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Defining business process maturity. A journey towards excellence

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Organisations are increasingly focusing on their business processes (BPs) to excel. Since the journey towards process excellence is challenging, various authors have proposed a business process maturity model (BPMM) to gradually improve maturity and capability. Nonetheless, a comprehensive definition for BPMM, maturity and capability is missing. Moreover, the differences between maturity and capability are frequently neglected. Therefore, this study elaborates on the lacking foundation. In particular, a thorough literature study is conducted to address three gaps regarding the BPMM scope, terminology and design. It reveals six basic BPMM components within a BP lifecycle (scope gap): (1) modelling, (2) deployment, (3) optimisation, (4) management, (5) culture and (6) structure. Their overall growth refers to maturity, whereas the growth of an individual component includes capability (terminology gap). To increase its usability, a BPMM gives guidance on both assessing and improving BPs (design gap). The findings allow clear communication about BPMMs, and new models based on the identified components. This unambiguous understanding helps to avoid confusion and inappropriate assumptions in the BP literature. Future research will further validate the definitions by comparing BPMMs.

Keywords: business process maturity; business process capability; business process management; business process orientation; continuous improvement; process excellence; business excellence

1. Introduction

Today’s customers have higher requirements than ever before. Therefore, organisations are striving to excel by increasingly focusing on their business processes (BPs) to improve quality and performance. Hence, business process management (BPM) is expected to contribute to business excellence by assuring a uniform way of working (Cobb, 2003; Harrington, 2006).

Nonetheless, the journey towards process excellence and business excellence is challenging. As a result, various authors have proposed step-by-step road maps with best practices, from which organisations gradually benefit. These road maps are called business process maturity models (BPMMs), and are increasingly receiving attention in BP literature, e.g. in Lee, Lee, and Kang (2007), Maier, Moultrie, and Clarkson (2008), and Rosemann and de Bruin (2005). This study draws attention to the definitions that underpin the BPMMs,
as part of a comparative BPMM research. Its subject is inspired by three gaps that were identified during the collection and preliminary review of existing models, in particular: (1) the scope, (2) the terminology and (3) the design. Genuinely addressing these topics is of paramount importance to obtain an appropriate BPMM foundation. Each gap is introduced in the subsequent paragraphs, and afterwards linked to a research question.

The first gap deals with properly defining the BPMM scope, and considers the proliferation of maturity models (MMs) in the recent decades. The history of MMs can be traced back to the leading quality thinkers of the twentieth century, whose techniques are still used to optimise processes (Deming, 2000; Juran, 1988; Shewhart, 1986). Crosby (1979) was one of the first scholars to present an MM, albeit for quality management. During the software crisis, which started in the 1970s–1980s, the need for MMs strongly increased to improve IT processes. This resulted in a myriad of process standards and models for software and systems engineering (Ahern, Clouse, & Turner, 2004). Estimates vary between 250 and 350 software frameworks (El Emam & Garro, 2000; Moore, 1999). Sheard (1997) correctly refers to a frameworks quagmire, in which practitioners tend to drown. Afterwards, the scope of MMs has been broadened, for instance towards product development, human resources, project management, e-government, IT architecture and business—IT alignment (Buglione, 2009). At present, various specific MMs have been integrated into single models, and new models have been designed to address generic BPs (Ahern et al., 2004). Examples for the four main tracks in the literature on BPMM are Capability Maturity Model Integration (CMMI) (SEI, 2009), ISO/IEC 15504 (ISO/IEC, 2003, 2008), FAA-iCMM (FAA, 2001) and OMG-BPMM (OMG, 2008). This multitude of MMs illustrates the difficulties among practitioners to choose a model that best fits their organisational strategy and objectives. Moreover, models that claim to be a BPMM also differ by emphasising different components, and without a clear link in the BP literature. Some models focus on BPs and/or their management such as Rohloff (2009), Skrinjar, Bosilj-Vuksic, and Stemberger (2008), whereas others include the organisational culture and structure to support BPs, for instance, de Bruin and Rosemann (2007), Hammer (2007), Lee, Lee, and Kang (2009), Maull, Tranfield, and Maull (2003), Pritchard and Armstead (1999) and Willaert, Van den Bergh, Willems, and Deschoolmeester (2007). Hence, the first research question focuses on the scope of a BPMM to define its basic components.

Second, the BPMM terminology varies among models and is frequently based on implicit assumptions instead of exact definitions. The premise is that maturity aims at systematically increasing the capabilities of a BP and the entire organisation to deliver higher performance over time (Hammer, 2007; Rosemann & de Bruin, 2005). However, concepts, such as maturity and capability, are not uniformly used in the BP literature. For instance, CMMI (SEI, 2009) explicitly refers to both maturity and capability levels, whereas the model of OMG (2008) only provides maturity levels. Some models invariably refer to maturity, even in situations that would rather be described as capability, such as Dowdle Stevens, McCarty, and Daly (2005), IDS Scheer (2010) and Rohloff (2009). As a result, the second research question deals with the BPMM terminology to avoid confusion and inconsistencies.

