



World Scientific News

An International Scientific Journal

WSN 129 (2019) 51-71

EISSN 2392-2192

Process Maturity Models – Applicability and Usability Review

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ABSTRACT

Maturity models are tools enabling application of structured approach for process improvement and assessment of business process management capabilities (BPM) of the organizations. In fact, the number of maturity models is so large that it is difficult or even impossible to identify leading standard. The aim of this paper is therefore to provide a review of BPM maturity models. Design/methodology/approach - the article follows research process of literature review. This work focuses in particular on the applicability and usability of process maturity models that were reviewed according to general design principles. Research Limitations/implications - The author is convinced that this review covers the main publicly available BPM maturity models. As the number of models is constantly increasing, paper is not claiming completeness.

Keywords: Business Process Management, BPM, Maturity Model, Maturity Assessment, evaluation of process maturity

1. INTRODUCTION

The basic assumption of process management is that the quality of products and services largely depends on the quality of processes used to develop, deliver and support them. Regardless of what is the activity of the organization, the need to clearly define, manage, measure, control, analyze and improve their business processes is the same.

This article focuses on maturity models, their historical development, how they are applied, and when business process management (BPM) can use maturity concepts to achieve organizational benefits.

The concept of maturity is ambiguous and often used imprecisely, both in relation to entire organizations and individual processes. Presentation of basic definitions is therefore necessary to properly describe the subject of process maturity models.

A. Organizational process maturity, just like maturity in general (defined by Cambridge Dictionary as the “state of being completely grown”) is a consequence of interconnected: growth, development, changes and improvement of various areas of the company's functioning, especially those related to the implemented processes. Organization's process maturity can be explained as a measure of an organization's readiness and capability expressed through its people, processes, data and technologies and the consistent measurement practices that are in place identifies the degree to which processes are formally defined, managed, flexible, measured and effective. In a mature organizations processes are not only defined executed and managed, but also executed in accordance with design. The processes need to be documented, roles and responsibilities clearly defined and understandable to those who carry out related activities. Necessary improvements in selected processes are developed, controlled and adjusted to business objectives. The quality of products and services as well as the processes that make them up is monitored. As a result, the significance and benefits of the maturity of processes in the organization are clear.

B. Process maturity is a narrower concept than organizational maturity and depends on reaching maturity in other areas of the organization. Process maturity is an indication of how close a developing process is to being complete and capable of continual improvement through qualitative measures and feedback. The maturity of the process is based on the first ideas of Crosby, [6] and Humphrey [13] and represents a degree of clear definition, management, measurement, control and effectiveness of the process. Maturity therefore can be explained as "the state of being complete, perfect, or ready".

C. Process is defined as a number of interrelated activities that creates a given output based on given inputs. The input consists of supplies (material, immaterial), attributes, resources, development environment (infrastructure, tools, ...). The output consists of deliverables that are used in the next interdependent process (or customer, user). The purpose of the processes is to achieve the business objectives.

D. Measurement. It is defined as a result, usually expressed in numbers, that is obtained by measuring something. It describes the quality, value, or effect of something. Measurement is therefore the activity of deciding how great it is. In recognizing the subject of maturity models, it is important to notice that measurement is essential for organizations that intend to reach a high level of maturity in their processes. Measurement provides objective information on project performance, process efficiency, process capability and the quality of products and services. In addition, measurement helps to ensure objective assessment, and leads to risk identification (and management) as well as to early detection and troubleshooting. Measurement enables organizations to learn from the past to improve performance and achieve greater predictability over time. It also provides information that improves the decision-making process. Therefore, measurement activities are fundamental to improving the quality of processes, products and services, as they provide objective information that can be used to make

decisions. An organization with a mature approach in this area will be confident that it will be able to provide products or services that meet the needs of its customers [10].

E. Model is a theoretical description that can help to understand how the system or process works, or how it might work. It is used in order to understand or explain how something works. It is a system that is being used and that people might want to copy in order to achieve similar results [www.collinsdictionary.com].

2. MATURITY MODELS – BASIC CONCEPTS

The main objective of the maturity models is to outline the stages of the improvement and maturity pathways. This also covers characteristics of each stage and logical relationship between them [13]. In terms of practical use, the typical purposes of use are descriptive or comparative [7].

The maturity model serves a descriptive purpose if it can be used for assessment as such. It serves a normative purpose if it indicates how to identify desired future maturity levels and if it provides guidance on how to implement improvement measures.

The maturity model serves a comparative purpose if it allows internal or external benchmarking. Based on the assumption of predictable patterns of evolution and organizational change, maturity models usually present theories of how the capacity of an organization evolves step by step along an expected, desired or logical path [14, 30]. Therefore, they are also called growth stage models, stage models or stage theories [19]. Early examples of maturity models refer to the hierarchy of human needs [18], economic growth [16] and IT progress in organizations [22]. For example, Nolan's phased hypothesis has stimulated many studies, which have resulted in formulations its empirical validity [24].

Such a step-by-step model was widely accepted and led to hundreds of models based on a step-by-step sequence of levels [7]. Only a few mature models follow other structural projects [23]. Models of maturity have been the subject of criticism since their creation. Their nature of 'step-by-step regulations' oversimplifies reality and has no empirical basis [3, 7, 15].

Moreover, they tend to neglect the existence of many and perhaps equivalent maturity paths [17]. Since internal and external features may limit the applicability of the maturity model in its standard version, [21] require the maturity models to be reliable. Common base for critic is the fact that most maturity models are focused on a sequence of levels in the direction of a predefined "end state" and not on factors that actually change and evolve [15].

Criticism refers to a large number of similar maturity models, unsatisfactory documentation, non-reflexive acceptance and missing economic foundations [2, 22]. In fact, the number of maturity models is so huge that identification of widely accepted standard is difficult or even not possible. The aim of this document is therefore to provide a systematic, in-depth review of BPM maturity models and allow selection of the most appropriate one based on meaningful criteria.

3. PROCESS MATURITY LEVELS

The maturity of the process is an indicator of how close it is to be complete and capable of continuous improvement through quality measures and feedback.

The process maturity is gradual. This is evidenced both by the definition of process maturity models and their design. The dominant approach is to use descriptions of maturity levels according to the specified scale.

