4 provides answers to research questions, and Section 5 concludes with the summary of our findings and limitations of the study.

2 Related Work

There are few studies that sets the relation between critical success factors and critical practices or maturity models in the BPM domain. In this section, we first provide an overview of literature reviews on CSFs of BPM, and briefly introduce maturity models included in this study. We then highlight few works that relate CSFs to the means of their realization to achieve BPM.

2.1 Critical success factors of Business Process Management (BPM)

There are many studies on critical success factors of Enterprise Resource Planning (ERP) systems implementation but not of Business Process Management or BPM systems implementation. Following are few studies that provide comprehensive literature review on the CSFs of implementing BPM or BPM systems.

The study of (Hajiheydari & Dabaghkashani, 2011) aims to elicit and categorize success factors that influence BPM implementation. The study follows a qualitative meta-synthesis research method based on previous qualitative studies with different methods. The authors identify seven clusters of CSFs, namely strategy, people, IT architecture, optimization and process management, standards and measurement, process architecture, and project management. The result of the study demonstrates that strategy, people, and process architecture are the most important clusters affecting BPM implementation.

(Trkman, 2010) proposes a framework with the utilization of three theories, namely contingency theory, dynamic capabilities, and task-technology fit, in order to establish a basis for rationalizing the success of BPM efforts. The author respectively focuses on; (i) fit between business environment and

business processes, (ii) continuous improvement to assure sustained benefits from BPM, (iii) fit between IT and business processes. The underlying framework is used to identify critical success factors on a case study from the banking sector. The results of the study show that the implications of all three theories and consequently their identified CSFs are closely interrelated.

The study of (Ravesteyn & Versendaal, 2007) introduces a framework of success factors from a literature study of 104 articles and books, with respect to BPMS implementation. The authors identified 55 factors under five dimensions that are management of organization and processes, architecture design, developing an IT solution based on service-oriented architecture, management of implementation and change, and measurement and control. To validate the complete list of success factors, a multi method research approach is used consisting of three techniques: open interviewing, measuring the necessity of the success factors (direct validation), and measuring the factors by creating and measuring constructs that relate to a factor (indirect validation). The results of the study indicate that the list of CSFs is recognized and agreed upon by the respondents, but a larger population of respondents is needed to be able to draw conclusions on basis of quantitative analysis. In addition, at the end of the study the authors suggest a BPMS implementation approach that takes into account all critical success factors that are divided in five different project phases or areas.

2.2 Business process (management) maturity models (BPMMs)

In this section, we briefly describe the properties of five business process (management or orientation) maturity models that are mostly referred to in scientific literature (Tarhan et al., 2015a).

Business Process Management Capability Framework (BPM-CF) (Rosemann & de Bruin, 2005) is a multi-dimensional model including a number of distinct components, namely factors, stages, and scope (organisational entity and time). Six factors are strategic alignment, governance, method, information technology/information systems, people, and culture. These factors have been derived from an extensive literature review of BPM critical success factors and barriers to successful BPM implementations. Five stages are initial, defined, repeated, managed, and optimized. An assumption of the model is that the factors represent independent variables and the dependent variable is BPM success, i.e. the actual process performance. A further assumption is that higher maturity in each of these factors will be reflected in higher levels of success in the BPM initiative.

Business Process Orientation Maturity Model (BPO-MM) (McCormack & Johnson, 2001) describes a four-step pathway (ad hoc, defined, linked, and integrated level) for systematically advancing business processes along the maturity continuum. Each step builds on the work of the previous steps to apply improvement strategies that are appropriate to the current maturity level. The model defines three basic components of maturity, which are process view, process jobs, and process management and measurement; and two supporting components, namely process structure, and customer-focused process values and beliefs.

Business Process Orientation Maturity Framework (BPO-MF) (Willaert & Bergh, 2007) represents BPO maturity by eight dimensions that are produced as a result of literature review, expert interviews, academic visions and case studies within several organizations. The dimensions include Customer Orientation, Process View, Organizational Structure, Process Performance, People Management, Information Technology, Supplier Perspective, and Culture, Values and Beliefs.

Object Management Group's Business Process Maturity Model (OMG-BPMM) (OMG, 2008) consists of 30 process areas structured horizontally by five maturity levels (1 through 5) and vertically by five process area threads. Maturity levels represent a path for organizational improvement through the stages of Initial, Managed, Standardized, Predictable, and Innovating. Process area threads gather processes with similar concerns by the groups of Organizational Process Management, Organizational Business Management, Domain Work Management, Domain Work Performance, and Organizational Support. A process area contains a cluster of related practices in an area, that when implemented collectively, provides a process capability that is an important component of the maturity level at which it resides. A process area thread depicts how practices at one maturity level are transformed into one or more process areas at higher maturity levels. Each process area (e.g. Organizational Process Leader-

ship) has a number of specific goals and practices defined in its own knowledge area. The model also has institutionalization goals and related practices that apply to all process areas. OMG-BPMM follows the established structure of the Software Capability Maturity Model, which has been widely used in research and practice, and has been adopted in the development of several maturity models (Stojanov et al., 2015; Turetken et al., 2016; Becker, Knackstedt & Pöppelbuß, 2009; Turetken & Demirors, 2004).

