



Business Process Maturity Models Research: A Systematic Literature Review

T. Bartosz Kalinowski

University of Lodz, Faculty of Management, Poland

Abstract: Business Process Maturity can be defined as the „degree of explicit definition, management, measurement, control and effectiveness” of organisational processes (Humphrey, 1987, p. 1- 13) or their ability to systematically provide better business results (McCormack, Johnson, 2001, p. 12). The practical implementation of the above concept is reflected through Business Process Maturity Models (BPMs). They have been designed in order to enable companies to shift their business process management from „as-is” state, where process are undefined and underperforming to a desired „to-be” state, in which processes are being continuously improved. The available literature proves that many review papers on BPMs, in particular those issued before 2010 lack an extensive set of systematic literature review or analysis criteria. For example, the authors didn't pay attention whether the analysed models focused on a single process, a specific group of processes or all organisational processes. Often, there was also no distinction between organisational and process maturity, which appeared in the analysed models as separate concepts, or different types of maturity (e.g. process, project, supply chain, etc.). Some systematic attempts for analysing BPMs were undertaken by e.g. A. Van Looy (2010, p. 687-697), M. Rosemann and J. vom Brocke (2010, pp 105-122), as well as M. Röglinger, J. Pöppelbuß and J. Becker (2012, p. 328-346), however still significant limitations of these research can be enumerated. As a result of the identified research gap, this paper aims at performing a systematic literature review based on transparent and sound criteria. The paper is divided into three main parts. The first part (introduction) focuses on presenting briefly the „state-of-the-art” regarding the Business Process Maturity Models research. The second part provides insights into the methodology of performing the systematic literature review. Finally, the last part of the paper discusses the results of the performed study and resulting conclusions.

Keywords: Business process maturity, Business process maturity model, Research, Systematic literature review

1. Introduction

There have been many different attempts to define “maturity” over the years. The general discussion on maturity and organisational maturing was started by R. L. Nolan (Nolan, 1973, p. 399-405) and P. B. Crosby (Crosby, 1980, p. 65). In more recent works, M. Kohlegger, R. Maier and S. Thalmann (Kohlegger, Maier, Thalmann, 2009, p. 51-61) claim that maturity models are “models that reflect certain aspects of reality, often called capabilities, and define qualitative attributes which are used to classify a competence object into one of several clearly defined classes”. With the growing interest in the concept of maturity in general, the Business Process Maturity has appeared as one of its important types. It was defined by W. Humphrey in 1987 as the „degree of explicit definition, management, measurement, control and effectiveness” of organisational processes (Humphrey, 1987, p. 1-13). Other authors (e.g. K. P. McCormack and W. C. Johnson) emphasized that Business Process Maturity means the ability to systematically provide better business results as a consequence of mature processes (McCormack, Johnson, 2001, p. 12). Consequently the Business Process Maturity Models (BPMs), have appeared as the practical examples of applying the Business Process Maturity within organisations.

BPMs can be characterized as models that aim at shifting the process management approach in companies from „as-is” state, where process are undefined and underperforming to a desired „to-be” state, in which processes are being continuously improved. It is worth noting that, although Business Process Maturity related papers became popular in

management journals over the last 20 years, the literature reviews reveals, that there is no consensus about the definition of the both terms (Business Process Maturity and Business Process Maturity Models). The authors who made the first attempts to present a comprehensive collection and analysis of various BPMMs were:

1. P. Harmon (Harmon, 2009, p. 1), who analysed 14 articles in the field of process maturity models published on the BPTrends.com website in the years 2003-2009
2. M. Rosemann and J. vom Brocke (Rosemann, vom Brocke, 2010, p 105-122), who analysed 9 different maturity models, however apart from BPMMs, their study focused as well on models beyond Business Process Maturity such as: Strategic Alignment Maturity Model or SOA Maturity Model. The first covered the maturity of strategic planning processes and the second the maturity of service oriented architecture.