In majority of existing models five-stage scales dominate, but there are also different approaches, under which less (e.g. in the PPI model there are three) or more maturity levels are identified. It can also be observed that scales with fewer levels (e.g. three or four) are generally more aggregated - differences in each of the implementation's level of the process approach are large, compared to scales with more levels (e.g. five or six), where transitions between levels are smoother.

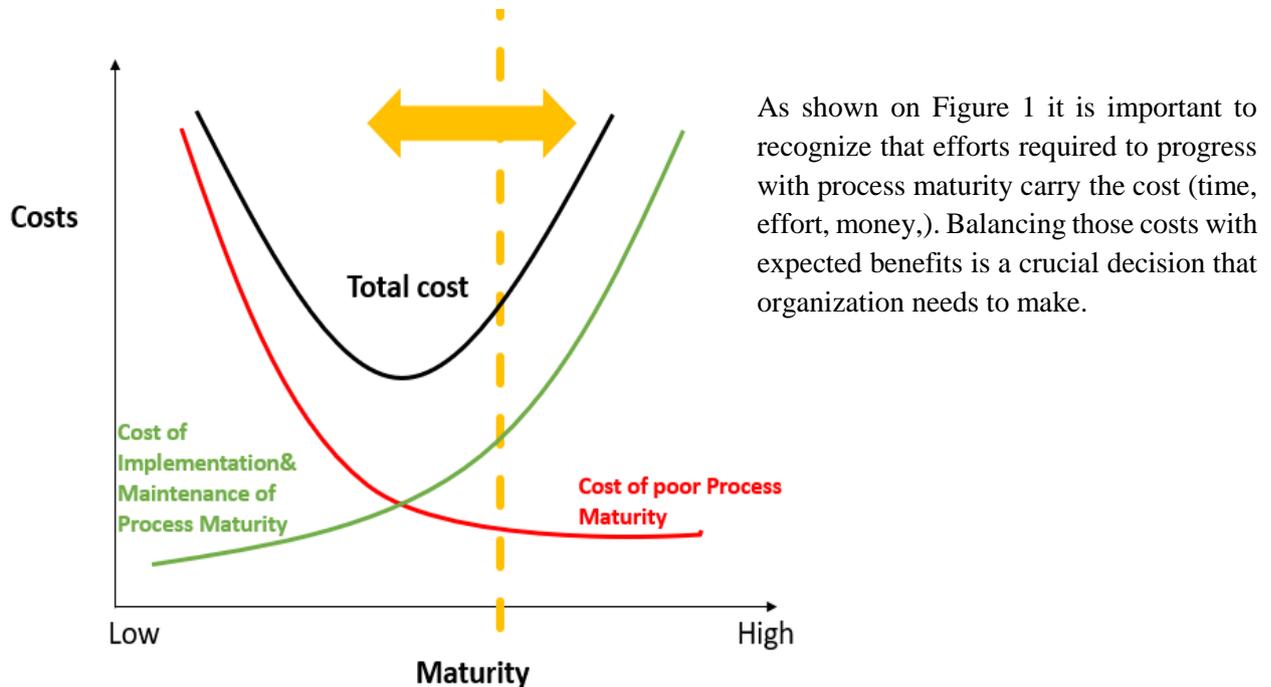


Figure 1. Cost vs Process Maturity relationship -own work based on literature review

The detailed characteristics of the maturity levels used in the different models have certain points in common. The lowest maturity levels are mainly indicative of: 1) lack of awareness that the performed work takes place or may take the form of processes; 2) lack of organization of processes and their implementation in an accidental, ad hoc manner; 3) effectiveness of process implementation depending on individual efforts of individual employees; 4) focus primarily on functional organizational units and lack of process structures.

As maturity grows, emphasis is placed on, among other things: 1) identification and description of processes; 2) identification and analysis of process customers' needs; 3) definition of the design and assignment of roles related to the processes carried out; 4) process measurement, development of measures and collection of information on the results of implemented processes; 5) beginnings of work related to the analysis and optimization of processes; 6) support for processes through IT solutions; 7) gradual transition from an organization dominated by functional units to an organization dominated by processes; 8) use of reference models and methods and tools facilitating process management.

At the highest levels of process maturity, it is crucial first and foremost for the organization to demonstrate: 1) consolidation of activities related to continuous improvement of processes and their optimization; 2) focusing on the dominant role of processes in the organizational structure; 3) building a process culture. Due to similar characteristics of different levels of procedural maturity and their reference to similar procedural practices, it can be concluded that from the point of view of the application of maturity levels in practice, the choice of a specific approach will be of secondary importance.

Not all the measures required to achieve a given level of process maturity will be implemented in the case of a specific organization and it will not be clear at which level of process maturity it should be classified. However, regardless of the problems identified, the process maturity scale should be treated as an attempt to describe organizational reality, which may help organizations to identify the degree of their advancement in process management.

4. DESIGN PRINCIPLES FOR BUILDING MATURITY MODELS

As mentioned in previous paragraph maturity models can be used for different purposes - diagnostics, improvement or comparison with others, and therefore they are usually differentiated into [19]:

- Descriptive models - which are used as diagnostic tools to determine the existing state for reporting to management or external stakeholders (so-called as-is models).
- Normative/Prescriptive models - which are used as tools for improvement, because in addition to identifying the current state, they describe the desired target state and provide guidance on the next steps to be taken and improvement measures (so-called to-be models).
- Comparative models - which enable internal or external benchmarking

Distinction between descriptive, prescriptive and comparative models actually illustrates the evolution of the maturity model, as the model must first be descriptive, to gain a deeper understanding of the current situation achieved in the field, then improving, indicating concrete, repetitive actions to improve the current state, and finally becoming a model used by so many companies that it is possible to collect sufficient data to make reliable comparisons. It leads to conclusion that designed procedure needs to provide clear guidelines for the development of a maturity model that considers all these stages of evolution. Moreover, such a scheme needs to be universal enough to be ready for use in different disciplines. The order of individual phases is important here, as it follows from the logical order (e.g. determining the scope of the model will then influence the choice of research methods to fill it with knowledge, as well as the way it is tested), while the transitions between successive steps may be iterative (after the testing phase it is possible, and even advisable, to return to earlier stages) [7].