Third, regarding the BPMM design, some models give more guidance than others to assess and improve processes. Some BPMMs provide a general assessment method, without imposing an improvement road map. An example is ISO/IEC 15504, which relies on external frameworks to prescribe the processes to improve and the corresponding best practices (ISO/IEC, 2003). On the other hand, models such as Champlin (2008) and Melenovsky and Sinur (2006) are limited to describing the gradual improvements among levels, without emphasising a method to assess the organisation’s current level. In general,
the main tracks in the BPMM literature, as previously discussed, are recognised as detailed models (FAA, 2001; OMG, 2008; SEI, 2009). Examples of BPMMs with little guidance are (Oracle, 2008a; Pritchard & Armistead, 1999; Remoreras, 2009; Smith & Fingar, 2004). This explains the need for evaluation criteria that practitioners can apply while choosing a particular BPMM. To our knowledge, BP literature remains elusive in describing this dichotomy of assessing and improving maturity and capability. Consequently, the third and last research question defines the usefulness of BPMM designs.

These three gaps prompt us to thoroughly investigate the BPMM-related concepts, which are the vital foundation to guide organisations on their journey towards excellence. For this purpose, this study examines three research questions:

(1) What is the appropriate BPMM scope? When does an MM consider BPs?
(2) What is the appropriate BPMM terminology? When does an MM consider maturity and capability?
(3) What is the appropriate BPMM design? When does an MM provide practical guidance to achieve process excellence?

The subsequent sections further elaborate on the research questions. We start with discussing the methodology in Section 2. Afterwards, the definitions for the basic BPMM components are presented (Section 3). In Section 4, the difference between maturity and capability is explained. Next, we clarify the BPMM design in Section 5. The final section discusses the results and the plans for future research.

2. Methodology

The three research questions are examined by conducting an in-depth literature review. The literature on BPMMs for generic BPs is, however, relatively recent and very scarce. Hence, as BPs are the main subject of BPMMs, we relied on the more extensive body of academic and professional literature on BPs, in order to derive the components that affect process performance. This literature analysis resulted in three umbrella terms: (1) business process (BP) (2) business process management (BPM) and (3) business process orientation (BPO). It was not the intention to present a complete overview of definitions regarding these basic concepts within the BPMM field, but rather to be comprehensive enough to provide a grasp of interesting areas in the BPMM field. These descriptions clarify the difference between the concepts and indicate the basic components within the BPMM scope.

2.1 Reviewing and defining the BPMM scope

While collecting and reviewing BPMMs, we experienced that the models emphasised different elements of a typical BP lifecycle. Consequently, we analysed the extensive body of academic and professional literature on BPs, in order to derive the components that affect process performance. This literature analysis resulted in three umbrella terms: (1) business process (BP) (2) business process management (BPM) and (3) business process orientation (BPO). It was not the intention to present a complete overview of definitions regarding these basic concepts within the BPMM literature. Instead, the purpose was to be comprehensive enough to provide a grasp of interesting areas in the BPMM field. These descriptions clarify the difference between the concepts and indicate the basic components within the BPMM scope.

2.2 Reviewing and defining the BPMM terminology

To our knowledge, most models merely briefly describe the differences between maturity and capability. Nonetheless, detailed definitions are provided by the four main tracks in the BPMM literature. Therefore, we start with generally explaining both concepts. Afterwards, the definitions of the main tracks are exhaustively compared to derive the common elements of maturity and capability.
2.3 Reviewing and defining the BPMM design

Due to a close link with the BPMM terminology, the same twofold approach is adopted for the purpose of defining the BPMM design: (1) an introduction to the BPMM concept and (2) a thorough comparison of the main tracks. This mainly includes an evaluation of the assessment method and the improvement method.

3. Reviewing and defining the BPMM scope

The basic BPMM components are derived from defining: (1) BP, (2) BPM and (3) BPO. By doing so, we obtain a BPMM foundation, which is based on well-known umbrella terms within the BP literature. Above all, these concepts represent a typical BP lifecycle, which is the central focus within BPMM.