Nevertheless the available literature proofs that the review papers on BPMMs, in particular those issued before 2010 (including the two aforementioned) lacks an extensive set of systematic literature review or analysis criteria. In many cases any reference to “Business Process Maturity” was sufficient criterion for including the paper in the scope of conducted analysis. For example, the authors didn't pay attention whether the analysed models focused on a single process, a specific group of processes or all organisational processes. Often, there was also no distinction between organisational and process maturity, which often appeared in the analysed models as separate concepts, or different types of maturity (e.g. the maturity of a process, a project, a supply chain, etc.). Some recent systematic attempts for analysing BPMMs have been undertaken by A. Van Looy et al. (Van Looy, De Backer, Poels, Snoeck, 2010, p. 687-697), as well as M. Röglinger, J. Pöppelbuß, J. Becker (Röglinger, Pöppelbuß, Becker, 2012, p. 328-346). A. Van Looy et al. pointed out that in order to compare models, they should focus on generic business processes (such as BPM – Business Process Management or BPO – Business Process Orientation) and exclude solutions for specific types of processes (e.g. software development, product development or human resources). M. Röglinger, J. Pöppelbuß and J. Becker also emphasized the requirement for analysing models for generic business processes, while criticizing the existing approaches to compare models of maturity in various areas (e.g. business maturity model versus supply chain maturity model) or those that differ in scope and detail of processes being considered (organisational process maturity vs. single process maturity). The three authors were the first to draw attention to the need for a more systematic approach to performing literature analyses regarding Business Process Maturity as well as the need to identify the principles of developing BPMMs (design criteria). They also argued that the studies on Business Process Maturity commonly adopted as cross-sectional and cited in the literature contained models that, although covered the aspect of maturity, could not be qualified as BPMMs. As it can be observed in works of different authors, there is no consensus in approaching the BPMMs related studies and still significant limitation of the conducted research can be identified. Therefore this papers aims at performing a systematic literature review based on transparent and sound criteria. The paper is divided into three main parts. This part have focused on presenting briefly the „state-of-the-art” regarding BPMMs research. The second part provides insights into the methodology of performing the presented systematic literature review. Finally, the last part of the paper discusses the results of the performed study and resulting conclusions.

2. Research Methodology

The literature study presented in the paper, covered the contents of the leading databases containing scientific publications, including conference articles. In particular the following sources have been analysed (in alphabetical order): Emerald, ScienceDirect, Scopus, SpringerLink, Web of Science and Wiley. In order to improve the research process, the EBSCO Discovery Service tool was used, which enables searches within the above-mentioned databases with a common interface. The analysed period covered the years 2002-2017. The database fields for which the search queries have been applied included the title and keywords, and also wherever possible (the database allowed this type of search) the abstract. The following search terms were used:

1. („process maturity” OR „process capability” OR „process management maturity” OR „process management capability” OR „process orientation maturity” OR „process orientation capability” OR „BPM maturity” OR „BPM capability” OR „BPO maturity” OR „BPO capability”)
2. („process management” OR „business process management” OR „BPM” OR „process orientation” OR „business process orientation” OR „BPO”) AND („maturity” OR „maturity model” OR „capability model”).

In total, 153 papers were identified in the first stage, however after eliminating duplicates and papers not matching the scope of the research, the number of papers was reduced to 60. However, as the number of the papers was still substantial, an in-depth analysis was introduced afterwards. In order to achieve a focused analysis, the following criteria were introduced:

1. The publication should focus on a large number of analysed BPMMs (at least 5).
2. The study should primarily focus on organisational process maturity (BPM/BPO), excluding such approaches like: single processes (e.g. purchasing process maturity) or other than BPM/BPO approaches to maturity (e.g. supply chain maturity).
3. Conference papers that were developed into journal publications by their authors were excluded.

The applied procedure resulted in selection of 6 papers that were included in the presented study:

1. Rosemann, M., vom Brocke, J. (2010). The six core elements of business process management. In vom Brocke, J., Rosemann, M. (ed.), Handbook on business process management (p. 105-122). Berlin: Springer.
2. Röglinger, M., Pöppelbuß, J., Becker, J., (2012). Maturity models in business process management. Business Process Management Journal (p. 328-346).
3. Wendler, R. (2012). The maturity of maturity model research: A systematic mapping study. Information and Software Technology (p. 1317-1339).
4. Van Looy, A., De Backer, M., Poels, G., Snoeck, M. (2013). Choosing the right business process maturity model. Information & Management (p. 466-488).
5. Tarhan, A., Turetken, O., Reijers, H. A. (2016). Business process maturity models: A systematic literature review. Information and Software Technology (p. 122-134).
6. Van Looy, A., Poels, G., Snoeck, M. (2017). Evaluating business process maturity models. Journal of the Association for Information Systems (p. 461-500).