Works on the methodology of such construction of process maturity models by T. de Bruin, M. Rosemann, R. Freeze and U. Kulkarnia [7], propose to distinguish six stages of the process of creating maturity models, which are: (1) determining the scope of the model, (2) design, (3) filling the model with knowledge, (4) testing, (5) application and (7) maintenance of the model. Another approach to the methodology of creating maturity models is the procedure proposed by J. Becker, R. Knackstedt and J. Poppelbuß [2], based on seven guidelines for design science defined by Hevner and his collaborators [12]:

The procedure begins with:

- 1) Definition of the problem, which must include both the identification of the area and target group, as well as convincing demonstration of the significance of the problem, i.e. the current demand for a given maturity model.
- 2) Comparison with the existing maturity models, which should indicate the added value brought by the new artifact, which is currently being created - the motivation to improve older models are here limitations of their transferability from the areas they were originally dedicated for.
- 3) Define a design strategy, which may consist in creating a completely new model, modifying the existing model, combining several models into one or transferring the structure (or content) of the existing model to the new domain [2].
- 4) Iterative development of the maturity model, which includes repetitive activities such as: selection of design level, choice of approach, design of the model section and testing of results. The design level defines architecture, i.e. the basic structure of the maturity model, which is generally multidimensional and hierarchical. The attributes of the individual dimensions and the criteria for assessing them should be further defined.
- 5) Model evaluation, in which different forms of model are transferred to the users. It must also take into account the possibility of evaluating the solutions proposed by the model, which means that it is possible to obtain feedback from potential users (e.g. in the form of questionnaires).
- 6) Model implementation, is to ensure that the model becomes available to pre-defined target groups.
- 7) Assessment of the model from point of view of the question whether it provides the anticipated benefits and actually improves the solutions to a specific problem of the organization (the assumed objectives are compared with actual observations).

Comparison of these two methods of building maturity models allows to draw several conclusions. First of all, the methods presented are very similar. Other phase-by-phase nomenclature actually includes the same or similar activities (e.g. determining the scope of the de Bruin model is the same as the stages of model definition, comparison with others and [1]). Secondly, the authors recommend the same research methods in creating the structure of the model and filling it with content - e.g. literature analysis, group interviews, expert panels. Thirdly, the authors use a slightly different terminology, what makes comparison difficult.

5. THEORETICAL COMPONENTS OF PROCESS MATURITY MODELS

The starting point for the formulation of detailed areas of process maturity is identification of key elements of process management (so called competence areas).

This concept is a foundation for model proposed by M. Rosemann and J. Vom Brocke [25] who identified six key elements (strategic alignment, governance, methods, information technology, people, and culture), each with five competence areas - a total of 30 competence areas.

Similarly, A. Van Looy, M. De Backer [31] has built their model as an assessment method of theoretical components of the process maturity models. They indicate 6 components of

models and divide them into 17 subcategories. This model provides detailed explanations of the practical justification and content of the individual BPM area.

Despite a slightly different theoretical basis and a different patterns for the distribution of issues related to process management, Rosemann's approach is clearly similar to the seventeen subcategories defined by A. Van Looy, M. De Backer, and G. Poels [31].

Model proposed by de Bruin [7] is different. This model was founded on the logical sequence of development phases - it starts from descriptive phase, that sets the foundation for further evolution in prescriptive and comparative phases.

The first phase in developing a de Bruin's model is to determine the scope of the model. Decisions taken at this stage influence all remaining phases in the model development. Determining the scope of the desired model will set the outer boundaries for model application and use.

The second phase of the framework is to determine a design or architecture for the model that forms the basis for method of application (Self Assessment, Third Party Assisted, Certified Practitioner, other), scope of application (1 entity / 1 region, Multiple entities / single region, Multiple entities / multiple region) and audience (Internal, External)

In the third phase content of the model is decided. In this phase it is necessary to identify what needs to be measured as well as what measurement system will be applied.

Fort phase concentrates on testing of both the construct of the model and the model instruments for validity, reliability and universality.

Phase 5 concentrates on making the model available for use and leads to initial decision of general acceptance or rejection.

Final phase- Maintenance (6th) defines set of actions required to improve maturity together with resources dedicated for them. This aspect is a essential for continued support for the model's standardization and global acceptance. The availability of maintenance resources is determined to some degree by initial scoping.

Another model that follows phased approach is the one proposed by Becker [2]. This model refers to IT management and distinguishes 7 phases in the development of maturity models (and Rejection as potential 8th phase). Design strategy applied by Becker in his model combines several models into a final one. Becker proposed to use the identified maturity models as a starting point for the design process. His maturity model was designed in series of 5 iterations. The evolution path proposed by Becker is started from a complete lack of IT performance transparency and ends at its highest level in a networked IT performance measurement process that is supported by companywide integrated BI tools.

Main components of presented Maturity models are summarized in Table 1 "Components of Process Maturity Models".

The second area of importance for the construction of process maturity models, emphasized by numerous authors, are the principles of model design. J. Pöppelbuß and M. Röglinger [23], who were the first to describe this issue, analyzed selected models of process maturity and on this basis divided the principles of their design into three groups:

- A. basic design principles,
- B. principles for a descriptive purpose of use;
- C. principles for a prescriptive purpose of use.

Relationships between groups are incremental - the following group includes the previous one.