Process and Enterprise Maturity Model (PEMM) (Hammer, 2007) identifies two distinct groups of characteristics, namely process enablers and enterprise capabilities, that are needed for business processes to perform well and to sustain that performance. Five process enablers are design, performance, owner, infrastructure, and metrics; and four enterprise capabilities are leadership, culture, expertise, and governance. The model defines four levels of strength for process enablers (P-1 through P-4) and enterprise capabilities (E-1 through E-4). For each strength level of each enabler, the model also defines the characteristics of implementation. The stronger the enablers, the better the results the process or enterprise can deliver on a sustained basis. Stronger organizational capabilities make for stronger enablers, which allow for better process performance. Thus, for example, when an enterprise has E-1 capabilities in leadership, culture, expertise, and governance, it is ready to advance all its processes to the P-1 level. The structure of PEMM has been taken as a reference for a number of maturity models proposed in the literature in different domains (e.g., (Schriek et al., 2016))

Among the maturity models described above, BPM-CF and OMG-BPMM have strong level of descriptive properties whereas BPO-MM, BPO-MF, and PEMM have medium level of descriptive properties that can be taken as the base for maturity assessments. OMG-BPMM is the only model that has strong level of prescriptive properties that can be taken as the base for maturity improvements (Roeglinger et al., 2012), (Tarhan et al., 2015b).

2.3   Relationship of CSFs to BPM implementation approach

There are only a handful of studies that aim to set or validate relations between critical success factors and implementation approaches of business process management. The study of (Buh et al., 2015) aims to identify CSFs in different stages of BPM adoption, and conducts a case study for analyzing a successful BPM adoption in a public company. The results of the study indicate that the identification of well-known CSFs of BPM adoption gives only a limited view since the factors change between stages, and that organizations need to carefully identify the stage and prepare a roadmap for their BPM adoption.

In the study of (Skrinjar & Trkman, 2013), the authors analyze previously suggested practices to identify those that are critical at a certain BPO maturity level and those that are not. The study reports a case study to identify CSFs, and a survey to operationalize the CSFs in the form of critical practices. Business Process Orientation Maturity Model (BPO-MM) (McCormack & Johnson, 2001) is used to investigate the relation between critical practices and BPO maturity level. The results of the study show that organizations following the critical practices at a certain level will reach higher process orientation sooner.

The study of (Quesada & Gazo, 2007) aims to develop a methodology to help manufacturers determine and rank key internal business processes based on critical success factors. The authors determine CSFs and key performance measures of the company based on vision, mission and strategic objectives statements. They prioritize most important CSFs according to rating scores such as cost savings, necessary improvement, and own discretion using a balanced scoreboard procedure and a prioritization matrix. CSFs are related to internal business processes based on strength of relationship in order to define the most critical internal processes, and possible differences in the perception of CSFs and strategic objectives among different management levels are compared. The authors validate this methodology in three furniture manufacturing companies, and findings from implementations show that better results are obtained when the methodology is applied to highest-level of management.

3 Research Design

In this study, we intended to investigate content coverage of BPMMs with respect to CSFs of BPM. We defined following research questions to direct our research:

RQ-1: Which critical success factors are identified for business process management or orientation in the scientific literature and how are they categorized?

RQ-2: How do these CSFs map to content items of business process maturity models as a potential enabler of realization?

In order to answer RQ-1, we performed a systematic review of scientific literature (EBSE, 2007) on the critical success factors of BPM or BPO. Such in-depth reviews of existing literature have gained popularity in the IS research due to the rigorous and reproducible review process (vom Brocke et al., 2015). Systematic literature review (SLR) was performed for the studies published in academic journals and conference proceedings between the years 2000 and 2015 (October), as made available through the digital libraries of (in alphabetical order); Emerald, IEEExplore, ScienceDirect, Scopus, SpringerLink, Web of Science, and Wiley. For retrieval from the digital libraries, the following string was taken as the basis, which was applied to the title, keywords, and abstracts of publications:

(("business process management" OR BPM OR "business process orientation" OR BPO)

AND ("critical success factors"))

Some electronic libraries (such as Web of Science and SpringerLink) do not provide advanced search options that allow for the use of the search string as is. For these sites, we either extended the context of the search (e.g., in Topic in Web of Science) or separated the search into several sub-searches (e.g., in SpringerLink) preserving the initial search context.

The numbers of studies initially retrieved and initially selected from these libraries are given in Table 1. The search using the string retrieved 242 studies, out of which 32 were identified as relevant for the purpose of this study. Eliminating the duplicate works retrieved from different libraries, we targeted 24 studies for a thorough analysis. Figure 1 presents the steps followed in refining and eventually reaching to the studies that were thoroughly analysed.

Digital Library	# Initially retrieved	# Initially selected
SpringerLink	63	4
Scopus	53	10
Emerald	37	4
Wiley	32	1
Web of Science	27	8
IEEExplore	25	2
ScienceDirect	5	3
TOTAL	**242**	**32**

Table 1.   Number of studies initially retrieved and selected from each electronic library.
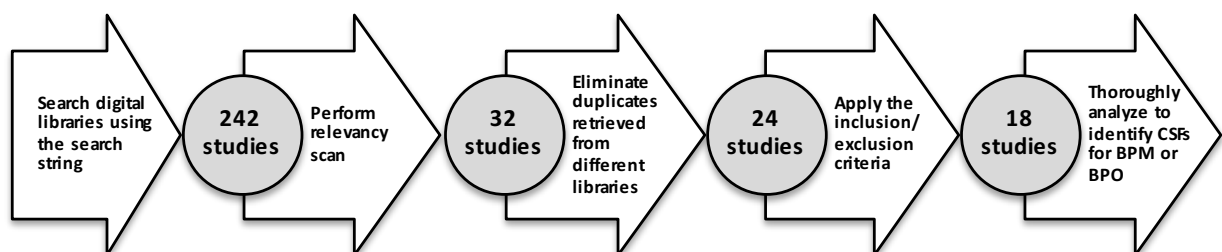

Figure 1.   The refinement steps and the resulting number of articles in SLR.

In selecting the relevant studies, we applied the inclusion criteria as "the studies that propose, identify, classify, or validate one or more CSFs of BPM or BPO". While reviewing the studies, we excluded the ones that address CSFs of Enterprise Resource Planning (ERP) systems implementation in a narrower view and that focus only on process management as a generic enabler.