3.1 Business process (BP)

Most definitions of a BP refer to a transformation, based on: (1) predictable and definable inputs, (2) a linear, logical sequence or flow, (3) a set of clearly definable and interrelated activities and (4) predictable and desired outputs (Zairi, 1997). In addition, Palmberg (2009) mentions: (5) horizontal or cross-functional, (6) performed by resources, (7) repeatable and (8) adding value for customers and stakeholders. For instance, Harrington (2006) agrees that ‘a process is a series of interconnected activities that takes input, adds value to it, and produces output. It’s how organisations work their day-to-day routines’ (p. xxii). However, this traditional view on BPs originates from manufacturing, and is too restrictive in the current knowledge society.

Indeed, inputs, flow and outputs may be less clear in service delivery, because of interpretations by actors and unstructured information exchange. In this context, a BP rather refers to coordination towards goal achievement than to a predefined and strict transformation. Richter-von Hagen, Ratz, and Povalej (2005) refer to such BPs as knowledge-intensive. As a result, more holistic definitions exist, e.g. in Gillot (2008).

In addition to the definitions, BPs are categorised according to their (1) functionality and (2) structure. First, the functional types are (Armistead, Pritchard, & Machin, 1999; Earl, 1996; Palmberg, 2009):

- **core, operational, primary or value-adding processes**: concerning the production and delivery of products or services, contributing to value creation and directly related to external customers. Davenport (1993) and DeToro and McCabe (1997) mention 10–20 core processes for each organisation;
- **support or value-enabling processes**: for supporting the core processes and facilitating organisational performance, characterised by internal customers, for instance, processes in information management or human resources;
- **management processes**: linked to the strategy and policy setting, serving the overall planning, and controlling all activities in the organisation.

Earl (1996) adds business network processes as a fourth functional type, which extends the core processes to external trading partners. Armistead et al. (1999) also propose to separate management processes from direction-setting processes. The former apply to decision-making and communication, whereas the latter are concerned with formulating the organisational strategy and change management. Additionally, the interplay of core, network and support processes is referred to as a horizontal ‘value chain’ or ‘supply chain’, comprising all activities from suppliers to customers (Harmon, 2004; Porter & Millar, 2008).
Second, regarding the structural classification, BPs can be fully structured, semi-structured or fully unstructured. The next steps in a fully structured process are completely predefined by fixed rules, whereas the next steps in a fully unstructured process are ad hoc. A semi-structured process is a combination of both previous types (Richter-von Hagen et al., 2005; Scheer, 2007). Any process type can be knowledge-intensive. However, we expect them to be less structured, given the flexibility of human interactions.

Besides the notion of knowledge-intensive processes, Silver (2009), OMG (2009) and Oracle (2008b) refer to ‘dynamic’ or ‘collaborative’ modelling of semi-structured processes as ‘case management processes’, with merely predefined starting points and process goals. The main difference is that a case management process is not a single process, but a case or a collection of interlinked processes, which in turn can be structured, semi-structured or unstructured. The next steps are determined at runtime, e.g. by business events, business rules, and human judgment (Silver, 2009). The automation of knowledge-intensive and case management processes relates to workflows and document management systems.

Consequently, the traditional BP definitions originate from manufacturing and are less applicable to service delivery. In order to provide a general BP definition, considerations have been made with regard to knowledge-intensive processes and case management processes. The following comprehensive BP description is derived and used in this research: ‘a BP is (1) a repeatable set of coherent activities, (2) triggered by a business event and (3) performed by people and/or machines, (4) within or among organisations, (5) for jointly realising business goals and (6) in favour of internal and/or external customers’.

The focus of this BP definition is on two components: modelling (i.e. predefining processes in textual or graphical descriptions) and deployment (i.e. performing or running processes accordingly). Both components will be used in further research as assessment criteria for a BPMM. The next sections present BPM and BPO. Their components are derived and compared with those of BP.

### 3.2 Business process management (BPM)

Customer needs are not met by individual departments, but by (core) processes that frequently cut across departments. As a consequence, an organisation is a collection of BPs that must be modelled, managed and improved (McCormack & Johnson, 2001). BPM involves continuously managing BPs by process owners, while using the benefits of IT (Burlton, 2001; Smith & Fingar, 2002). Depending on the background of the authors, the numerous BPM definitions emphasise the IT part, the management part or both.

- IT-focused BPM definitions stress the importance of BP automation and analysis. For instance, Weske, van der Aalst, and Verbeek (2004) define BPM as ‘supporting business processes using methods, techniques, and software to design, enact, control, and analyze operational processes, involving humans, organisations, applications, documents, and other sources of information’ (p. 2).
- On the contrary, BPM can also be described as a strategic way of managing an organisation to improve performance. For instance, Jeston and Nelis (2006) define BPM as ‘the achievement of an organisation’s objectives through the improvement, management and control of essential business processes’ (p.11).