A schematic representation of this relationship is shown in Figure 2 “Relationship between design principles for maturity assessment models”:

Table 1. Components of Process Maturity Models- own work based on literature review

Components of Process Maturity Models			
1.De Bruin	2. Becker	3. A. Van Looy	4.M. Rosemann i J. Vom Brocke
Scope of the model	Problem definition	Modelling of the processes	Strategic adjustment
Design	Comparison of existing models	Implementation	Management
Populate	Determination of Development strate	Optimalization	Methods
Test	Iterative development of the model	Managing of the procesesses	Information Systems
Deploy	Model evaluation	Culture	People
Maintain	Implementation	Process' structure	Culture
	Assesment		

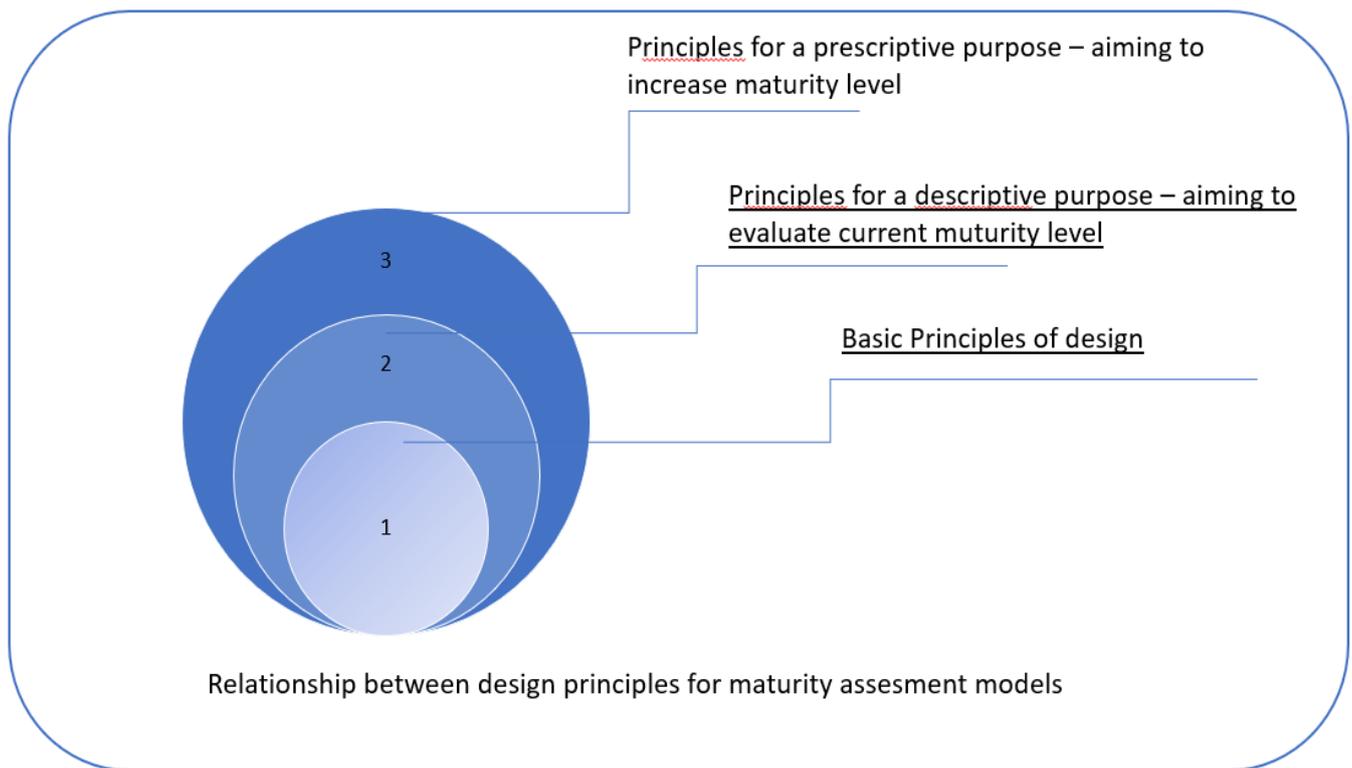


Figure 2. Relationship between design principles for maturity assessment models -own work based on Röglinger, Pöppelbuß, & Becker (2012).

Subsequently, for each of the groups detailed rules of model design were identified.

Table 2. Rules of maturity model design - own work based on Röglinger, Pöppelbuß, & Becker (2012)

<p>1.1. Basic Information:</p> <ul style="list-style-type: none"> • Field and conditions of use of the model • Purpose of Use • Target Group of users • Entities for which the model is intended • Comparison with existing models • Design Process and scope of empirical verification 	<p>2.1. Assessment Criteria for each maturity level and of each degree of detail</p>	<p>3.1. Improvement Meters for each level of maturity and each degree of detail</p>
<p>1.2. Definitions of key concepts related to maturity:</p> <ul style="list-style-type: none"> • Maturity and maturity dimensions • Maturity Levels and maturity path • Levels of detail (granularity) of maturity • Theoretical Fundamentals of the model (theoretical assumptions about evolution and change) 	<p>2.2. Assessment Methodology intended for the target group:</p> <ul style="list-style-type: none"> • Evaluation Procedure • Guidelines for assessment criteria • Tips for adapting and configuring the criteria • Expertise from previous model applications 	<p>3.2. Decision-making Analysis for selection of appropriate improvement measures:</p> <ul style="list-style-type: none"> • Explanation of objectives • Explanation of important factors influencing the choice of gauges • Distinction between external reporting and internal improvement perspectives
<p>1.3. Definitions of key concepts related to the field of the model</p>		<p>3.3 Decision-making Methodology intended for the target group:</p> <ul style="list-style-type: none"> • Operating Procedure • Guidelines for evaluating variables • Guidance on the creation and adaptation of the improvement meters • Guidance on adaptation and configuration of decision analysis • Expertise from previous model applications
<p>1.4. Documentation for the target group</p>		

Summarizing the theoretical components and principles of maturity models construction described in this section, it can be stated that the concept of maturity often determines the shape of the model. Models may include very simple constructions that try to determine the level of process maturity, averaging different problems occurring in the organization and do not focus on details (e.g. they do not consider the maturity level of individual processes). In an extreme case, such models may lead to defining maturity levels and assessing at which level the organization is at, considering all the processes carried out together.

6. OVERVIEW ON MAIN PROCESS MATURITY MODELS

The construction of models aims to reduce the complexity of the real situation in such a way that its understanding is as easy as possible. According to J. Levie and B. Lichtenstein [17], one of the first scientific studies on maturity models was J. Dean's proposal formulated in 1950. He defined the Product Life Cycle formula, which shows the stages of maturation on the

example of company products. Early examples of maturity models were also pyramid needs of A. Maslow [18] and the economic growth model of S. Kuznets [16]. Among the precursors of contemporary maturity models, literature is indicated by R. L. Nolan [22], who in 1973 published a growth model for organizations in the information technology sector.

