

Do mature business processes lead to improved performance? : a review of literature for empirical evidence

Citation for published version (APA):

Tarhan, A., Turetken, O., & Reijers, H. A. (2015). Do mature business processes lead to improved performance? : a review of literature for empirical evidence. In *Proceedings of the 23rd European Conference on Information Systems (ECIS 2015), 26-29 May 2015, Munster, Germany* (pp. 1-16). Association for Information Systems.

Document status and date:

Published: 01/01/2015

Document Version:

Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

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DO MATURE BUSINESS PROCESSES LEAD TO IMPROVED PERFORMANCE? -- A REVIEW OF LITERATURE FOR EMPIRICAL EVIDENCE

Complete Research

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Abstract

There is a considerable number of maturity models proposed for business processes or BPM, but their exact contribution or impact on business performance is unclear. In order to better understand the state of the research on the relation between the use of business process maturity models (BPMMs) and business performance and to identify opportunities for future research, we conducted a systematic literature review. We searched the studies between the years 1990 and 2014 in established digital libraries. Out of 2899 studies retrieved initially, we selected 62 studies to provide a list of BPMMs referenced in the academic literature and 7 studies within this set to thoroughly review the evidence provided for the relation between higher maturity leading to higher business performance. We found that while several BPMMs were proposed in the last decade, the number of empirical studies that reveal the effect of using these maturity models on a firm's performance is scarce - even for the most referenced BPMMs. We propose that future research should be directed towards empirical studies in the form of longitudinal case studies and surveys to better demonstrate the validity and usefulness of BPMMs and thereby foster a wider adoption of these models in practice.

Keywords: Business process maturity, Business process management, Business process orientation, Maturity model, Business performance.

1 Introduction

The quality of business processes plays an important role in delivering high-quality products and services (Bandara et al., 2007; Indulska et al., 2009; Lodhi et al., 2011). The discipline of Business Process Management (BPM) aims to improve the quality of business processes by consolidating Business Process Reengineering, Process Innovation, Business Process Modeling and Business Process Automation/Workflow Management (Rosemann and de Bruin, 2005). Given the success stories of some domain specific maturity models (e.g. Capability Maturity Model in system and software engineering), the maturity models in the BPM field has gained considerable attention in the research. 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 et al., 2009)

In the last decade, researchers and practitioners in the BPM field have proposed maturity models with varied focus and depth (Van Looy et al., 2010; Röglinger et al., 2012). The Business Process Orientation Maturity Model (McCormack and Johnson, 2001), the BPM Capability Framework (Rosemann and de Bruin, 2005), the Process and Enterprise Maturity Model (Hammer, 2007), and the OMG

standard Business Process Maturity Model (OMG, 2008) are among the ones commonly referred to in the literature.

Despite the substantial number and broadened scale of available models (Van Looy, 2014; Röglinger et al., 2012; Wendler, 2012), the use of generic business process (management) maturity models has still not gained widespread acceptance in practice (Wolf and Harmon, 2014, p. 30). There is only a handful of studies in the literature examining the adoption of these models and their achieved benefits. With the purpose of extensively investigating the effect of using BPMMs on corporate performance and to identify opportunities for future research, we targeted at a systematic review of the literature. A systematic literature review (SLR) is a means of evaluating and interpreting all available research relevant to a particular research hypothesis, topic area, or phenomenon of interest (EBSE, 2007). A literature review represents the foundation for strengthening research in a particular field of study (Webster and Watson, 2002).

We searched and examined the studies performed between the years 1990 and Oct.2014 in a comprehensive set of academic digital libraries. We initially retrieved 2899 studies; 62 of which were analyzed to identify the maturity models referred to in the literature. Eventually 7 were selected in accordance to our selection procedure and criteria and thoroughly reviewed. In selecting relevant works, we targeted studies highlighting the firm's business performance in relation to using *generic* models proposed for *business process maturity*, *business process management maturity*, or *business process orientation maturity*. We refer to these models as *business process maturity models (BPMMs)* throughout this paper.

The remainder of the paper is organized as follows. Section 2 overviews the related work on business process maturity, and studies that report on the effect of process orientation on organizational performance. The research objectives and the review protocol are presented in Section 3. Section 4 discusses the results. Section 5 concludes with the summary of our findings, contributions and limitations of the study.

2 Related Work

There is a number of studies that demonstrate the existence of the relationship between organizational maturity and performance in domains such as software development (Campo, 2012; Harter et al., 2000) and supply-chain management (Lockamy III and McCormack, 2004). In this section, we overview the works that analyze the literature on business process maturity or orientation and summarize the findings on this relationship. First, we summarize the works that describe and compare multiple BPMMs and perform theoretical analyses on related concepts. Second, we provide a review of distinct studies that explore the relationship between business process orientation (BPO) and business performance. These studies assess BPO through diverse techniques but without referencing any specific BPMM. Finally, we provide a review of studies that relate business process maturity to firm's business performance in the Supply Chain Management domain in which business process maturity appears to have found an important place.