A comprehensive definition for BPM equally underlines IT and managerial aspects. Lee and Dale (1998) summarise the phrasing that is often used for generally describing
BPM, namely: (1) a structured approach, (2) analytic, (3) cross-functional and (4) continuous process improvements. In our search for a BPM definition, we need clear components that differentiate BPM from BP and BPO. We have found those components as summarised by Gillot (2008). The author defines BPM as: (1) the management of processes, each with a process owner and a cross-functional process team, (2) the modelling of processes, (3) the automation or deployment of processes, upon what can be automated and integrated and (4) optimisation, or improving processes based on real metrics which help in evaluating the process performance. As a result, these four components are included in the further research to indicate BPM maturity. They differ from the BP definition by including process management and optimisation for one or more BPs.

Some authors go beyond these four BPM components by also referring to the organisational structure and/or culture. However, these additional perspectives relate to the notion of BPO, as discussed below. Even though the distinction between BPM and BPO is not always explicitly made, for instance in Rosemann and de Bruin (2005), it allows us to separately study the different nuances.

3.3 Business process orientation (BPO)

In order to realise the full benefits of BPM in terms of quality and performance, various authors argue that an organisation should fundamentally change its organisation management. That is by adopting a horizontal view of the whole organisation, besides the horizontal view of its BPs or value chains (Davenport, 1993; DeToro & McCabe, 1997; Gardner, 2004; McCormack & Johnson, 2001; Porter, 1985).

The BPO focus is broader than simply implementing BPM as a management principle and modelling the processes. It implies developing process awareness or a process-driven mindset. Many aspects are impacted by BPO, such as strategic issues, people, technology, the organisational culture and a horizontal instead of a vertical organogram (Van den Bergh, Willaert, Willems, & Deschoolmeester 2007). Hammer and Stanton (1999) explain that the facilities for collaboration and knowledge sharing, training, compensation and career paths need to be tailored to processes, not vertical departments, and to process teams, not individuals. For instance, process owners will set performance goals for their process team, taking into account the organisational strategy (Hammer & Stanton, 1999). Hence, there is a funnel structure where BPO implies BPM, which in turn relates to BPs. It is referred to as holistic (Willaert et al., 2007) or comprehensive (Kohlbacher, 2010). However, organisations applying BPM are not necessarily BP-oriented, nor are they necessarily evolving towards BPO (Gardner, 2004). For instance, an organisation that assigns a process owner can manage and statistically optimise a BP by tracking metrics, possibly restricted to a department. However, it would not gain all benefits if the owner has no cross-departmental or cross-organisational authority, nor if the collaborating departments distrust each other.

McCormack (2007a) defines BPO as ‘an organisation that emphasises process, a process oriented way of thinking, outcomes and customers as opposed to hierarchies’ (p. 6). The corresponding components are (McCormack, 2007a): (1) a process view of the business, including process modelling and documentation (2) structures that match these processes, with a flat hierarchy, cross-functional process teams and process ownership (3) empowered, multi-dimensional and process team-oriented jobs, (4) management and measurements systems that direct and assess these processes and (5) a process culture that is embodied in all components, with values and beliefs such as a customer focus, empowerment and continuous improvement. When comparing to the previously defined BPM components,
the process view (1) relates to the modelling component, whereas the process jobs (3) and
the management and measurement systems (4) are covered by the other BPM components.
This implies that the structure (2) and culture (5) are the distinct aspects of BPO. The basic
components of BP, BPM and BPO and the funnel structure are shown in Figure 1.

These six components define the BPMM scope, as part of the first research question,
and specify whether a BPMM deals with BP, BPM or BPO.

4. Reviewing and defining the BPMM terminology
The definitions presented in the previous section deal with BP, BPM and BPO. For each
concept, the distinct components have been derived, resulting in a funnel structure from
the comprehensive BPO to BPM and BP. As explained above, these components are cri-
teria to specify whether a BPMM deals with BP, BPM or BPO. More specifically trans-
lated to the BPMM terminology, they indicate the type of maturity and capability being
measured by a BPMM.

The present section explores the definitions of the latter concepts, in order to obtain a
consistent BPMM terminology for the second research question. As explained in the meth-
odology section, we first draw attention to the general meaning of maturity and capability,
followed by a thorough comparison of the definitions in the main tracks found in the
BPMM literature to illustrate the difference of opinion. This dual approach allows us to
derive a comprehensive definition for both concepts.

4.1 Introduction to the concepts of maturity and capability
In general, maturity is defined as ‘a very advanced or developed form or state’ (Cambridge
Advanced Learner’s Dictionary, http://dictionary.cambridge.org) or ‘the state or quality of
com). In management theories, it frequently refers to the stages through which an organi-
sation progresses in realising an end goal (Buglione, 2009; McCormack & Johnson,
2001). We will explain that, when translated to BP, BPM and BPO, the organisational
maturity indicates an overall growth in the six basic BPMM components, whereas the
process capability refers to a particular component. Although intertwined, the principal
ideas are separately summarised below.