For a detailed analysis of the selected works, the following analysis criteria were adopted:

1. Characteristics of the publication:
 - a. Aim of the publication and/or presented research.
 - b. Research questions and/or hypotheses, which were stated in the publication/study.
 - c. Research methods, which were applied in the publication/study.
2. Number of models/articles, which were analysed in the publication/study.
3. Results/conclusions of the conducted study, including, first of all, the results of the literature research.
4. Limitations formulated by the author/authors in the publication (or if they weren't specified, limitations that can be identified on the basis of the analysis of the conducted study).

3. Research Results

The results of the conducted systematic literature review are presented in the table below.

Table 1: Results of the performed systematic literature review (Rosemann, vom Brocke, 2010, p. 105-122; Röglinger, Pöppelbuß, Becker, 2012, p. 328-346; Wendler, 2012, p. 1317-1339; Van Looy, De Backer, Poels, Snoeck, 2013, p. 466-488; Tarhan, Turetken, Reijers, 2016, p. 122-134; Van Looy, Poels, Snoeck, 2017, p. 461-500)

M. Rosemann, and J. Vom Brocke (2010)	
Aim	Perform a review of BPMMs in order to identify key elements of their construction.
Research questions/hypotheses	Not specified
Research methods	Not specified
Number of analysed models/papers	9/not specified
Results/conclusions	Six key elements of the construction of BPMMs were defined and described, including: Strategic alignment, Governance, Methods, Information technology, People, and Culture. Each of the key elements was divided into 5 detailed sub-areas.

Limitations	Small number of models included in the study. Lack of information on the applied research methodology. Unclear criteria for the selection of the analysed models, apart from the models on Business Process Maturity other aspects of maturity have also appeared.
M. Röglinger, J. Pöppelbuß, J. Becker, (2012)	
Aim	Provide a systematic in-depth review of BPMMs.
Research questions/hypotheses	RQ1 What maturity models exist for BPM? RQ2 To what extent do these models meet the requirements of applicability and usefulness?
Research methods	Systematic literature review
Number of analysed models/papers	10/not specified
Results/conclusions	The analysed models describe Business Process Maturity in organisations, which is graded from immature/initial to developed. Models differ in scope because some of them focus on process practices (broadly understood activities associated with the implementation of the processes in the organisation, going beyond the management of the process), processes (narrowly understood activities concerning primarily the management of a single process) or both. Based on the analysis, the authors formulated the principles of designing BPMMs, that were divided into: 1. Basic, containing information about the content of the model. 2. Descriptive, containing information about the scale and method of assessing the level of process maturity. 3. Prescriptive, containing information and good practices on how to improve process maturity as a result of the performed evaluation. The analysis revealed that most models cover basic and descriptive level, but the presentation of the prescriptive level is very rare.
Limitations	Small number of models included, which was mainly limited to the selections presented in previously published articles - P. Harmon (2009) and M. Rosemann, J. vom Brocke (2010), which can be characterized by numerous limitations. The BPMMs design principles, didn't consider works of other authors in this area (e.g. Trkman, 2010, p. 125-134).
R. Wendler (2012)	
Aim	Structure and analyse the available literature in the field of maturity model research to identify the state-of-the-art research as well as research gaps.
Research questions/hypotheses	RQ1 What is the main focus of maturity model research and what research topics are relevant besides developing and using maturity models? RQ2 How can the field of maturity model research be structured? RQ3 What are the most common research designs and methods applied? RQ4 How important are design-oriented vs. conceptual designs for the development of maturity models? RQ5 How are developed maturity models validated? RQ6 How important are qualitative vs. quantitative methods for validation? RQ7 What are the most common maturity models addressed in research? How important are maturity models developed by industrial consortia, practitioners, or standardization organisations for research? RQ8 In what domains are maturity model research applied? RQ9 How have publication amount, frequency, and research topics changed over time? RQ10 What are relevant search terms and what are the main publication forums?
Research methods	Systematic literature review
Number of analysed models/papers	Not specified/237