We should re-state that the search was conducted only over the academic literature, and therefore excluded publications such as white papers, expressions of opinion, experience papers, or success stories as reported in non-academic journals and magazines. We also excluded dissertations and industrial and technical reports under the assumption that important results from these were already published in academic journals or conference proceedings. Finally, we excluded books, because it is generally difficult to determine how robust their findings are and whether they have been subjected to peer review. Still, distinct chapters from books that are compiled as scientific articles or conference proceedings were included in the review.

As the result of applying the exclusion criteria, 24 studies were identified. After a thorough analysis over these articles, we identified *18 studies* that are applicable for our research purposes. These studies are listed in the Appendix. Among these works, 11 are published as journal articles, 6 are published in conference or workshop proceedings, and 1 is compiled as a book chapter. At the end of the SRL process, we obtained a merged list of CSFs from included studies, and organized these CSFs under a number of CSF categories. The identification and categorization of CSFs were done independently by the authors of this study, and the separate lists were aligned by discussions held in joint meetings.

As a response to RQ-2, first, we selected five business process (management or orientation) maturity models that are commonly referred in the academic literature as reported by (Tarhan et al., 2015a). These are Business Process Management Capability Framework (BPM-CF), Business Process Orientation Maturity Model (BPO-MM), Business Process Orientation Maturity Framework (BPO-MF), Business Process Maturity Model (OMG-BPMM), and Process and Enterprise Maturity Model (PEMM). Next, we investigated how (if) each BPMM addresses the CSFs. Following the same method used in categorizing CFPs, the mappings of CSF categories to BPMMs were independently performed by two authors of this paper, and results are consolidated in joint meetings where conflicting issues were also resolved.

4 Results

4.1 CSF Categories of BPM by systematic review of literature (SLR)

Our first research question concerns the critical success factors proposed for business process management or orientation field in the scientific literature, and their categorization. As the result of our SLR, we identified 127 CSFs proposed for BPM or BPO and organized these CSFs under 14 CSF categories. For brevity, we do not provide the complete list of CSFs, but present here the categories and give examples of CSF sub-categories where necessary.

Table 2 presents the CSF categories with respect to the studies included in our SLR, and whether they have been addressed by the studies (a '√' denotes that the CSF category is addressed by the study). (For reporting purposes, we also provide the number of CSF sub-categories identified under each category with the numbers in parentheses next to CSF category name).

The CSFs in Table 2 are sorted in accordance to the number of times they are referred to by the studies included in the SLR. Accordingly, the CSF categories of Information Technology, Change Management and Communication, Program and Project Management, Organizational Culture, Strategic Alignment, Employee Involvement and Ownership, Management Commitment and Involvement, Process Management Competencies, and Process Management Organization are referred to by more than half of the studies included in the SLR. Interestingly, the CSF categories of Process Related Standards, Process Management Methods, Domain (Process) Understanding, Governance, and Process Measurement are overlooked by many studies.

Critical Success Factor (CSF) categories and # of CSFs under each category	# times referred to	Studies in SLR (as given in Appendix)																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Information Technology (18)	14	√	√	√	√	√	√		√			√	√		√	√	√	√	√
Change Management and Communication (12)	13	√	√		√	√	√		√			√	√	√	√	√	√		√
Program and Project Management (18)	12	√		√	√	√	√		√			√	√	√	√	√		√	
Organization Culture (7)	11	√		√	√		√	√		√		√	√		√	√			√
Strategic Alignment (7)	10			√	√	√	√	√		√			√			√	√		√
Stakeholder Involvement and Employee Ownership (11)	10	√		√	√	√	√		√		√			√			√		√
Management Commitment and Involvement (2)	10		√	√	√	√	√		√				√	√		√		√	
Process Management Competencies (11)	10		√		√		√	√	√			√			√	√	√		√
Process Management Organization (10)	10	√	√		√		√			√		√	√		√		√		√
Process Measurement (4)	8		√	√	√		√					√			√		√		√
Governance (8)	7				√		√	√	√	√				√		√			
Domain (Process) Understanding (7)	6						√	√	√			√			√				√
Process Management Methods (8)	5				√		√				√				√	√			
Process Related Standards (4)	4						√					√			√				√

Table 2.   CSF categories of BPM as identified by our systematic literature review.

Below we briefly describe these CSF categories also by referring to the works that studied them.

- *Information Technology (IT)*: As an infrastructure that supports execution and management of business processes, IT is combination of common hardware, software and network solutions together with policies and principles to maintain these solutions. Effective use of IT is an important enabler of BPM. This category involves CSFs such as integration of process and data (Ravesteyn & Versendaal, 2007), automation (Hajiheydari & Dabaghkashani, 2011), BPM suites/systems (e.g., vendor support and usability) (Mutschler et al., 2008), deployment (Spanyi, 2010), and level of IT investment (Trkman, 2010).

- *Change Management and Communication*: Change management deals with significant organizational changes with the objective of improving the collective performance and results. The changes may address processes, technology, staffing, organizational structure and/or culture, and should be made transparent and effectively communicated organization-wide. This category covers facilities for effective change management and communication within the organization regarding BPM efforts. Among the key points under this category are readiness for change (Hajiheydari & Dabaghkashani, 2011), re-organization of information (Mutschler et al., 2008), experience with change management (Ravesteyn & Versendaal, 2009), and communication between process team and organizational staff (Santos et al., 2012).

- *Program and Project Management*: BPM initiatives should be managed using effective program and project management practices. The efforts should be planned and controlled. This category include CSFs such as identifying and addressing the risks (Hajiheydari & Dabaghkashani, 2011), involving the right people in the project (P. A. Ravesteyn & Batenburg, 2010), developing a process management plan (Spanyi, 2010), ensuring adequate financial resources (Ahmad et al., 2007), and clearly defined objectives (Buh et al., 2015).