- (Process) capability. Day (1994) presents capability as competencies or ‘complex
bundles of skills and accumulated knowledge, exercised through organisational pro-
cesses, that enable firms to coordinate activities and make use of their assets’ (p. 38).
Van Loon (2004) adds that it ‘relates to the organisation’s ability to deliver specified or desired performance consistently/predictable’ (p. 13). In sum, process capability refers to: (1) controlling the variation in actual results, (2) predicting process costs and performance, (3) effectively reaching the targeted results and (4) raising the targeted results. It is realised by institutionalisation, i.e. by policies, standards and organisational structures which support routine-based practices (Lockamy & McCormack, 2004; McCormack et al., 2009).

- (Organisational) maturity. Maturity is a measure to evaluate the capabilities with regard to a certain domain, for instance BP, BPM or BPO (Rosemann & de Bruin, 2005). In this context, Hammer (2007) describes maturity as ensuring that BPs ‘are capable of delivering higher performance over time’, which is realised by developing characteristics linked to both the individual process and the entire organisation (p. 113). Consequently, a growth in organisational maturity implies a growth in process capability (McCormack, 2007b).

While measuring maturity, the BPMMs will either implicitly or explicitly measure the corresponding capability. Hence, the exact interpretation and the related levels for maturity and/or capability strongly depend on the model. This diversity in definitions is illustrated by comparing the four main tracks found in the BPMM literature: (1) CMMI, (2) FAA-iCMM, (3) ISO/IEC 15504 and (4) OMG-BPMM. For each model, the similarities are indicated in bold, whereas the differences are underlined.

4.2 Comparison of the definitions for ‘maturity’ and ‘maturity level’

Table 1 presents the definitions for maturity and maturity levels in the main tracks.

Table 1: Definitions for maturity and maturity levels in the main tracks.

First, concerning maturity, the exact naming is a point of difference among the definitions. CMMI and ISO/IEC 15504 explicitly refer to organisational maturity, whereas FAA-iCMM and OMG-BPMM mention process maturity. Conforming to the introduction above, maturity should be seen as an organisational characteristic to excel. Hence, the notion of ‘organisational maturity’ seems an accurate choice, with merely ISO/IEC 15504 stressing the link to the achievement of business goals. However, as BPs are not the only organisational characteristics to perform, the same general concept may also be used in other situations, such as the organisation’s IT infrastructure. Nevertheless, the more restricted naming of ‘process maturity’ suggests a single BP, (1) which contradicts the descriptions of the main tracks, partly except for FAA-iCMM, and (2) which makes no distinction between the process perspective of BP and BPM, and the organisational perspective of BPO. For this purpose, we suggest to specify whether (organisational) maturity concerns BP, BPM or BPO, according to the BPMM components that are addressed in a specific model. Possibly, an indication can be added whether it concerns a single BP, or more BPs. Notwithstanding these differences, the maturity definitions are very similar. All main literature tracks define maturity as the extent to which processes are explicitly and/or consistently deployed. With respect to the BP, BPM and BPO classification, the emphasis is limited to the first four components: (1) modelling, (2) deployment, (3) optimisation and (4) management. According to the previous finding, this suggests BPM maturity. Despite their importance, the maturity definitions ignore the organisation’s culture and structure to improve process performance. Nevertheless, this finding is merely based on the maturity definitions, without taking into account the actual components of the main literature tracks. For instance, a refinement should already be made for OMG-BPMM, which mentions a process culture in its definition of a maturity level. As a result, questions remain about the completeness of the definitions.
Second, the definitions of a maturity level particularly vary on the description of the results (e.g. stabilisation and achievement of a process culture in OMG-BPMM) and on the naming of the components that are matured (e.g. a set of process areas with goals in CMMI, a subset or a part of the processes in CMMI and OMG-BPMM, and a set of process areas and capability levels with goals in FAA-iCMM). They do not mention an increase in process performance nor excellence. There is an overall agreement on the meaning of a maturity level to indicate the organisational growth. For all tracks, a maturity level expresses the amount of maturity, described as a ‘degree’ (CMMI, FAA-iCMM), a ‘point on an ordinal scale’ (ISO/IEC 15504) or an ‘evolutionary plateau’ (CMMI, OMG-BPMM). The sequence of interdependent maturity levels and/or corresponding components are characterised as predefined in the corresponding MMs.