Results/conclusions	Mapping of 237 articles showed that current research on maturity models refers to more than 20 areas of enterprise functioning, largely dominated by development and implementation of software. Four main groups of articles and potential future research areas on maturity models were identified, covering: development, application, validation and comparative analysis (46%, 35%, 14% and 6% of the analysed publications, respectively). Publications that review maturity models or analyse them are rare. Maturity in organisations has gained a growing interest over the analysed period (1993-2010). A research gap has been identified in relation to the evaluation and validation of the majority of developed models.
Limitations	The article focuses on different maturity models, treating Business Process Maturity as one of the domains of maturity, but it has been included in this study due to its comprehensiveness (number of analysed models) and relevance of the stated research questions.
A Van Looy, M De Backer, G Poels, M Snoeck (2013)	
Aim	Present the methodology of developing a tool that facilitates the selection of a BPMM, which is appropriate to the organisation's specificity.
Research questions/hypotheses	RQ1 Which criteria help users (e.g. organisations or academics) choose a BPMM?
Research methods	Systematic literature review
Number of analysed models/papers	69/80
Results/conclusions	As a result of the conducted research, an electronic tool (BPMM Smart - Selector) was developed in order to enable selection of the most appropriate model according to specified criteria. The tool is based on six areas of competences related to Business Process Maturity: Modelling, Deployment, Optimisation, Management, Culture, Structure and 17 specific areas of competence: Design, Analysis, Implementation and enactment, Measurement and control, Evaluation, Improvement, Strategy and key performance indicators, External relationships and service level agreements, Roles and responsibilities, Skills and training, Daily management, Values, Attitudes and behaviours, Appraisals and rewards, Top management commitment, Organisation chart, Governance bodies.
Limitations	Although the article in the title and content refers to BPMMs, the applied selection criteria resulted in considering a wide selection of models (beyond BPM and BPO).
A. Tarhan, O. Turetken, H.A. Reijers (2015)	
Aim	Better understand the state of the research on BPMMs and identify opportunities for future research.
Research questions/hypotheses	RH1 The BPM academic community has put more effort and emphasis on developing maturity models than empirically evaluating them. RH2 There is a lack of studies validating that an increased process maturity level of an organisation with respect to a BPMM leads to an improved business performance. RH3 Most BPMMs display descriptive rather than prescriptive characteristics. RH4 The distinction between a maturity model and an assessment model is not well defined in the BPMM research.
Research methods	Systematic literature review
Number of analysed models/papers	10/61

Results/conclusions	The paper, as the only review study, focused on BPM/BPO maturity models (covering the entire organisation and all processes). Despite many models developed in recent years (the paper covered works published between 1990 and 2014), the number of empirical evidence proving their usefulness is small. The research on Business Process Maturity is at an early stage of development, and it primarily lacks a description of the methodology of using BPMMS. Future research should be aimed at: supplementing existing models with application procedures; confirming the usefulness of existing models; introducing a clear distinction between the BPMM (understood as a reference model that can be used to perform the assessment of the maturity) and the model/method of Business Process Maturity assessment.
Limitations	With regard to the presented study – none.
A Van Looy, G Poels, M Snoeck (2017)	
Aim	Develop a comprehensive, ranked, and weighted set of selection criteria for BPMMS that are not specific to any organisation.
Research questions/hypotheses	RQ1 Which criteria are most relevant for BPMM selection, and what is their relative importance? RQ2 How can one evaluate current BPMMS against these selection criteria?
Research methods	Systematic literature review, content analysis
Number of analysed models/papers	69/not specified
Results/conclusions	As a result of the analysis, 14 criteria determining the selection of a specific model by potential users were determined. At the same time, they were also discussed as guidelines for the development of new BPMMS. Those criteria were: Capability areas, Functional role of respondents, Number of business processes, Type of business processes, Architecture details, Architecture type, Data collection technique, Purpose Rating scale, Validation, Assessment availability, Assessment duration, Costs, Number of assessment items.
Limitations	Although the paper does not specify this, it is expected that the same set of models was used for analyses as in the previous paper of the same authors (Van Looy, De Backer, Poels, Snoeck, 2013, p. 466-488), therefore similar limitations may be applied.