2.1 Review studies on business process (management) maturity models

There are few studies that extensively analyze the literature on BPMMs. In this section we overview the studies that evaluate BPMMs or clarify the concepts related to business process or BPM and its maturity, by highlighting their emphasis on organizational performance.

In a systematic mapping study on the maturity models proposed in different domains, Wendler (2012) provides an in-depth analysis of 237 articles published between 1999 and 2010. The study reveals that the maturity model research is dominated by studies in the software engineering field. Also, most studies deal with the development of maturity models, where evaluations and validations are scarce. This mapping study delivers the first systematic summary of maturity model research and helps researchers to gain an understanding of the general research gaps. However, the study includes a limited number

of maturity models proposed in the BPM field and refers to only one study (Raschke and Ingraham, 2010) on the effect of business process maturity on performance.

The study by Röglinger et al. (2012) provides a review of a set of BPMMs by focusing on their applicability and usefulness. It provides an in-depth analysis of a sample of ten BPMMs with respect to a framework of general design principles. Accordingly, these models sufficiently address the basic design principles as well as principles for a descriptive purpose of maturity model use. However, the design principles for their prescriptive use are largely unmet. This means that the adopters of maturity model in practice still face a challenging task when searching for the right measures to improve their BPM capabilities up from the level they already have achieved. Investigating the effect of empirical usage of the BPMMs on performance, however, is out of the focus of this study.

With the intention to develop grounded criteria to compare maturity models for business processes, Van Looy et al. (Van Looy et al., 2010, 2011) point out the lack of a comprehensive definition for the BPMM concept and highlight the gaps regarding the scope, terminology and design. The authors identify three umbrella terms based on a literature review: business process, business process management (BPM), and business process orientation (BPO). From the point of scope, business process is enclosed by BPM, which is further enclosed by BPO. The authors also identify six BPMM components falling under these terms, which are claimed to contribute to business process performance: modeling and deployment (under business process), optimization and management (under BPM), culture and structure (under BPO). These components are then used to compare and classify 69 maturity models, some of which with a particular focus on different domains or fields, such as supply-chain management, logistics, collaboration, and software development. In a follow-up study (Van Looy et al., 2013), the authors add further design elements to their comparative framework by conducting a content analysis of 69 maturity models, and transform the identified 14 design elements into a questionnaire that practitioners can use to find the maturity model that best fits their needs.

The book authored by Van Looy provides a comprehensive overview of the framework and the 69 maturity models (Van Looy, 2014). The book offers contributions to the literature through in-depth reviews of existing BPMMs, including their structural characteristics and point of focus. In addition, a recent study (Van Looy et al., 2014) provides a conceptual framework and classification of capability areas for business process maturity. The framework contains three layers (clusters, main-areas, and sub-areas) identified by literature and theories that characterize the direct relationship with business (process) excellence as summarized in Table 1. The relationships with business (process) performance are, however, not empirically tested within the scope of this work.

Cluster	Main Area	Sub-Area
BPM	Modeling	business process design, business process analysis
	Deployment	business process implementation & enactment, business process measurement & control
	Optimization	business process evaluation, business process improvement
	Management	Strategy & KPIs, external relationships & SLAs, roles & responsibilities, skills & training, daily management
Intermediate BPO	Culture	Values, attitudes & behaviors, appraisals & rewards, top management commitment
BPO	Structure	Organization chart, governance bodies

Table 1. *Conceptual framework and classification of capability areas for business process maturity (Van Looy et al., 2014). -- Note that each cluster through the rows covers the main- and sub-areas of the previous ones.*

This analysis of the existing works signal an unbalanced emphasis on BPMM development over empirical application or validation of its effect on business performance. With the aim to clarify this concern, we performed a systematic literature review by following a bottom-up approach on the works

that investigate the relation between advancing up in the process maturity and the business performance. To the best of our knowledge, this is the first systematic literature review that explores generic BPMMs from this perspective.

2.2 Business process orientation and business performance

There are few works that investigate the relationship between BPO and business performance without referencing any specific BPMM. These works often measure the level of BPO (of a large number of companies) using several metrics, and analyze the data to identify correlations with those collected for quantifying business performance. In this section, we summarize these works and highlight their findings.

Kohlbacher (2009) empirically explores the relationship between process orientation (PO) and non-financial firm performance. Process orientation is measured by means of ten dimensions: process design and documentation, management commitment, process owner, process performance measurement, corporate culture, information technology, organizational structure, people and expertise, human resources systems, and coordination and integration of process projects. Firm performance is measured by customer satisfaction, product quality, time to market, delivery time, and delivery reliability. The study includes 133 Austrian corporations operating in metal and machinery industry with at least 50 employees. Firms were selected randomly and telephone interviews were used for data collection; for every firm one executive (CEO, CIO or quality manager) was interviewed. The preliminary findings indicate that PO has a significant positive effect on all these performance dimensions, and that firm size does not moderate these relationships. Neither does the manufacturing process type moderate these relationships, i.e. PO leads to better performance not only for batch/line producers, but also for project/jobbing manufacturers.