- *Organization Culture*: This category encompasses values and behaviors that contribute to the social and psychological environment unique to an organization. Organizational culture represents the collective values, beliefs and principles of organizational members, and therefore plays a significant role in the success of BPM efforts. Collaborative working environment (Bai & Sarkis, 2013), culture of change (Buh et al., 2015), synergies between different departments (Malinova & Mendling, 2013), and bureaucracy of the domain (Santos et al., 2012) are relevant factors.

- *Strategic Alignment*: The goals of BPM implementations should be aligned with strategic goals of an organization. With this alignment, the results of BPM efforts are tied to business objectives and become meaningful. Precise goal definition (Hajiheydari & Dabaghkashani, 2011) and linkage to organizational strategy (Buh et al., 2015) are relevant components.

- *Stakeholder Involvement and Employee Ownership*: Stakeholder involvement is a critical factor in all organization-wide undertakings. Empowered workers can take decisions independently, which may result in smoother operations with shorter throughput times (Skrinjar & Trkman, 2013). Key elements regarding this CFS include end user participation (P. Ravesteyn & Batenburg, 2010), employee empowerment (Trkman, 2010), and employee motivation and rewarding mechanisms (Ahmad et al., 2007).

- *Management Commitment and Involvement*: High-level management support and involvement to BPM efforts has upmost importance in creating motivation for implementation, obtaining required resources, and ensuring strategic alignment. Critical concepts regarding this CFP include leadership (Hajiheydari & Dabaghkashani, 2011) and management accountability (Spanyi, 2010).

- *Process Management Competencies*: An organization's background on BPM knowledge and skills is an important indicator of its competency in BPM implementation. Ability to redesign business processes (Mutschler et al., 2008), competencies of BPM team (Santos et al., 2012), training and re-skilling (Trkman, 2010), and using external consultants (Al-Mudimigh, 2007) are relevant factors.

- *Process Management Organization*: Process-based organization of BPM implementation is important for effective planning and maintenance of BPM efforts. This may include process management structure (Al-Mudimigh, 2007), establishing a suitable team organization (Hajiheydari & Dabaghkashani, 2011), appointment of process owners (Skrinjar et al., 2013), and well-organized maintenance and control of the process models (Ravesteyn & Versendaal, 2009).

- *Process Measurement*: Being able to evaluate actual process performance through effective KPIs is important in translating strategic objectives to process-specific goals (Rosemann et al., 2015). Having a set of key performance indicators (Ravesteyn & Versendaal, 2009), benchmarking (Hajiheydari & Dabaghkashani, 2011) are relevant factors.

- *Governance*: This category deals with optimization and sustainability of BPM implementation in the organization. Governance is concerned to create the right structures, metrics, roles, and responsibilities to measure and manage organizational performance. Governance of process initiatives (Malinova & Mendling, 2013), well-defined accountability (Hajiheydari & Dabaghkashani, 2011), and business environment (Nurbanum et al., 2013) are relevant aspects under this CFP.

- *Domain (Process) Understanding*: For the success of BPM implementation, prevalence of domain understanding is crucial in support of process management organization and competencies. Key factors regarding this CSF include awareness and understanding of the process by employers (Hajiheydari & Dabaghkashani, 2011), level of employee specialization (Trkman, 2010), and understanding interdependencies of data sources (P. A. Ravesteyn & Batenburg, 2010).

- *Process Management Methods*: Following a standard or commonly accepted methodology may influence the success of BPM initiatives. This can be important for secure and systematic execution and management of BPM efforts (Hajiheydari & Dabaghkashani, 2011), (Ravesteyn & Versendaal, 2009).

- *Process Related Standards*: The use of standards in structuring and defining processes and their outputs enable high-quality processes. Standards can be taken as reference sources in BPM implementations. Using the best modeling standards and techniques (Ravesteyn & Versendaal, 2009), and implementation of internal and external standards (Hajiheydari & Dabaghkashani, 2011) are relevant factors under this CSF.

4.2   Mapping of CSF Categories of BPM to content items of BPMMs

Our second research question involves mapping CSFs that we have identified to the content items of business process maturity models to investigate the extent of coverage provided to the models. Table 3 shows mappings of content items of business process (management or orientation) maturity models with respect to CSF Categories identified by our systematic literature review.

The mappings in the table show that the selected maturity models cover CSFs in different degrees. BPM-CF address almost all categories. This is expected since BPM-CF has emerged from an extensive literature review of CSFs for BPM. PEMM and OMG-BPMM cover majority of the CSF categories, which are followed by BPO-MM and BPO-MF in terms of the extent of coverage.

We also see from Table 3 that OMG-BPMM does not explicitly address the CSF categories of Information Technology and Organization Culture. It explicitly refers to COBIT (Control OBjectives for Information and Related Technology) or ITIL (Information Technology Infrastructure Library) for concerns regarding IT. As a process-based model, it implicitly assumes that through establishing necessary practices (that are parts of process areas in the model), ideal organizational culture or positive attitude towards change, teamwork capabilities would eventually emerge. This notion constitutes the primary difference between the prescriptive maturity models (e.g. OMG's BPMM) and those that show more descriptive properties (e.g. PEMM). Some components of the descriptive models, such as those mentioned above (culture, attitude towards change, teamwork, responsibility) are treated as the outcome to emerge through execution of a collection of certain practices of prescriptive models. This is one of the main reasons why descriptive models are more suitable for maturity assessments of as-is situations, while prescriptive models are better for creating roadmaps for process improvements (Rosemann et al., 2015; Tarhan, Turetken & van den Biggelaar, 2015).

Despite the variance in degrees of coverage of CSF categories by selected BPMMs, the mappings in Table 3 as a whole demonstrate that business process (management or orientation) maturity models constitute a solid reference to serve realization of critical success factors of BPM implementations.