<table>
<thead>
<tr>
<th>Track</th>
<th>Maturity</th>
<th>Maturity level</th>
</tr>
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<tbody>
<tr>
<td>CMMI</td>
<td>Organisational maturity is the extent to which an organisation has explicitly and consistently deployed processes that are documented, managed, measured, controlled and continually improved. Organisational maturity may be measured via appraisals (SEI, 2009, p. 512)</td>
<td>A maturity level is the degree of process improvement across a predefined set of process areas in which all goals in the set are attained (SEI, 2009, p. 509). A maturity level is a defined evolutionary plateau for organisational process improvement. Each maturity level matures an important subset of the organisation’s processes, preparing it to move to the next maturity level (SEI, 2009, p. 26)</td>
</tr>
<tr>
<td>FAA-iCMM</td>
<td>Organisational process maturity is the extent to which an organisation has explicitly and consistently deployed processes that are documented, managed, measured, controlled and continually improved. Organisation process maturity may be measured via a process appraisal (FAA, 2001, p. B-9). Process maturity is the extent to which a process is explicitly documented, managed, measured, controlled and continually improved (FAA, 2001, p. B-13)</td>
<td>A maturity level is the degree of process improvement across a predefined set of process areas and capability levels in which all goals within the set are attained (FAA, 2001, p. B-8)</td>
</tr>
<tr>
<td>ISO/IEC 15504</td>
<td>Organisational maturity is the extent to which an organisation consistently implements processes within a defined scope that contributes to the achievement of its business goals (current or projected) (ISO/IEC, 2008, p. 2)</td>
<td>An organisational maturity level is a point on the ordinal scale of organisational maturity that characterises the maturity of the organisation in the scope of the organisational maturity model used; each level builds on the maturity of the level below (ISO/IEC, 2008, p. 2)</td>
</tr>
<tr>
<td>OMG-BPMM</td>
<td>Process maturity is the extent to which processes are explicitly defined, managed, measured, controlled and effective. Maturing processes implies a growth in capability and indicates both the richness of an organisation’s processes and the consistency with which they are applied throughout the organisation (OMG, 2008, p. 72)</td>
<td>A maturity level is a well-defined evolutionary plateau that serves as a stepping stone for achieving a mature process culture. (…) Each maturity level stabilises an important part of the organisation’s processes (OMG, 2008, p. 72)</td>
</tr>
</tbody>
</table>
4.3 Comparison of the definitions for ‘capability’ and ‘capability level’

The main tracks define ‘capability’ and ‘capability levels’ as mentioned in Table 2.

The definitions of capability and a capability level are almost similar in all tracks. In contrast to the definitions of maturity, all tracks agree on the naming: ‘process capability’. This naming satisfies the previous assumptions in Section 4.1. Capability is unanimously described as the extent or the range of expected results by following a process. It is linked to the achievement of a process purpose, and process or business goals, albeit not in CMMI. Only ISO/IEC 15504 and FAA-iCMM mention the current and projected goals.

Table 2. The definition for capability and capability level in the main tracks.

<table>
<thead>
<tr>
<th>Track</th>
<th>Capability</th>
<th>Capability level</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMMI</td>
<td><strong>Process capability</strong> is the range of expected results that can be achieved by following a process (SEI, 2009, p. 515)</td>
<td>A capability level is the achievement of process improvement within an individual process area. A capability level is defined by appropriate specific and generic practices for a process area (SEI, 2009, p. 500)</td>
</tr>
<tr>
<td>FAA-iCMM</td>
<td><strong>Process capability</strong> is the range of expected results that can be achieved by following a process. The ability of a process to achieve a required goal (FAA, 2001, p. B-12)</td>
<td>Capability levels are a means for incrementally improving the processes corresponding to a given process area (SEI, 2009, p. 21)</td>
</tr>
<tr>
<td>ISO/IEC 15504</td>
<td><strong>Process capability</strong> is the extent to which the implemented processes achieve the process purpose (ISO/IEC, 2003, p. 2)</td>
<td>A process capability level is a point on the six-point ordinal scale (of process capability) that represents the capability of the process; each level builds on the capability of the level below (ISO/IEC, 2004, p. 5)</td>
</tr>
<tr>
<td>OMG-BPPM</td>
<td><strong>Process capability</strong> is (1) the range of expected results, expressed quantitatively, that can be achieved by following a process or (2) the degree to which a process is able to achieve the goals or specifications that are assigned, usually expressed quantitatively (OMG, 2008, p. 464)</td>
<td>The combination of process attribute achievement and a defined grouping of process attributes together determine the process capability level (ISO/IEC, 2003, p. 6)</td>
</tr>
<tr>
<td></td>
<td>Process performance focuses on the results achieved, while process capability focuses on the results expected (OMG, 2008, p. 72)</td>
<td>The process areas and maturity levels of the BPMM are indicators of process capability (OMG, 2008, p. 72)</td>
</tr>
</tbody>
</table>
In contrast to maturity, the capability definitions are generally described, without mentioning any of the BP, BPM or BPO components.