In a literature review, Kohlbacher (2010) identifies a total of 26 studies that report about effects of PO on organizational performance. The author claims that studies where positive effects are obtained are predominant and that positive effects of PO are clearly more often reported than negative effects. The effects most often reported are speed improvements, increase of customer satisfaction, improvement of quality, reduction of cost, and improvement of financial performance. The author highlights a lack of quantitative studies investigating the effects of PO on organizational performance.

The study by Zaheer et al. (2010) develops a business process orientation model on the basis of theoretical background to improve employee and organizational performance, and tests it by using factor analysis and structural equation modeling techniques. The data is collected by using a structured questionnaire from employees of private sector banks in Pakistan. The sample size of the study is 350 with a response rate of 17%. The conclusion of the study is that business process orientation has a significant impact on employee and organizational performance.

With the aim to measure the construct of process orientation by means of whether the process approach is actually lived in the organization, the study by Kohlbacher et al. (2011) empirically explores the relationship between a corporate culture in line with business process orientation and firm performance in industrial settings - using the same population studied in (Kohlbacher, 2009). The empirical evidence indicates that firms, which actually live the process approach, are outperforming other firms in terms of financial performance, delivery time, and delivery reliability.

In a recent study on the effects of process-oriented organizational design on firm performance (Kohlbacher and Reijers, 2013), the authors empirically explore the relationship between process orientation (PO) and firm performance. The study uses an exploratory research design and investigates the effects of the different PO dimensions on profitability, customer satisfaction, product quality, and time-based performance using a random sample of Austrian manufacturing firms. The empirical findings reveal that process performance measurement, a process-oriented organizational structure, the application of continuous process improvement methods, and a culture in line with the process approach, are significantly and positively associated with organizational performance.

2.3 Supply chain management (SCM) maturity and performance

Our systematic literature review focuses on academic works and those that refer only to generic BPMMs that are not domain specific (as discussed in detail in the next section- sec.3). Yet, the relationship between process maturity and business performance has also been investigated considerably in the supply chain management field where business process management is of particular importance. Therefore, in this section we summarize the findings from these works to offer further insight and additional perspective on the linkage between process maturity and business performance.

In an empirical study to investigate the factors that allow companies to manage their supply chains so as to maximize business performance (Hofmann and Reiner, 2006), the authors focus on two classes of enablers - business processes and information technology. The data from 60 companies providing detailed non-disclosure information on 68 different supply chains is collected and analyzed to characterize the linkage between supply chain performance and the maturity of business processes and IT infrastructure. The results show that companies with best-in-class (BIC) IT systems that do not apply the corresponding BIC business processes not only have 7% lower profitability than their peers with traditional organization and no IT systems support but also a lower supply chain performance. That is, these companies not only waste their money on IT investments but even slow down their value chain.

Another study (McCormack et al., 2008) investigates the relationship between supply chain maturity and performance, with specific references both to the business process orientation maturity model (McCormack and Johnson, 2001) and to the supply chain operation reference model. The study applies quantitative, survey-based research with 478 Brazilian companies. Empirical results indicate a strong and positive statistical relationship between supply chain maturity and performance, and also suggest that the delivery process maturity has a higher impact on overall performance than the other supply chain processes. The study provides solid statistical evidence that a company that has achieved a higher maturity level and implemented the maturity factors also has achieved superior performance, and also validates the application of these specific maturity factors in Brazil.

In the study by Soderberg and Bengtsson (2010), the authors aim to empirically explore the relationship between supply chain maturity and financial performance in 15 small- and medium-size enterprises (SMEs) within the Swedish engineering industry. This study is a replication of a former study by Lockamy III and McCormack (Lockamy III and McCormack, 2004) in the context of SMEs. The former study proposes Supply Chain Management Maturity model to analyze the maturity and examines the relationship between supply chain management maturity and performance, and shows a very strong correlation between maturity and performance. Similar to the results of the former one, the results of this study indicate that there is a strong relationship between SCM maturity and supply chain performance in SMEs as well as some relationships between SCM maturity and financial performance.

3 Research Design

In understanding the existence, application and use of maturity models in relation to business performance in the BPM field, we aimed at identifying empirical evidence reported in the academic literature, which validates that an increased process maturity level of an organization with respect to a specific BPMM leads to an improved business performance. This, essentially, indicates the practical utility and validity of a particular BPMM. In addition, we also aimed at identifying the BPMMs that are reported in the academic literature and those that were subject to studies investigating the relation between maturity and firm's business performance.

In doing so, we focused on the models with *discrete* maturity levels and addressing the maturity of business processes, business process management or orientation in an all-inclusive manner rather than with a narrow viewpoint that centers on a specific domain or aspect of BPM (e.g. knowledge management or supply chain management).

We defined the following hypotheses for our research:

H1: Despite a significant number of BPMMs developed in the last decade, there are only a handful of models that were subject to empirical works relating an increasing maturity level to higher business performance.