The next stage of the maturity assessment models concept was the work of P. B. Crosby [6], who in 1979 presented the maturity matrix of quality management - Quality Management Maturity Grid. It is embedded in the concept of Total Quality Management. The Crosby model had five levels of ability to use and use quality management tools and techniques, and the assessment itself was based on a comparison of the company's activities with the adopted model. The application of the Crosby's model included both the assessment of the maturity of processes occurring in the organization and their embedding in the organizational culture, together with the specificity of quality management of services and products of a given unit.

To define the concept of maturity model, it is necessary to refer to the assumptions related to the growth and development of the organization. As a rule, the model presents maturity in categories indicating the step-by-step nature of changes and an increase in organizational capacity according to a logical, sequential model. According to this assumption, maturity models are usually presented as stages-of-growth models, stage models or stage theories, and only a few studies point to different approaches to model construction than those based on stages.

G. A. García-Mireles, M.A. Moraga and F. García [9] define a process maturity model as a structured set of elements that describes the characteristics of effective and efficient processes at different stages of the organization's development, as well as the levels of maturity and the ways to pass between them. J. Becker, R. Knackstedt and J. Pöppelbuß [2] point out that the process maturity model is a conceptual model which consists of sequential, separate maturity levels for processes in one or more areas of the organization and represents the expected, desired or typical evolutionary path for these processes. Other authors also claim that the process maturity model is a tool for process improvement [1] aimed at achieving higher quality of products and services.

It clearly leads to recognition on maturity models applicable for particular process/ area of operations, and the models that describe organizations capability to deliver results through process based approach. Relationship between those 2 areas assessed through maturity models is presented on Figure 3 "Process maturity versus organizational process maturity".

To sum up, according to the current state of knowledge, the main objective of maturity models is to determine the stages and/or paths to maturity in a specific field. Their scope covers the characteristics of the different stages, the logical links between them, as well as the elements of evaluation in relation to a specific template. On the grounds of growing popularity of maturity models for various areas of organization functioning, as well as interest from economic practice and the academic community, Business Process Maturity Models have appeared, indicated as one of the tools for improving various aspects of process management in the organization.

The literature review shows that, as in the case of the concept of maturity there is no consensus on how to approach this issue. Many literature sources describe the objectives of model application, maturity levels, the implementation approaches leading into higher process maturity, but do not define the concept of process maturity model itself. Some of them focuses on individual process, while the other concentrate on organizational aspects of BPM.

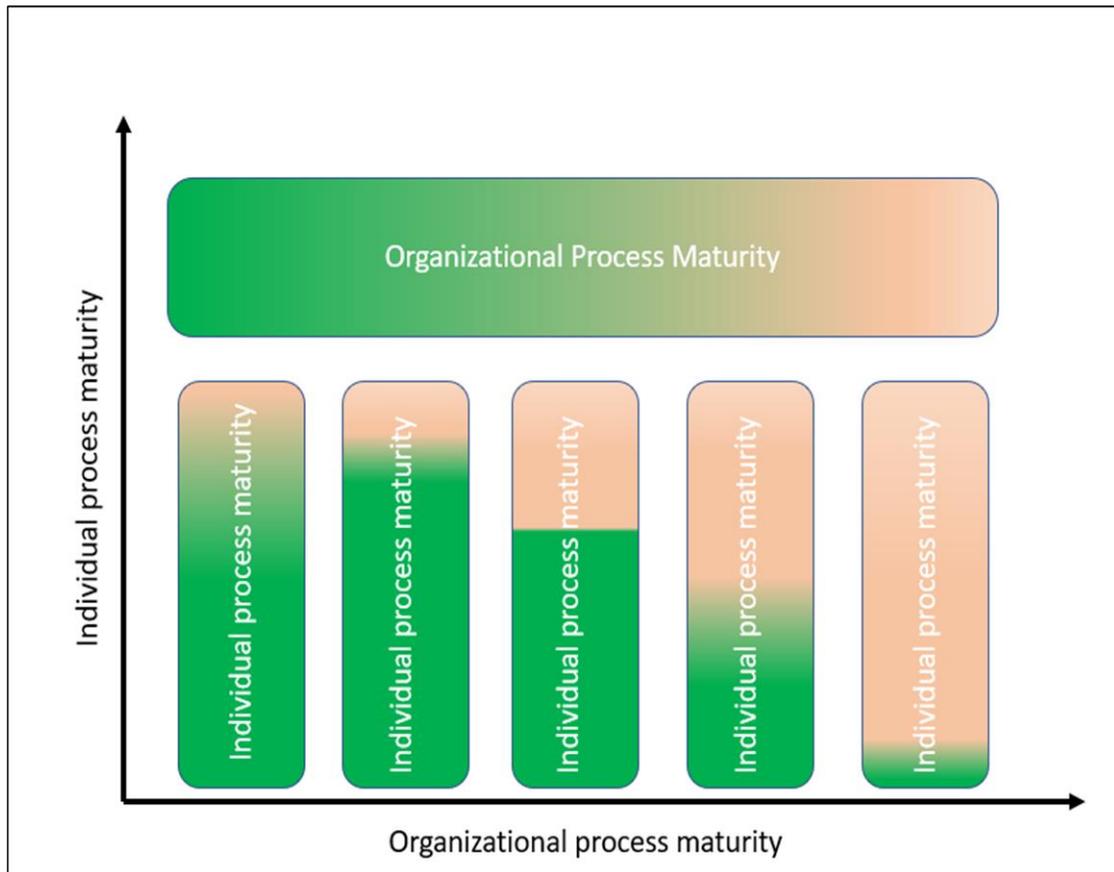


Figure 3. Process maturity versus organizational process maturity - own work based on literature review

The Capability Maturity Model (CMM) developed by W. S. Humphrey [13] and Software Engineering Institute/Carnegie Mellon University is considered to be the first process maturity model. CMM is also considered to be a precursor to many current process maturity models. The assumption underlying the assessment of the maturity of processes within this model is that organizations where managers understand the principles of process approach and systematically manage processes are able to respond more effectively and quickly to changing customer requirements and objectives defined at the organizational level, as well as better anticipate the required time and costs necessary to perform the planned tasks. On the other hand, organizations that do not apply such an approach, i.e. do not clearly define processes, do not apply procedures ensuring repeatability or have not defined measurement points in processes, are not able to function effectively and efficiently in the long term. Originally, the CMM was developed to evaluate software development processes. In the first version, it was a list of so-called good practices, divided into sectors called process areas (e.g. requirements management, project planning, etc.), on which the method of assessing the maturity of information technology organizations was based. The maturity levels in the above model were evaluated on a scale from 1 (initial state) to 5 (processes in continuous improvement) when considering the specified process areas.