OMG-BPMM is the only track without a definition for a capability level. Instead, process capability is implicitly measured through maturity. Hence, it explicitly stresses the close relationship between maturity and capability. All other tracks describe a capability level as achieving process improvement, in respect of an individual process area or set of process attributes. These process areas are the equivalents of the BP, BPM and BPO components. Consequently, the definitions show evidence for the refinement into different types of capability, in particular per component. The definitions of ISO/IEC 15504 and FAA-iCMM are in line with that of a maturity level, for instance by referring to the amount of capability and the sequence of interdependent levels. Another minor difference is the type of practices: CMMI mentions both specific and generic practices in its definition, whereas FAA-iCMM only refers to generic practices in order to facilitate institutionalisation.

4.4 Comprehensive definition for maturity and capability

Taking into account the multitude of BPMMs and their corresponding definitions, the concepts of maturity and capability are elaborated in Figure 2.

We strongly rely on the main tracks to define maturity as ‘the extent to which an organisation has explicitly and consistently deployed processes’. Additionally, we refer to business objectives or key performance indicators (KPIs), since its final aim is increasing quality and performance to excel. It is measured by the interplay of BP, BPM and/or BPO components, which implies that maturity grows by simultaneously focusing on (1) process

![Figure 2. The difference between maturity and capability.](image-url)
modelling, (2) process deployment, (3) process optimisation, (4) process management, and the organisation’s (5) culture and (6) structure to facilitate performance. As derived from the maturity definitions of the main tracks, BPMMs do not necessarily address all six theoretical components.

On the other hand, capability is ‘the ability or competence (e.g. skills and knowledge) of an organisation to achieve the targeted results by following a particular process or process area’. Despite the similarities, this definition is more specific than those provided in the main tracks, by broadening the process ability with competences of the entire organisation and its people. In general, a growth in capability focuses on narrowing the gap between the targeted and actual process results, to achieve the process purpose. It is realised by institutionalisation or routine, for instance, policies, standards, training, the organisational culture and structure. The outcomes are not linked to organisational excellence, but to the control, predictability, effectiveness and efficiency of an individual process or component. The latter is also called a key process area within the main tracks, e.g. in SEI (2009).

Maturity is thus a broader concept than capability. The former focuses on the whole assessment unit and the organisational strategy by taking into account all basic components, whereas the latter relates to the associated parts and their specific purposes by improving an individual component. Consequently, the terms ‘organisational maturity’ and ‘process capability’ can be used to properly stress this difference in scope. An alternative and more specific naming is that of BP, BPM or BPO maturity, as discussed above. However, further research will validate whether all three maturity types exist in actual BPMMs for generic BPs. For instance, we assume that few models are limited to BP maturity, given the importance of ‘optimisation’ and ‘management’ to mature one or more BPs.

Notwithstanding this difference in scope, a strong positive relationship exists between both concepts: an increase in overall maturity indicates an increase in each capability, with the latter being part of the former. A maturity road map prioritises continuous improvements in a BP lifecycle, and gradually facilitates the necessary institutionalisation of all BPMM components: higher maturity → institutionalisation → higher capability. Due to this gradual character, capability needs an organisation that is mature enough to sustain it. In theory, an increase in the capability of one component contributes to an increase in overall maturity: higher capability → higher maturity. However, whether this increase also suffices for achieving a higher maturity level strongly depends on the actual BPMM. In particular, it does not directly impact other components nor is it necessarily the next step prescribed in the maturity road map. In practice, a BPMM will concretise in its architecture how the impact of capability on maturity is calculated if components are separately improved (cf. Section 5). For instance, CMMI refers to this conversion from capability to maturity as ‘equivalent staging’ (SEI, 2009).

5. Reviewing and defining the BPMM design

We now cope with the BPMM design and suggest criteria to evaluate its usefulness, as stated in the third research question.

5.1 Introduction to the concept of BPMM

Maturity and capability are part of an MM, as explained in Tapia, Daneva, van Eck, and Wieringa (2008):

MMs have been developed to assess specific areas against a norm. Based on maturity assessments, organisations know the extent to which activities in such areas are predictable. (…)
MMs apply a life-cycle approach where an area develops over time until it reaches its highest maturity level. (p. 71)

The authors distinguish five elements in the design of an MM: (1) the type, classified as an assessment tool, e.g. for certification and/or an improvement tool, (2) the lifecycle levels, (3) the architecture to reach the levels, which is staged with one improvement path for overall maturity or continuous with separate improvement paths for each individual component or domain, (4) the components and (5) the domains or key areas that span the components, e.g. BP, BPM or BPO (Tapia et al., 2008). Like the previous section, we first summarise the principal ideas.