H2: There is only limited evidence reported in the academic literature which validates that an increased process maturity level of an organization with respect to a specific BPMM leads to an improved business performance.

In conducting our systematic literature review, we used (EBSE, 2007) and (Webster and Watson, 2002) as our guidelines for gaining a comprehensive insight into the existing literature. The literature search was performed for the studies published in academic journals and conference proceedings between the years 1990 and 2014 (October), as made available through the digital libraries of (in alphabetical order); ACM, Ebsco, Emerald, 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:

*("process maturity" OR "process management maturity" OR "BPM maturity" OR "process management capability" OR "BPM capability") OR
 (business AND ("maturity model" OR "capability model")) OR
 ("business maturity" OR "business capability") OR
 (business AND "process orientation" AND maturity))*

The string aims at retrieving *all* studies that refer to a BPMM (i.e., by proposing, applying, validating, classifying, or thoroughly analyzing that BPMM) (i.e. not necessarily those that have BPMM-performance relationship as their focus of research).

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 2. The search using the string retrieved 2899 studies, out of which 147 were identified as relevant for the purpose of this study. Eliminating the duplicate works retrieved from different libraries, we targeted 88 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
Scopus	946	48
SpringerLink	666	37
Web of Science	494	40
ScienceDirect	229	8
Emerald	218	12
Wiley	193	1
ACM	90	0
Ebsco	63	1
Total	2899	147

Table 2. Number of studies initially retrieved and selected for each electronic library.

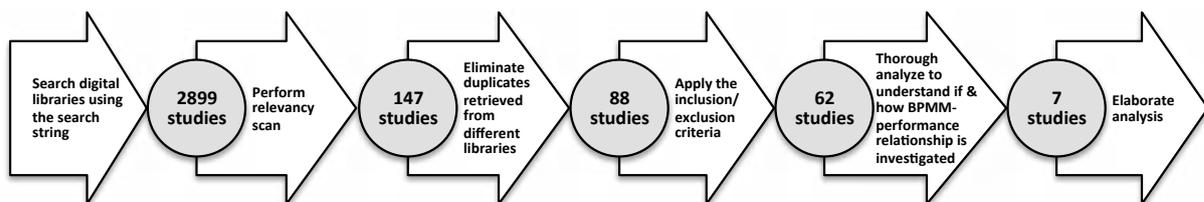


Figure 1. The refinement steps and the resulting number of articles.

In selecting the relevant studies, we applied the inclusion criteria as “the studies that propose, apply, validate, classify, or thoroughly analyze one or more ‘generic’ maturity models for business process, BPM or BPO”. We took the definition of maturity by Becker et al. (Becker et al., 2009) as our reference in identifying and labeling a generic BPMMs (given in Section 1). While reviewing the studies, we *excluded* those: (i) that refer to (i.e., propose, apply, validate, classify, or thoroughly analyze) a maturity model that focuses only on specific business domains (e.g., software development, supply-chain management), (ii) that refer to a maturity model that focuses on a particular aspect of BPM or on a related field (e.g., business-IT alignment, knowledge management, information technology), (iii) that propose or apply a method for measuring an organization’s level of BPM or BPO maturity, but do not refer to a generic model that complies with the definition of maturity model that we adopted [such works include, for example, (Reijers, 2006), (Chen et al., 2009), and (Kohlbacher and Gruenwald, 2011)], and (iv) that refer to a process or quality management model (e.g., European Foundation of Quality Management (EFQM), and ISO 9001) without direct emphasis on BPM or BPO maturity.

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 they mostly present and discuss concepts and ideas and they scarcely report, in a scientific manner, specific experiences or results from real-world implementations. 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, 62 studies were identified, which were used as the basis for the list of BPMMs that are referred to in the literature. Subsequently, we distinguished - within this set- the studies that provide empirical evidence for the argument that using BPMMs lead to improved business performance. After a thorough analysis over these articles, we identified a mere 7 studies that are applicable for our research purposes. These studies are listed in the Appendix. Among these works, 4 are published as journal articles, 2 published in conference proceedings, and 1 compiled as a book chapter.

We categorized these works with respect to the *research design and methodology*. With regard to the research design, we distinguished between qualitative, quantitative and mixed methods research (Creswell, 2008). Palvia et al. (2004) gives an overview of the *research methodologies* used in the Management Information Systems (MIS) research. Based on this work, the 7 articles that were analyzed were evaluated on their use of three research methodologies (strategies): (1) Case study, (2) survey, or (3) interview, Delphi study, focus group.

4 Results and Discussion

In this section, we present and discuss the results that provide answers to the research hypotheses given in Section 3.

4.1 BPMMs referred to in the literature

Our first research hypothesis (RH1) relates to the unbalanced focus in BPM community on model development over their empirical evidence of its effect on business performance. In verifying this contention, we investigated the generic maturity models that have been proposed for business process, BPM or BPO based on the studies reported in the scientific literature. Table 3 lists 20 maturity models that were identified after an in-depth scan of 62 articles. Nine out of 20 models were considered ‘leading’ with respect to the attention they acquired in the academic research. A BPMM is classified under ‘OTHER’ in the table when the model is not referred to (i.e. applied, validated, classified, or thoroughly analyzed) in at least two other articles with distinct authors different from those that have devel-

oped/released the model. According to these criteria, about half of the BPMMs listed in Table 3 have not been substantially referenced.