Another model widely described in the literature is the Process and Enterprise Maturity Model (PEMM) by M. Hammer PEMM. PEMM distinguishes two groups of elements influencing maturity: five factors enabling the implementation of the process and four organizational skills. Factors influencing the implementation of the process include the following elements: 1) project - a comprehensive specification of the process implementation method; 2) contractors - people who will perform the process, especially in the context of their skills and competences; 3) owner - a member of senior management who is responsible for the process and its results; 4) infrastructure - IT systems and management methods facilitating the process implementation; 5) measures - measurement methods used by the company to observe process effectiveness indicators.

Organizational skills include, on the other hand, organizational skills: 1) leadership - senior management to support process development, 2) culture - appreciating the importance of customer focus, teamwork, personal responsibility and willingness to change, 3) competence - skills and methodology needed to redesign processes, 4) supervision - mechanisms to manage complex projects and change initiatives. Taking into account the above set of factors, the degree of maturity of the process and organization shall be assessed. The PEMM defines four possible levels, each of which is an extension of an earlier one.

The third maturity model, which is often described in literature and used as a reference model in research projects, is the Business Process Maturity Model developed by Object Management Group (BPMM-OMG). Its first edition was published in 2009. BPMM-OMG defines the criteria that must be met by the processes within an organization in order to define it as mature and capable of performing the tasks assigned to it; these criteria are formulated in such a general way that it is possible to adapt them to the specificity of different organizations; the model uses experiences, ideas and ideas for process improvement published in numerous previous models and other approaches (e.g. comprehensive quality management);

The BPMM-OMG reference model is CMMI; this means that BPMM-OMG is based on similar principles and assumptions as CMMI, but BPMM-OMG was designed specifically for business processes that are better perceived as flows within and between organizations than as projects on which CMMI focused. BPMM-OMG is a model of planning, prioritization, management and optimization of business processes in an organization in a comprehensive way; it describes the evolutionary development path that allows to move from the level of inconsistent, uncoordinated business activities to the stage of structured and managed processes; it is both a tool for determining the level of process development and a methodology supporting improvement, which naturally corresponds to the objectives of process management.

In BPMM-OMG, as in CMMI, five maturity levels is determined. Each of them is determined by the degree of implementation of the so-called key process areas, identifying the most important directions of the organization's development. Areas are defined by specific goals, closely related to a specific process area or related to the functioning of the whole organization. In order to achieve specific objectives, specific practices are selected, while in order to achieve organizational objectives, five specific applies are set out, covering the following areas: 1) description and documentation of processes, 2) planning activities necessary for the implementation of processes, 3) defining and ensuring competence, skills and knowledge necessary for the implementation of processes, 4) measuring, monitoring the implementation of processes and their results and correcting (if necessary), 5) control of processes in terms of compliance (e.g. with applicable regulations, standards, applicable rules,

company policy, implemented procedures) and indicating and removing inconsistencies. Important to note that all 3 models described above are models of both process and organizational assessment. They link aspects of individual process maturity with the maturity of the organization to deliver business outcomes through processes.

Available research results indicate that apart from the models that are best described or most popular due to the numerous references to them in the literature (this includes models described so far: CMM/CMMI, BPMM-OMG or PEMM), many other models of process maturity can be identified, differing in the scope, details of the description or the degree of validation.

Some sources point to more than 150 models, but given that different authors apply different eligibility criteria and that new models are constantly being developed and published, the actual number of models is difficult to estimate. Many models are based on assumptions from the CMM or CMMI model. Among other models, that can also be considered popular due to their inclusion in cross-functional analyses concerning process maturity worth to mention, among others: (1) BPR maturity model (BPRMM), (2) Process performance index (PPI), (3) Business process maturity model (BPMM-Fisher), (4) Process maturity ladder (PML), (5) Business process management maturity model (BPMMM), (6) Process management maturity assessment (PMMA).

7. PRACTICAL APPLICATION OF THE PROCESS MATURITY MODELS

Models of process maturity, depending on the needs of the organization, can be used in practice in different situations. As indicated earlier, their basic assumption is to identify the current level of maturity of the implemented processes and to define ways to achieve a higher level of maturity.

However, depending on the specificity of the organization and the requirements set, among others, by managers responsible for process management, the maturity assessment models may perform the following functions: 1) descriptive/assessment method - in this case the models may be used for ongoing assessment of the processes, taking into account the criteria contained therein (as-is assessment); such assessment may be internal or external; its result may be communicated to internal or external stakeholders; 2) prescriptive/ improvement method - in this case the models may be used for ongoing assessment of the processes carried out, taking into account the criteria contained therein (as-is assessment); the result may be communicated to internal or external stakeholders; 2) procedural (prescriptive)/ improvement method - in this case the models may be used for the current assessment of the processes in question: 3) comparative - in this case the models can be used as reference models enabling internal or external comparisons; with historical data on the functioning of processes, it is possible to compare their maturity for individual organizational units or entire enterprises (this measure is similar in essence to benchmarking).

Maturity models are used in many aspects of the company's operations:

- a) In the area of project management, two organizations dominate: the British organization Office of Government Commerce (OGC) and the American Project Management Institute (PMI). The first of these organizations developed the PRINCE2 Maturity Model (P2MM), which evaluates organizations in terms of effective application of the PRINCE2 methodology [www.axelos.com]. It is based on the guidelines used in the

CMMI model, therefore the assessment of the organization is based on selected areas and practices. The PRINCE2 Maturity Model, however, uses 3 maturity levels, and the condition for reaching a given level is that the conditions presented for all the assigned areas are met.