CSF category	BPM-CF (Factor / Capability Area(s) (CA))	BPO-MM (Component(s))	BPO-MF (Domain(s))	OMG-BPMM (Maturity Level (ML) # - Process Area(s) (PAs))	PEMM (Process Enabler (PE) or Enterprise Capability (EC) / Sub-components)
Information Technology	(Factor) Information Technology / (CAs) Process Program and Project Management, Process Improvement and Innovation, Process Monitoring and Control, Process Instrumentation and Execution, Process Design and Modelling	*N/C* *(Not Covered)*	Information Technology	*N/C* *(Not Covered)*	(PE) Infrastructure / Information Systems, Human Resource Systems; (PE) Design / Purpose, Documentation; (PE) Owner / Authority
Change Management and Communication	(Factor) Culture / (CAs) Responsiveness to Process Change, Process Management Social Networks; (Factor) People / (CA) Process Collaboration and Communication	Process View	Process View	(ML2-PAs) Organizational Process Leadership; (ML3-PAs) Organizational Configuration Management; (ML4-PAs) Organizational Common Asset Management; (ML5-PAs) Organizational Improvement Planning, Organizational Innovative Improvement, Organizational Improvement Deployment, Defect and Problem Prevention, Continuous Capability Improvement	(EC) Leadership / Style; (EC) Expertise / People, Methodology; (EC) Culture / Teamwork, Attitude Toward Change; (PE) Performers / Skills; (PE) Owner / Activities, Authority
Program and Project Management	(Factor) Methods / (CA) Process Program and Project Management; (Factor) Information Technology / (CA) Process Program and Project Management; (Factor) Strategic Alignment / (CA) Process Improvement Plan	Process Measurement and Management Systems	*N/C*	(ML2-PA) Organizational Process Leadership, Organizational Business Governance; (ML3-PAs) Organizational Process Management, Organizational Resource Management;(ML4-PAs) Organizational Capability and Performance Management;(ML5-PAs) Organizational Improvement Planning, Organizational Improvement Deployment, Organizational Performance Alignment	(EC) Expertise / People;(EC) Governance / Process Model, Accountability, Integration;(PE) Design / Context;(PE) Owner / Identity, Activities, Authority;(PE) Metrics / Definition, Uses
Organization Culture	(Factor) Culture / (CAs) Process Management Social Networks, Leadership Attention to Process, Process Attitudes and Behaviors, Process Values and Beliefs, Responsiveness to Process Change	Customer-Focused Process Values, and Beliefs	Culture, Values, and Beliefs	*N/C*	(PE) Culture / Teamwork, Customer Focus, Responsibility, Attitude Toward Change
Strategic Alignment	(Factor) Strategic Alignment / (CAs) Process Customers and Stakeholders, Process Measures, Enterprise Process Architecture, Strategy and Process Capability Linkage, Process Improvement Planning	*N/C*	*N/C*	(ML2-PAs) Organizational Business Governance, Organizational Process Leadership; (ML3-PAs) Organizational Resource Management, Organizational Competency Development; (ML5-PA) Organizational Improvement Planning, Organizational Performance Alignment	(EC) Leadership / Alignment; (PE) Performers / Behavior; (PE) Owner / Activities; (PE) Metrics / Definition, Uses
Stakeholder Involvement and Employee Ownership	(Factor) Culture / (CAs) Process Values and Beliefs, Process Attitudes and Behaviors; (Factor) People / (CAs) Process Management Leaders, Process Collaboration and Communication; (Factor) Strategic Alignment / (CAs) Process Customers and Stakeholders	Customer-focused Process Values, and Beliefs; Process Jobs	Customer Orientation; People Management	(ML2-PAs) Organizational Process Leadership; (ML5-PA) Organizational Improvement Planning	(EC) Leadership / Style; (EC) Culture / Responsibility, Customer Focus, Attitude Toward Change; (EC) Governance / Accountability, Integration; (PE) Design / Context; (PE) Performers / Knowledge, Skills, Behavior; (PE) Owner / Identity, Activities, Authority
Management Commitment and Involvement	(Factor) Governance / (CA) Process Management Decision Making; (Factor) People / (CAs) Process Management Leaders; (Factor) Culture / (CAs) Leadership Attention to Process	*N/C*	*N/C*	(ML2-PAs) Organizational Business Governance, Organizational Process Leadership	(EC) Leadership / Behavior; (EC) Governance / Process Model, Accountability, Integration