Abbreviation	Business Process Maturity Model (BPMM)	Primary Source
(1) BPM-CF	Business Process Management Capability Framework	(de Bruin and Doebeli, 2010; Rosemann and de Bruin, 2005)
(2) BPMM-FIS	Business Process Maturity Model	(Fisher, 2004)
(3) BPMM-HR	Business Process Maturity Model	(Harmon, 2004)
(4) BPMM-OMG	Business Process Maturity Model	(OMG, 2008)
(5) BPO-MF	Business Process Orientation Maturity Framework	(Willaert and Bergh, 2007)
(6) BPO-MM	Business Process Orientation Maturity Model	(McCormack and Johnson, 2001)
(7) PEMM	Process and Enterprise Maturity Model	(Hammer, 2007)
(8) PMMA	Process Management Maturity Assessment	(Rohloff, 2009)
(9) vPMM	Value-based Process Maturity Model	(Lee et al., 2009)
OTHER	Process Management Maturity Model	(Cronemyr and Danielsson, 2013)
	Process Safety Degree	(Dombrowski and Brinkop, 2011)
	Process Maturity Continuum – PMC	(Gardner, 2001)
	Maturity Model for Knowledge-Intensive Business Processes	(Heinze and Geers, 2009; Jochem et al., 2011)
	Business Process Maturity Model –BPMM	(Jadhav and Sapre, 2009)
	Maturity Estimation Model	(Kangilaski et al., 2013)
	Model for Business Process Maturity Assessment	(Moradi-Moghadam et al., 2013)
	Business Maturity Assessment Model	(Paunescu, 2009)
	Process Management Maturity (PMM) Model	(Saco, 2008)
Process-Structure Development Model (PSDM)	(Skrinjar et al., 2006)	

Table 3. Business Process Maturity Models referred to in the academic literature.

Figure 2 reports on two key concepts. First, based on 62 articles it shows the leading BPMMs and the numbers of articles that refer to these models (please note that an article may address more than one BPMM). Accordingly, Rosemann and De Bruin’s BPM-CF (2005), McCormack and Johnson’s BPO-MM (2001), and OMG’s BPMM (2008) were studied and referred to most in the academic literature (with 18, 17, and 13 studies, respectively).

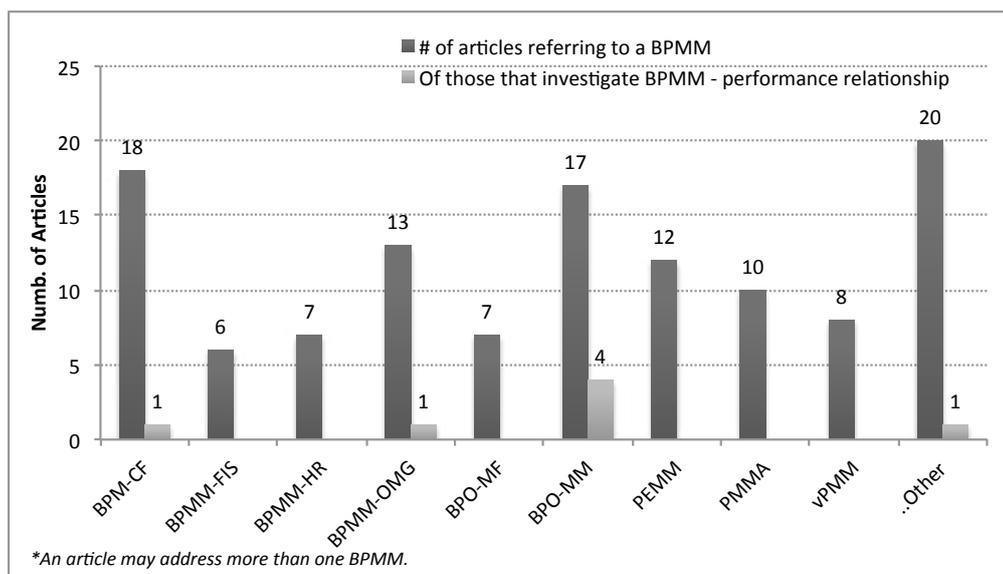


Figure 2. Number of articles that refer to a BPMM and business performance.

As a second key concept, the chart in Figure 2 shows the number of articles that investigate BPMM-performance relationship. Accordingly, the three models mentioned above (BPO-MM, BPM-CF and BPMM-OMG) are the only leading models that have been subjected to studies claiming the connection of their usage to the increased business performance. Therefore, 6 out of 9 leading BPMMs do not demonstrate evidence on the relation of their usage to firm’s improved business performance. This finding confirms our first hypothesis (RH1), which argues that a very limited set of models (among several existing ones) has been subjected to empirical research on the relation between increased process maturity and higher business performance.