- b) In terms of programs and portfolios, the Cabinet Office (formerly OGC) has developed the P3M3 model. The structure of the model is built on three "internal" models: portfolio management, programs and projects, which are not closely interrelated - the evaluation is carried out independently for each area in the aspect of seven areas of knowledge. At the end of the nineties of the twentieth century, the Project Management Institute created a maturity model OPM3 based on Organizational Project Management. The structure of the model is based on four related elements: best practices, skills, indicators and results, with the assessment strongly correlated with the percentage share of individual practices used in the organization [www.opmexperts.com].
- c) In the area of quality management is the model developed by the European Foundation for Quality Management, called the EFQM Excellence Model, which is used to assess organizations applying for the EFQM Excellence Award (Bugdol 2008). The assessment is based on nine key criteria broken down by "Potential". (5 criteria) and "Results". (4 criteria) and is implemented on a 3-stage maturity scale [www.efqm.pl].
- d) In the area of risk and business continuity management, the most popular model is the Business Continuity Maturity Model (BCMM), which was developed by Virtual Corporation. The evaluation is carried out on a 6-stage scale, while the structure includes 11 areas to be evaluated, broken down by company competence (7 areas) and the criteria of the Business Continuity Programme (4 areas) [www.virtualcorporation.com].

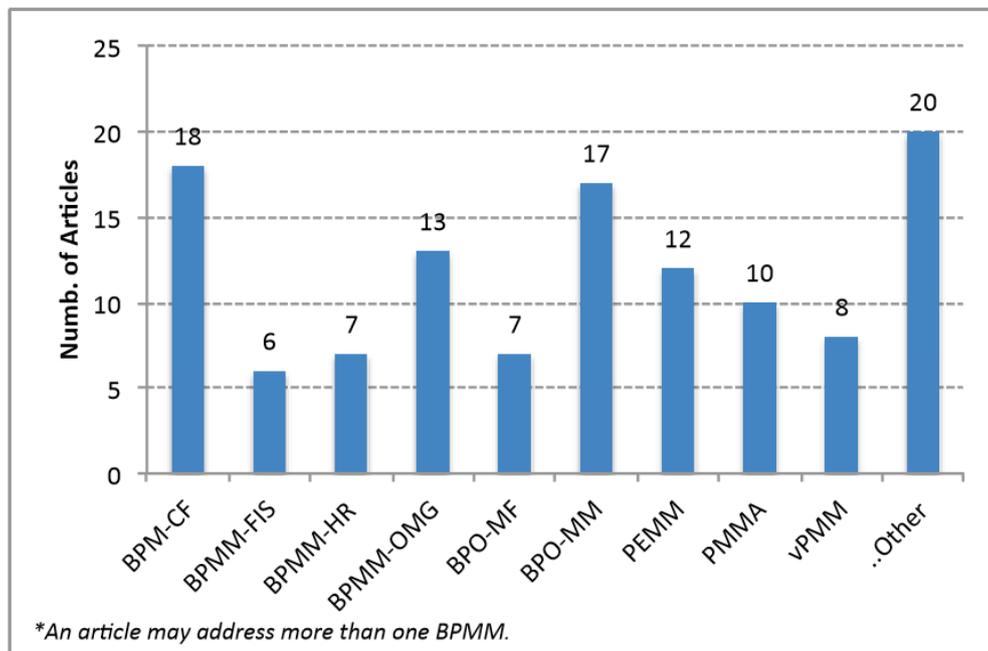


Figure 4. Number of articles that refer to a BPMM. Tarhan, A., Turetken, O., & Reijers, H. A. (2016) [24]

Another model in the area of risk and business continuity management is the Enterprise Risk Management Maturity Model (ERM Maturity Model), which presents a holistic approach to particular risk classes. The model identifies eight evaluation areas analyzed on a 5-point maturity scale (Ciorciari and Blattner 2008) [4].

Figure below shows the leading BPMMs and the numbers of articles that refer to (i.e., propose, apply, validate, classify, or thoroughly analyze) these models. Accordingly, Rosemann and De Bruin's [26] BPM-CF, McCormack and Johnson's [20] BPO-MM , and OMG's BPMM are the models that were the most studied and referred to in the academic literature (with 18, 17, and 13 studies, respectively).

Number of articles that refer to a BPMM - Business process maturity models: a systematic literature review is presented on Figure 4 “Number of articles that refer to a BPMM”

Organizations wishing to apply the process maturity model(s) in practice must be aware that they can choose from a wide range of solutions. For this reason, it may be necessary to apply specific criteria that will allow to choose the process maturity model best suited to the specificity of the organization (e.g. its size or the number of processes carried out) and taking into account the expectations related to its application. To this end, three groups of decision criteria identified by Van Looy [31] may be helpful (Table 3 “Criteria for maturity model selection”).

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Table 3. Criteria for maturity model selection. Van Looy (2013) [31]

Assessment criteria	Improvement Criteria	Non design criteria
Availability	Model Granularity	Cost
Data Collection	Model representation	Goal
Time of evaluation	Practices	Validation
Number of questions	Number of Processes	
Measurement scale	Process specification	
Interviewees		

8. JUSTIFICATION AND BENEFITS OF USING PROCESS MATURITY MODELS

The starting point for determining the rationale for using process maturity models may be a comparison of organizations that are characterized by process maturity and immaturity. The

most important features cited in the literature of the subject are presented in the Table 4 “Characteristics of process maturity and immaturity”.

Table 4. Characteristics of process maturity and immaturity, P. Grajewski P., (2012). ‘The Procedural management of the organization’, The Polish Economic Publishing House. Warszawa, p. 2 [11]

Characteristics of process maturity of the organization	Characteristics of process immaturity of the organization
<ol style="list-style-type: none"> 1. The ability to build and improve a product and/or service is a feature of an organization and not of individual employees. 2. Processes are fully identified and knowledge about them is effectively passed on to employees. 3. Process design work is planned. 4. Processes are also observed and improved by means of controlled experiments and cost/effect analysis. 5. The division of roles and responsibilities is clearly defined within the organization and individual projects. 6. Quality of products and/or services, as well as the degree of customer satisfaction are monitored. 7. There is an objective, quantitative basis for assessing the quality of products, services and activities. 	<ol style="list-style-type: none"> 1. Process improvisation by employees and managers. 2. The specified processes are not observed. 3. Reactive management (ad hoc response to emerging crises), 4. Schedule and budget are usually exceeded because they are not based on stable processes. 5. With unchanging schedule and budget constraints, they are enforced at the expense of the quality and functionality of the product and/or service. 6. Lack of formal and objective criteria for product, quality and process evaluation and early identification of problems (unpredictability of product and/or service quality).