CSF category	BPM-CF (Factor / Capability Area(s) (CA))	BPO-MM (Component(s))	BPO-MF (Domain(s))	OMG-BPMM (Maturity Level (ML) # - Process Area(s) (PAs))	PEMM (Process Enabler (PE) or Enterprise Capability (EC) / Sub-components)
Process Management Competencies	(Factor) Methods / (CAs) Process Design and Modelling, Process Implementation and Execution, Process Monitoring and Control, Process Improvement and Innovation, Process Program and Project. Management; (Factor) People / (CAs) Process Skills and Expertise, Process Knowledge Management, Process Education, Process Collaboration and Communication, Process Management Leaders	Process Jobs; Process View	Process View; People Management	(ML3-PA) Organizational Competency Development, Organizational Process Management; (ML5-PA) Organizational Improvement Planning	(EC) Expertise / People, Methodology; (PE) Design / Purpose, Context, Documentation; (PE) Performers / Knowledge, Skills, Behavior; (PE) Owner / Identity, Activities, Authority
Process Management Organization	(Factor) Strategic Alignment / (CAs) Process Improvement Planning, Enterprise Process Architecture; (Factor) Governance / (CAs) Process Management Decision Making, Process Roles and Responsibilities, Process Management Compliance	Process View; Process Structure	Process View; Organizational Structure	(ML2-PAs) Organizational Business Governance, Organizational Process Leadership; (ML3-PA) Organizational Process Management	(EC) Expertise / Methodology; (EC) Governance / Process Model
Process Measurement	(Factor) Strategic Alignment / (CA) Process Measures; (Factor) Governance / (CA) Process Metrics and Performance Linkage; (Factor) Methods / (CA) Process Control and Measurement (Factor) IT / (CA) Process Control and Measurement	Process Measurement and Management Systems	Process Performance	(ML2-PAs) Organizational Business Governance, Organizational Process Leadership; (ML3-PA) Organizational Process Management; (ML4-PAs) Organizational Capability and Performance Management, Quantitative Process Management; (ML5-PAs) Organizational Improvement Planning, Continuous Capability Improvement, Organizational Improvement Deployment	(PE) Performers / Knowledge; (PE) Owner / Identity, Activities; (PE) Metrics / Definition, Uses
Governance	(Factor) Governance / (CAs) Process Management Compliance, Process Related Standards, Process Metrics and Performance Linkage, Process Roles and Responsibilities, Process Management Decision Making	*N/C*	*N/C*	(ML2-PA) Organizational Business Governance	(EC) Governance / Process Model, Accountability, Integration
Domain (Process) Understanding	*N/C*	*N/C*	*N/C*	*N/C*	*N/C*
Process Management Methods	(Factor) Methods / (CAs) Process Design and Modelling, Process Implementation and Execution, Process Monitoring and Control, Process Improvement and Innovation, Process Program and Project Management	Process View	Process View	(ML3-PA) Organizational Process Management; (ML4-PAs) Organizational Capability and Performance Management; (ML5-PAs) Organizational Improvement Planning, Organizational Innovative Improvement	(EC) Expertise / Methodology
Process Related Standards	(Factor) Governance / (CA) Process Related Standards	*N/C*	*N/C*	(ML3-PA) Organizational Process Management	*N/C*

Table 3.   Content mapping of BPMMs with respect to CSF Categories of BPM.

5   Conclusion

Business process management is a multi-faceted discipline which makes it challenging to cope with various dimensions in different domains. Although domain-specific requirements are quite important, a generic set of best practices might be useful in starting BPM efforts and dealing with common difficulties in BPM adoption. Business process maturity models have emerged in the last decade by identifying critical components such as factors, capabilities, enablers, process areas, and practices, in order to serve organizations in their BPM implementations. In this study we aimed at investigating the extent of the support provided by the maturity models to address critical success factors of BPM.

During our study we first identified the state-of-the-art of CSFs and CSF categories by a systematic review of literature, and then performed mappings of content items of a selected set of BPMMs frequently referred to in the literature. The mappings showed that selected BPMMs cover a large portion of CSF categories, which indicate that these maturity models stand as a promising resource to take as the base to direct BPM efforts.

This study has a number of limitations. First, the list of CSFs and CSF categories are derived from a systematic review of scientific literature and not of gray literature, and some maturity models (i.e. PEMM and OMG-BPMM) emerged from industrial studies and related experiences. Although neither PEMM nor OMG-BPMM has a large gap with respect to CSF categories, this situation might have created a disparity in comparison of the mappings. Second, some maturity models are aimed at different scopes; for example, BPM-CF address business process management maturity, BPO-MM address business process orientation maturity, and OMG-BPMM address business process maturity. The differences in scopes might have created a disparity in comparison of the mappings. Still, we find the mappings valuable to provide insight in understanding which maturity model (and related components) can be useful to address which CSF category. Third, the primary sources that we used to perform mappings are at different levels of detail, and therefore we had to work with varying details of information regarding the BPMMs while performing the mappings. We think that this situation also creates a difficulty in understanding of the models by the community, and in taking the models as the guide for BPM implementations. We expect that the mapping table that we provided in this study constitute a base for further research to consolidate existing maturity models or to propose/revise maturity models of sufficient detail to guide BPM efforts.

Appendix. List of studies included in the systematic review

(1)   Ahmad, H., Francis, A., & Zairi, M. (2007). Business process reengineering: critical success factors in higher education. Business Process Management Journal, 13(3), 451–469. doi:10.1108/14637150710752344

(2)   Al-Mudimigh, A. S. (2007). The role and impact of business process management in enterprise systems implementation. Business Process Management Journal, 13(6), 866–874. doi:10.1108/14637150710834604

(3)   Bai, C., & Sarkis, J. (2013). A grey-based DEMATEL model for evaluating business process management critical success factors. International Journal of Production Economics, 146(1), 281–292. doi:10.1016/j.ijpe.2013.07.011

(4)   Buh, B., Kovačič, A., & Indihar Štemberger, M. (2015). Critical success factors for different stages of business process management adoption – a case study. Economic Research-Ekonomska Istraživanja, 28(1), 243–258. doi:10.1080/1331677X.2015.1041776

(5)   Cheng, T. C. E., & Chiu, I. S. F. (2008). Critical Success Factors of Business Process Re-engineering in the Banking Industry. Knowledge and Process Management, 15(4), 258–269. doi:10.1002/kpm

(6)   Hajiheydari, N., & Dabaghkashani, Z. (2011). BPM Implementation Critical Success Factors : Applying Meta-synthesis Approach. 2011 International Conference on Social Science and Humanity, 5, 38–43.

(7)   Malinova, M., & Mendling, J. (2013). A Qualitative Research Perspective on BPM Adoption and the Pitfalls of Business Process Modeling. Business Process Management Workshops, 77–88. doi:10.1007/978-3-642-36285-9_10

(8)   Mutschler, B., Reichert, M., & Bumiller, J. (2008). Unleashing the Effectiveness of Process-oriented Information Systems: Problem Analysis, Critical Success Factors and Implications. IEEE Transactions on Systems, Man, and Cybernetics, Part C, 38(3), 280–291.