4.2 Empirical evidence on the practical utility/validity of BPMMs

Our second research hypothesis (RH2) relates to the scarcity of the studies on the practical utility and validity of the BPMMs with regard to business performance. Out of 62 studies that refer to a BPMM, only 7 provide empirical evidence on that matter. Within these studies, 4 of them refer to BPO-MM, which has the highest number of studies that provide objective evidence on its validity. BPM-CF and OMG’s BPMM each have only a single empirical study on their application and validation (as also seen in Figure 2).

We analyzed the design methods (qualitative, quantitative, mixed) adapted for empirical works, and the research methodologies (case study, survey, etc.) used in these studies. As to the former, Figure 3 shows the numeric distribution of the articles per BPMM by empirical research design. The majority of the studies (5 out of 7) pursued a quantitative approach.

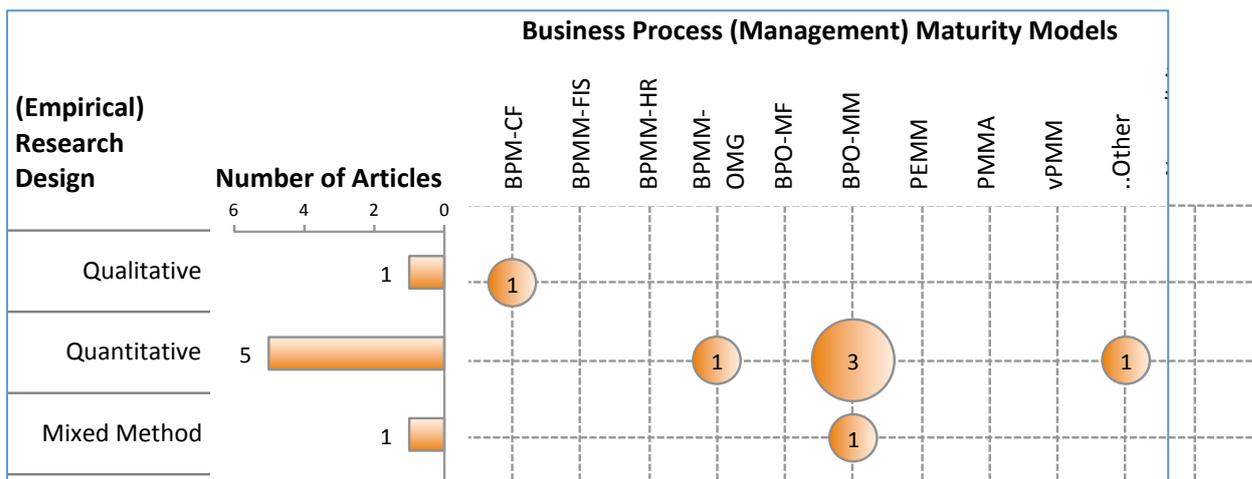


Figure 3. Distribution of articles per BPMM by Research Design.

Figure 4 depicts -for each BPMM- the distribution of works in terms of the research methodology they applied. Accordingly, the majority of the investigations (5 out of 7 studies) seem to rely on surveys as a method for deriving their conclusions. This is followed by the studies that applied the interview (or Delphi study/focus group) and the case study methods.

It is critical to note that *none* of these studies provide empirical evidence collected through a *longitudinal* (case) study, where companies are observed for long periods, and observations regarding the increased maturity level and performance indicators are collected continually over an elongated period of time. The studies evaluate the relationship between a maturity level and business performance through a single observation of vast numbers at a specific point in time, typically using surveys (e.g. [S1], [S2], [S3]).