On the basis of the comparison, it can be concluded that striving for process maturity brings a number of measurable benefits related not only to the implemented processes, but also to the functioning of the entire organization, such as: 1) improvement of processes and development of process approach within the organization; 2) integration of various management methods and techniques within one coherent approach to identification, description, evaluation and improvement of processes; 3) improvement of cooperation with external stakeholders (suppliers and customers) and better consideration of their needs and expectations in implemented processes; 4) use of good management practices developed by teams of experts (included in process maturity models), which enables implementation of solutions tailored to the needs of the organization with less effort and costs; 5) easier introduction of improvements, new processes and products thanks to the standard approach to

process management in the organization. D. Goldenson and D. Gibson [10], on the basis of research conducted in companies that decided to use process maturity models, formulated a list of basic benefits resulting from their application:

- 1) reduction of process implementation costs,
- 2) shortening the time and improving the timeliness of processes,
- 3) improving the final quality of products/services resulting from the processes,
- 4) improving customer satisfaction,
- 5) accelerating the return on investment in processes and their digitalization.

K. McCormack [20] mentioned the following as one of the advantages of achieving higher levels of process maturity:

- 1) better control of the results of the action,
- 2) improving predictability of costs and quality of performance,
- 3) greater effectiveness in achieving the defined objectives,
- 4) to improve management's ability to set new and higher objectives for the achievement of its tasks.

9. LIFE CYCLE OF THE MATURITY MODEL

By analogy to living organisms, the process of formation and development of the model of maturity is called its life cycle. In the so-called phase theories, the model goes through different phases of development. The "classic" concept distinguishes four phases: birth (creation), growth, maturity and decline (liquidation) of the company. This basic model has already been modified many times by various authors.

Most researchers agree that changes in organizations follow predictable patterns and are characterized by different stages. However, these stages are often not unambiguously defined. In the literature there are references to life cycle phases, growth stages or development phases [5]. Correia, E, Carvalho Hand Azevedo defined the life cycle phase as a configuration of variables in both the enterprise environment and its organizational structure.

The life cycle of the model consists of phases - what is visualized on Figure 5 "The life cycle of the maturity models".

The first phase that provides the basis for a continuous cycle is process identification. In this phase, the business problem is identified and the relevant business processes are identified, scope and related. The result of process identification is the current process architecture, which provides comprehensive support for two processes in the organization and the links between them. This is in line with the principles of contextual awareness and purpose proposed by Vom Brocke [32]. The principle of context means that process management should be part of the organizational context. In the process recognition phase, the current status of important processes is documented, usually in business models.

In the next phase, problems related to these processes are identified, analyzed, documented and, if possible, measured. This phase generates a set of structured problems and issues, which will then be prioritized based on their impact and the efforts needed to address them. The aim of the process redesign phase is to identify changes required in the processes in

order to solve previously identified problems. Several different choices are analyzed and compared in terms of efficiency, the result of which is usually the process to be carried out.

It is then implemented (process implementation phase) and controlled in the last phase in relation to the expectations defined in the reconstruction phase.

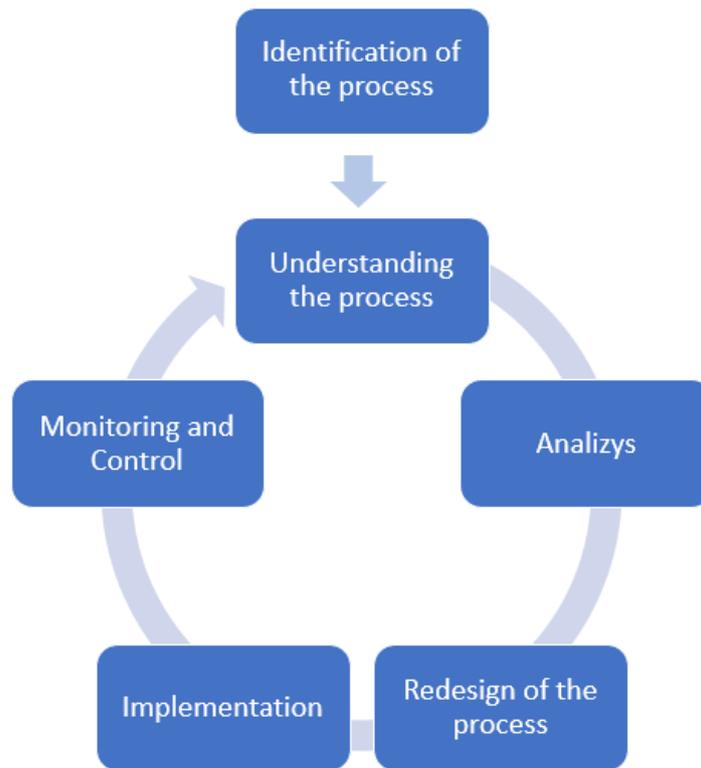


Figure 5. The life cycle of the maturity models- based on Correia, E, Carvalho H. and Azevedo [5]

10. CONCLUSIONS

The maturity models presented in this paper describe development of BPM concept in organizations, from immature and initial, up to highly developed practices demonstrating highest effectiveness of the company. The described models differ in scope, some of them focus on the assessment of current state of BPM practices, the other concentrate on the state of processes or take both of those dimensions into account. When it comes to evaluating mentioned models, we may conclude that both the basic principles and the descriptive principles are sufficiently addressed.

However, there is room for improvement regarding more detailed descriptions of the relevant application of easy-to-use evaluation criteria. As far as the normative purpose of the application is concerned, few specific and documented guidelines could be identified. This means that those applying the maturity model face the difficulties when looking for appropriate measures to improve their processes.

Presented considerations are subject to certain limitations related to the large and dynamically changing number of existing maturity models. This open scan sider able opportunity for further studies.

The next steps are to a) conduct more detailed exploration of the existing models and relations between maturity of process management practices and benefits recognized by organizations and b) conducting surveys among process oriented companies to enable more quantitative and explanatory analysis. Author believes that more qualitative data will confirm the usefulness of process management.

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