(9)   Nurbanum, M., Nasurdin, A. M., Ahmad, N. H., & Wong, W. P. (2013). What affects the extent of business process management implementation? An empirical study of Malaysia's manufacturing organizations. Operations Management Research, 6(3-4), 91–104. doi:10.1007/s12063-013-0081-6

(10)   Quesada, H., & Gazo, R. (2007). Methodology for determining key internal business processes based on critical success factors: A case study in furniture industry. Business Process Management Journal, 13(1), 5–20. doi:10.1108/14637150710721104

(11)   Ravesteyn, P. A., & Batenburg, R. B. (2010). Cultural differences in implementing business process management systems. In Proceedings of 16th Americas Conference on Information Systems (AMCIS 2010) (pp. 4106–4115).

(12)   Ravesteyn, P. A., & Versendaal, J. B. (2007). Success factors of business process management systems implementation. In Proceedings of 18th Australasian Conference on Information Systems (ACIS 2007) (pp. 395–406).

(13)   Ravesteyn, P., & Batenburg, R. (2010). Surveying the critical success factors of BPM-systems implementation. Business Process Management Journal, 16(3), 492–507. doi:http://dx.doi.org/10.1108/14637151011049467

(14)   Ravesteyn, P., & Versendaal, J. (2009). Constructing a Situation Sensitive Methodology for Business Process Management Systems Implementation. PACIS 2009 Proceedings. Retrieved from http://aisel.aisnet.org/pacis2009/70

(15) Santos, H. R. M., Alves, C. F., Santos, G. A. V., & Santana, A. F. L. (2012). Critical success factors of BPM initiatives in Brazilian public organizations. Innovation Vision 2020: Sustainable Growth, Entrepreneurship, and Economic Development - Proceedings of the 19th International Business Information Management Association Conference, 4(October 2015), 1806–1816.

(16) Skrinjar, R., Trkman, P., Škrinjar, R., & Trkman, P. (2013). Increasing process orientation with business process management: Critical practices'. International Journal of Information Management, 33(1), 48–60. doi:10.1016/j.ijinfomgt.2012.05.011

(17) Spanyi, A. (2010). Business Process Management Governance. In Handbook on Business Process Management 2. doi:10.1007/978-3-642-01982-1

(18) Trkman, P. (2010). The critical success factors of business process management. International Journal of Information Management, 30(2), 125–134. doi:10.1016/j.ijinfomgt.2009.07.003

References

Ahmad, H., Francis, A. & Zairi, M., 2007. Business process reengineering: critical success factors in higher education. *Business Process Management Journal*, 13(3), pp.451–469.

Al-Mudimigh, A.S., 2007. The role and impact of business process management in enterprise systems implementation. *Business Process Management Journal*, 13(6), pp.866–874.

Bai, C. & Sarkis, J., 2013. A grey-based DEMATEL model for evaluating business process management critical success factors. *International Journal of Production Economics*, 146(1), pp.281–292. Available at: http://dx.doi.org/10.1016/j.ijpe.2013.07.011.

Bandara, W. et al., 2007. Major Issues in Business Process Management: An Expert Perspective. In *European Conference on Information Systems*. pp. 1240–1251.

Becker, J., Knackstedt, R. & Poeppelbuss, J., 2009. Developing Maturity Models for IT Management. *Business & Information Systems Engineering*, 1(3), pp.213–222.

Becker, J., Knackstedt, R. & Pöppelbuß, J., 2009. Developing Maturity Models for IT Management. *Business & Information Systems Engineering*, 1(3), pp.213–222. Available at: http://link.springer.com/10.1007/s12599-009-0044-5 [Accessed December 21, 2019].

vom Brocke, J. et al., 2015. Standing on the shoulders of giants: Challenges and recommendations of literature search in information systems research. *Communications of the Association for Information Systems*, 37(1), pp.205–224.

vom Brocke, J. et al., 2014. Ten Principles of Good Business Process Management. *Business Process Management Journal*, 20(4), pp.530–548.

Buh, B., Kovačič, A. & Indihar Štemberger, M., 2015. Critical success factors for different stages of business process management adoption – a case study. *Economic Research-Ekonomska Istraživanja*, 28(1), pp.243–258.

Caralli, R. a., 2004. *The Critical Success Factor Method: Establishing a Foundation for Enterprise Security Management, CMU/SEI-2004-TR-010,*

CMU/SEI, 2010. *Capability Maturity Model Integration for Development v1.3, CMU/SEI-2010-TR-033,*

EBSE, 2007. *Guidelines for performing Systematic Literature Reviews in Software Engineering, Version 2.3, EBSE-2007-01,*

Gates, L.P., 2010. *Strategic Planning with Critical Success Factors and Future Scenarios: An Integrated Strategic Planning Framework, CMU/SEI-2010-TR-037,*

Hajiheydari, N. & Dabaghkashani, Z., 2011. BPM Implementation Critical Success Factors: Applying Meta-synthesis Approach. In *International Conference on Social Science and Humanity*. pp. 38–43.

Hammer, M., 2007. The Process Audit. *Harvard Business Review*, April, pp.1–14.

Indulska, M. et al., 2009. Process Modeling: Current Issues and Future Challenges. In *European Conference on Information Systems*. pp. 501–514.

King, S.F. & Burgess, T.F., 2006. Beyond critical success factors: A dynamic model of enterprise system innovation. *International Journal of Information Management*, 26(1), pp.59–69.

Kohlbacher, M., 2010. The effects of process orientation: a literature review. *Business Process Management Journal*, 16(1), pp.135–152.

Lodhi, A., Köppen, V. & Saake, G., 2011. *Business Process Modeling: Active Research Areas and Challenges, FIN-001-2011,*

Malinova, M. & Mendling, J., 2013. A Qualitative Research Perspective on BPM Adoption and the Pitfalls of Business Process Modeling. In *Business Process Management Workshops*. pp. 77–88.