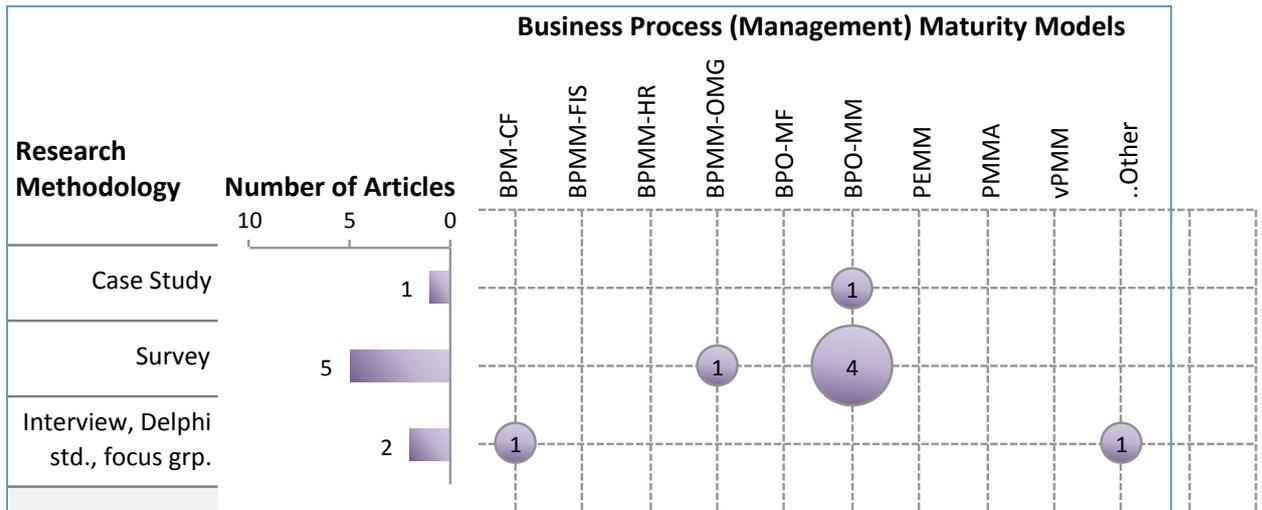


Figure 4. Distribution of articles per BPMM by Research Methodology (* an article may apply multiple research method).

In Table 4, we elaborate the characteristics of these studies, in terms of the BPMM referenced, research content, research design, research methodology, empirical context and population, investigated constructs and variables, achieved results and key limitations. As shown in the table, the studies [S1], [S4], [S5], and [S6] used BPO-MM as the underlying BPMM to demonstrate the effect of process orientation on organizational performance. The study [S2] used a specific model developed by the same authors (Paunescu, 2009), while the studies [S3] and [S7] used BPMM-OMG and BPM-CF respectively to show the effect of process maturity on process performance.

These studies confirmed the relation between a higher level of maturity and several aspects of organization's performance. However, the majority of the studies rely on a self-assessment of maturity level by a single survey participant. This may pose risks to the internal validity, as business process maturity assessments often require viewpoints of different organizational parties involved in diverse processes and functions.

A key finding in this regard is the scarcity of the works that relate business process, BPM or BPO maturity of an organization to its business performance in broad terms. The existence of evidence for this relationship is indeed an indicator for a maturity model's practical utility.

Ref. No	Referenced BPMM	Research Design	Research Method	Empirical Context and Population	Investigated Construct	Variables Studied	Method for Assessing Maturity	Result	Main Limitations
[S1]	BPO-MM	Quantitative	Survey	368 large and mid-sized industrial and service companies	The relationships among business analytics, BPO, and organizational performance	<i>Performance</i> : Financial, customer/market, process capability, learning and growth <i>BPO</i> : Leadership and strategy, process documentation, process performance assessment, organizational structure, people management, organizational culture and values, customer orientation, supplier orientation, and systems and information technology	A structured questionnaire (including BPO and performance constructs and indicators) sent electronically to the surveyed companies.	BPO and analytical indicators can be taken as predictors of performance.	- Not clear if the survey is answered by a single or multiple participants from each company. - Data collected at a single point in time.
[S2]	Other (Paunescu, 2009)	Quantitative	Interview, Delphi Study, Focus Group.	1302 public and private organizations from Romania	The relationships between the variables that account for a higher level of maturity and performance of organization's processes	Organization context, strategic planning, risk management, process management, resource management, results measurement and analysis, performance indicators, learning, improvement, innovation	The responses were gathered through face-to-face interviews using a structured questionnaire called Maturity Assessment Survey (MAS).	Strong positive correlations between the variables examined that account for a higher level of maturity and performance of organization's processes.	- Non-random selection of firms. - Maturity self-assessment based on an extensive questionnaire. - Data collected at a single point in time.
[S3]	BPMM-OMG	Quantitative	Survey	Two boundary spanning processes (purchasing and order fulfilment) in 880 randomly selected manufacturing firms	The effects of process maturity on performance	A total of 12 process outcomes from the perspectives of quality and efficiency (e.g., relative level of materials inventory holding costs, speed at filling orders, ease at which planned delivery dates can be changed)	Questions relating to the process maturity levels were taken from OMG defined levels.	Organizations with more mature purchasing and order fulfilment processes appear to have higher relative levels of quality and efficiency process outcomes than those with less mature purchasing processes.	- Only <i>two</i> processes of manufacturing firms. - Data collected at a single point in time.
[S4]	BPO-MM	Quantitative	Survey	405 companies with more than 50 employees in Slovenia and Croatia across industries in a transition economy	The effect of business process orientation on organizational performance	<i>BPO</i> : Process view, process jobs, process management and measurement <i>Organizational performance</i> : Financial performance, non-financial performance	Questionnaires were distributed to the CEOs or the chairpersons of the companies who were instructed to fill in the questionnaire themselves or give it to a competent person within the organization.	BPO leads to better non-financial performance and indirectly to better financial performance.	- Data collected through a single participant from each company. - Data collected at a single point in time.