4. Conclusion

On the basis of the preformed analysis, the following conclusions can be drawn:

1. There is a large discrepancy in the methods used for the analysis of BPMMS over the analysed period and studies.
2. Among the cited authors (e.g. M. Röglinger, J. Pöppelbuß and J. Becker, as well as A. Tarhan, O. Turetken and H. A. Reijers), the dominant approach comprises in a claim, that all analyses of BPMMS should only be conducted in relation to those that address the issue of Business Process Maturity at a possibly general level (referring to all processes and the entire organisation, thus employing the BPM or BPO view). Consequently, it can be concluded that models, that do not meet these criteria, and therefore relate to:
 - a. a specific management areas such as supply chain management;
 - b. a selected area of business management, such as knowledge management;
 - c. Business Process Maturity indirectly, as is the case of some quality management models (e.g. EFQM - European Foundation for Quality Management Model);
 should not be treated as BPMMS and included in comparative studies.
3. In the context of the previous point, it is worth emphasizing that some authors themselves were also inconsistent. For example, A. Van Looy et al. in the article from 2010, presented at the conference pointed out that in order to compare models with each other they should focus on Generic Business Processes (such as in BPM or BPO approach) and exclude models that present solutions for specific types of processes. However, the article from 2013, presented in this study, did not take this assumption fully into account.
4. The number of BPMMS described in the literature is very large, however, only few of them can be used by enterprises to actually assess Business Process Maturity. This is due to the fact that majority of the models provide a description of

Business Process Maturity concept and sometimes the assessment methodology, however in most cases, the examples of their validation are scarce. The same applies to papers demonstrating the use of BPMs for organisational improvement. In conclusion, it can be stated that there is no justification for the development of new BPMs. On the contrary, it is necessary to describe the existing ones better, through fine-tuning application procedures and their use for improvement purposes. This, in turn, will allow to go beyond the current development phase of BPMs, that can be described as conceptual and enrich the Business Process Maturity body of knowledge, as well as provide a useful tool for the business practice.

References

- Crosby, P. B. (1980). *Quality is free: The art of making quality certain*. New York: McGraw-Hill.
- Harmon, P. (19.05.2009). *Process maturity models*. BPTrends. Retrieved 24.11.2017 from http://www.bptrends.com/publicationfiles/spotlight_051909.pdf.
- Humphrey, W.S. (1987). *Characterizing the software process: A maturity framework*. Pittsburgh: Carnegie Mellon University/Software Engineering Institute.
- Kohlegger, M., Maier, R., Thalmann, S. (2009). *Understanding maturity models. Results of a structured content analysis*. Proceedings of I-KNOW 2009 and I-SEMANTICS 2009 (p. 51-61).
- McCormack, K. P., Johnson, W. C. (2001). *Business process orientation: Gaining the e- business competitive advantage*. Boca Raton: CRC Press. [Crossref](#)
- Nolan, R. L. (1973). *Managing the computer resource: a stage hypothesis*. Communications of the ACM (p. 399-405). [Crossref](#)
- Röglinger, M., Pöppelbuß, J., Becker, J., (2012). *Maturity models in business process management*. Business Process Management Journal (p. 328-346). [Crossref](#)
- Rosemann, M., vom Brocke, J. (2010). *The six core elements of business process management*. In vom Brocke, J., Rosemann, M. (ed.), *Handbook on business process management* (p. 105-122). Berlin: Springer. [Crossref](#)
- Tarhan, A., Turetken, O., Reijers, H. A. (2016). *Business process maturity models: A systematic literature review*. Information and Software Technology (p. 122-134). [Crossref](#)
- Trkman, P. (2010). *The critical success factors of business process management*. International journal of information management (p. 125-134). [Crossref](#)
- Van Looy, A., De Backer, M., Poels, G., Snoeck, M. (2013). *Choosing the right business process maturity model*. Information & Management (p. 466-488). [Crossref](#)
- Van Looy, A., Poels, G., Snoeck, M. (2017). *Evaluating business process maturity models*. Journal of the Association for Information Systems (p. 461-500). [Crossref](#)
- Wendler, R. (2012). *The maturity of maturity model research: A systematic mapping study*. Information and Software Technology (p. 1317-1339). [Crossref](#)