McCormack, K. & Johnson, W., 2001. *Business Process Orientation: Gaining the E-business Competitive Advantage, CRC Press*, Delray Beach, FL: St Lucie Press.

Mutschler, B., Reichert, M. & Bumiller, J., 2008. Unleashing the Effectiveness of Process-oriented Information Systems: Problem Analysis, Critical Success Factors and Implications. *IEEE*

Transactions on Systems, Man, and Cybernetics, Part C, 38(3), pp.280–291.

Nurbanum, M. et al., 2013. What affects the extent of business process management implementation? An empirical study of Malaysia's manufacturing organizations. *Operations Management Research*, 6(3–4), pp.91–104.

OMG, 2008. *Business Process Maturity Model (BPMM), Ver.1, Object Management Group,*

Owen, B.M., Raj, J. & Software, P., 2003. BPMN and Business Process Management Introduction to the New Business Process Modeling Standard. *Management*, 2678, p.27.

Quesada, H. & Gazo, R., 2007. Methodology for determining key internal business processes based on critical success factors: A case study in furniture industry. *Business Process Management Journal*, 13(1), pp.5–20.

Ravesteyn, P. & Batenburg, R., 2010. Surveying the critical success factors of BPM-systems implementation. *Business Process Management Journal*, 16(3), pp.492–507.

Ravesteyn, P. & Versendaal, J., 2009. Constructing a Situation Sensitive Methodology for Business Process Management Systems Implementation. In *Pacific Asia Conference on Information Systems*. p. Paper 70.

Ravesteyn, P.A. & Batenburg, R.B., 2010. Cultural differences in implementing business process management systems. In *16th Americas Conference on Information Systems (AMCIS 2010)*. pp. 4106–4115.

Ravesteyn, P.A. & Versendaal, J.B., 2007. Success factors of business process management systems implementation. In *The 18th Australasian Conference on Information Systems*. pp. 395–406.

Roeglinger, M., Poeppelbuss, J. & Becker, J., 2012. Maturity models in business process management. *Business Process Management Journal*, 18(2), pp.328–346. Available at: http://www.emeraldinsight.com/journals.htm?issn=1463-7154&volume=18&issue=2&articleid=17026640&show=html [Accessed November 20, 2012].

Rosemann, M. & vom Brocke, J., 2010. The Six Core Elements of BPM. In J. vom Brocke & M. Rosemann, eds. *Handbook on Business Process Management 1*. Berlin, Heidelberg: Springer Berlin Heidelberg, pp. 107–122.

Rosemann, M. & de Bruin, T., 2005. Towards a business process management maturity model. In *ECIS 2005 Proceedings*. Regensburg, Germany, pp. 26–28.

Rosemann, M., Bruin, T. de & Power, B., 2015. BPM Maturity Model. In J. Jeston & J. Nelis, eds. *Business Process Management, 3rd Edition*. Routledge.

Santos, H.R.M. et al., 2012. Critical success factors of BPM initiatives in Brazilian public organizations. In *The 19th International Business Information Management Association Conference*. pp. 1806–1816.

Schriek, M., Turetken, O. & Kaymak, U., 2016. A Maturity Model for Care Pathways. In *European Conference on Information Systems (ECIS 2016), Paper: 127*. AIS.

Skrinjar, R. et al., 2013. Increasing process orientation with business process management: Critical practices'. *International Journal of Information Management*, 33(1), pp.48–60.

Skrinjar, R. & Trkman, P., 2013. Increasing process orientation with business process management: Critical practices. *International Journal of Information Management*, 33(1), pp.48–60.

Spanyi, A., 2010. Business Process Management Governance. In *Handbook on Business Process Management 2*.

Stojanov, I., Turetken, O. & Trienekens, J.J.M., 2015. A Maturity Model for Scaling Agile Development. In *Proceedings - 41st Euromicro Conference on Software Engineering and Advanced Applications, SEAA 2015*.

Tarhan, A., Turetken, O. & van den Biggelaar, F.J.H.M., 2015. Assessing Healthcare Process Maturity: Challenges of Using a Business Process Maturity Model. In *Proceedings of the 9th International Conference on Pervasive Computing Technologies for Healthcare*. pp. 344–347. Available at: http://dl.acm.org/citation.cfm?id=2826165.2826233.

Tarhan, A., Turetken, O. & Ilisulu, F., 2015. Business Process Maturity Assessment: State of the Art and Key Characteristics. In *The 41st Euromicro Conference on Software Engineering and Advanced Applications*. pp. 430–437.

Tarhan, A., Turetken, O. & Reijers, H.A., 2016. Business Process Maturity Models: A Systematic

Literature Review. *Information and Software Technology*. Available at: http://www.sciencedirect.com/science/article/pii/S0950584916300015 [Accessed March 2, 2016].

Tarhan, A., Turetken, O. & Reijers, H.A., 2015. Do Mature Business Processes Lead To Improved Performance? -- A Review of Literature for Empirical Evidence. In *European Conference on Information Systems*. p. Paper 178.

Trkman, P., 2010. The critical success factors of business process management. *International Journal of Information Management*, 30(2), pp.125–134.

Turetken, O. & Demirors, O., 2004. People capability maturity model and human resource management systems: Do they benefit each other? *Human Systems Management*, 23(3).

Turetken, O., Stojanov, I. & Trienekens, J.J.M., 2016. Assessing the adoption level of scaled agile development: a maturity model for Scaled Agile Framework. *Journal of Software: Evolution and Process*.

Willaert, P. & Bergh, J. Van Den, 2007. The process-oriented organisation: a holistic view developing a framework for business process orientation maturity. In *BPM Conference (LNCS 4714)*. Springer Berlin Heidelberg, pp. 1–15.