Ref. No	Referenced BPMM	Research Design	Research Method	Empirical Context and Population	Investigated Construct	Variables Studied	Method for Assessing Maturity	Result	Main Limitations
[S5]	BPO-MM	Mixed Method	Case Study; Survey	Survey: 203 companies with over 50 employees in Slovenia. <i>Two case studies to assess BPO in:</i> Company A: manufactures female and male garments with 4,580 employees. Company B: a local affiliate of an international banking corporation with over 200 employees.	The effect of business process orientation on organizational performance	<i>BPO:</i> Process view, process jobs, process management and measurement <i>Organizational performance:</i> Financial performance, non-financial performance	The assessment of company's BPO is performed by using a BPO measurement instrument (with 15 items). Instrument for organizational performance measurement was devised and represented the second part of the entire instrument. Theoretically it is based on the balanced scorecard and its main goal is to measure different facets of organizational performance, namely the financial and the non-financial (a total of 19 items).	The impact of BPO on organizational performance is confirmed.	- Data collected through a single participant from each company. - Data collected at a single point in time.
[S6]	BPO-MM	Quantitative	Survey	127 organizations in Japan (from manufacturing, distribution, construction, service, and other domains)	The effect of business process orientation on organizational <i>innovation</i> performance	<i>BPO:</i> Process view, process jobs, process management and measurement <i>Effects of BPO:</i> Cross-functional integration, customer integration, and employee innovativeness.	All of the constructs were operationalized using scales that were validated in prior studies. Some items were slightly reworded to fit the context of the study. Each construct was measured with at least three items.	Process jobs and process management and measurement have an influence, however, neither process view nor cross-functional integration has a significant effect on organizational innovation performance.	- Data collected through a single participant from each company. - Data collected from companies operating in Japan. - Data collected at a single point in time.
[S7]	BPM-CF	Qualitative	Interview, Delphi Study, Focus Group.	4 financial services organizations in South Africa	The relations between success enablers (strategy, culture, people/resources, governance, methods, IT), and process success & business success.	<i>BPM enablers:</i> Strategy, culture, people/resources, governance, methods and IT <i>Process success:</i> Process efficiency, process quality, process agility <i>Business success:</i> Cost efficiency, client experience, business agility	The interview questions were open-ended and based on the BPM Success Model. Additionally, non-structured questions were asked de-pending on the information that emerged.	Process success does not necessarily result in business success. Increased maturity leads to process success.	- Business success constructs were dropped and only process success was investigated. - Only 4 organizations operating in South Africa and only in Financial Services domain.

Table 4. Characteristics of the studies included in the systematic literature review.

5 Conclusion

We speculated that the empirical evaluations of the BPMMs with regard to their relation to firm's business performance are scarce. In order to substantiate this argument, we conducted a systematic literature review. Out of 2899 initially retrieved studies published between years 1990 and 2014, we were able to identify 7 articles that report on the relationship between process maturity and business performance.

We identified 20 BPMMs that have been proposed in the literature, 9 of which were considered as leading with respect to the extent they have been studied in the literature. However, only 3 out of 9 leading models (BPO-MM, BPM-CF, and OMG's BPMM) have been referred to by studies that involve empirical works on their relation to business performance. The number of works per BPMM is yet limited: 4 empirical application or validation studies of BPO-MM, 1 empirical study on application of BPM-CF, and 1 empirical study on validation of OMG's BPMM. In total, we were able to identify 7 studies that report on the empirical evidence for the linkage between maturity and performance. In contrast to the considerable number of BPMMs proposed in the last decade, the extent of evidence for this relationship is very limited. Overall, these findings firmly validate our two research hypotheses.

An in-depth analysis of the leading models confirms the reflections by Pöppelbuß and Röglinger (2011) that the majority of the proposed models possess descriptive properties and show limited, prescriptive features. However, the granularity of descriptive properties in measuring business process maturity is a motivator to evaluate the relationship between the usage of the model and business performance. Still, limited prescriptive properties hinder the usage of a single BPMM for both assessment and improvement purposes. The studies included in our SLR provide empirical evidence on business performance at a specific time; and none of these studies measures business performance longitudinally, e.g. prior to and after implementing business process improvement based on using a BPMM. We consider such studies as an important future direction to strengthen the basis for business process maturity research.

To provide additional insight into the relationship between higher maturity and performance, we also provided an overview of the studies that explore the relationship between the level of BPO and business performance as well as a review of studies that relate business process maturity to business performance in the particular domain of Supply Chain Management. A glance of these studies indicates a positive influence of higher organizational process orientation on increased performance. Hence, research on BPMM can put more effort on uncovering and validating this relationship that also appear in other forms in closely related venues.

The limited number of works on model application and validation also makes it difficult for practitioners to build a business case for potential applications, which negatively influences the widespread acceptance of models in practice. Researchers in the BPM field should consider our study as a source that offers pointers and an initial basis for future research. Our findings indicate important gaps in the existing research where there is a potential for major, new contributions.

Our work has two basic limitations due to the inclusion and exclusion criteria used in selecting works and with regard to covering the academic literature only. Several works that are published as (non-academic) books, white papers in the grey literature reporting on model applications through case studies and surveys were not considered in this study. Future research can broaden the scope of the review to include contributions in the grey literature to gain further insight on the use and success of BPMMs in practice.

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Appendix List of studies included in the systematic review

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