- **BPMM.** In this research, maturity refers to the lifecycle of BP, BPM or BPO, as described in a BPMM (McCormack, 2007b). Most BPMMs distinguish four to five levels, each providing the foundation for subsequent levels (McCormack et al., 2009). They give guidance on how to implement those business process foundations, and to identify the risks of immature processes (Curtis & Alden, 2007), e.g. Harmon (2004) indicates that ‘mature organisations do things systematically, while immature organisations achieve their outcomes as a result of heroic efforts of individuals using approaches that they create more or less spontaneously’ (p. 1).

Further on, we compare the BPMM definitions of the main tracks in detail. For each model, the **similarities** are indicated in bold, whereas the **differences** are underlined.

### 5.2 Comparison of the definitions for ‘BPMM’

Table 3 illustrates the BPMM definition within the main tracks.

The primary difference concerns the naming of the BPMMs. CMMI and FAA-iCMM explicitly refer to both maturity and capability, whereas ISO/IEC 15504 and OMG-BPMM solely mention maturity in the model names. Given the inclusion of capability in maturity, the last naming is more concise and most used. Moreover, CMM, CMMI and iCMM are registered marks. Since our study relates to a general definition, we opt for the brief alternative. Further on, maturity seems organisational to ISO/IEC 15504, whereas it appears to be linked to BPs for OMG-BPMM. The same difference has already been discussed while considering the maturity definition. Although the definition of ISO/IEC 15504 is more complex by involving three models, it recalls the strong relationship between maturity and capability. Notwithstanding these differences, there are many similarities among the definitions. All main tracks refer to an evolution taking place, with or without using the words ‘levels’ or ‘stages’. They are structured around elements or components, also called process sets, and may contain best practices. Except for ISO/IEC 15504, all models explicitly describe themselves as applicable to multiple disciplines, such as software and systems engineering, product development and service delivery.

In summary, the design elements of the main tracks are compared in Table 4. The scope is inspired by Tapia et al. (2008), as explained in Section 5.1, and broadened with elements necessary during the assessment.

The BPMM definitions of the main tracks agree on three design elements: (1) lifecycle levels for maturity and/or capability, (2) an assessment and improvement method to determine the actual and desired lifecycle level, i.e. AS-IS and TO-BE and (3) with components arranged in domains, such as BP, BPM and BPO. As a result, these design elements are derived as the essential elements for a general BPMM definition. The architecture, which indicates whether a model represents maturity and/or capability levels, is merely mentioned in ISO/IEC 15504. The assignment of components to specific levels is typically
comprised in a BPMM, albeit not in its definition. Nonetheless, to be of practical use, a BPMM describes its architecture, data collection technique, calculation and representation of AS-IS and TO-BE levels. The latter are implicit to the BPMM definition for reasons of conciseness.

After having compared the current BPMM definitions, a general description is presented in the subsequent section, in respect of the third research question.

5.3 Comprehensive definition for a BPMM

We briefly define a BPMM as ‘a model to assess and/or to guide best practice improvements in organisational maturity and process capability, expressed in lifecycle levels, by taking into account an evolutionary road map regarding (1) process modelling, (2)
process deployment, (3) process optimisation, (4) process management, (5) the organisational culture and/or (6) the organisational structure’. In order to increase its usefulness, the BPMM design includes both a detailed assessment method and improvement method. Various BPMMs have been introduced, both by academia and industry, for specifying the subsequent levels in respect of predefined (sub) components. These MMs are supported by an internal or external assessment tool, for instance survey-based or document reviews, to apply the model in a concrete situation. The measurement of maturity and capability is summarised in the figure below.

As illustrated in Figure 3, the measurement of maturity and capability implies: (1) a diagnosis of the actual maturity and/or capability level (AS-IS), based on the current strengths and weaknesses regarding the basic components, (2) a determination of the desired level (TO-BE), depending on the organisational goals, and a gap analysis for indicating the improvement areas and (3) a road map to progress from AS-IS towards TO-BE, in order to prioritise the improvement areas. The assessment itself is conducted internally or externally, that is by the organisation itself (as a first party), by partners or stakeholders (as a second party), or by an (accredited) third party. The findings allow a longitudinal study and benchmarking (Lee et al., 2009; Pesic, 2009; Rosemann & de Bruin, 2005).

In conclusion, a BPMM can be divided into an assessment method and an improvement method. The former defines the AS-IS rating and the TO-BE gap analysis,
considering a specific representation, calculation and data collection technique. For instance, the levels are represented as decimals in a bar chart and calculated as the average of survey questions, or represented as an integer for the highest levels where all assigned (sub) components are satisfied. The latter prioritises the improvements areas in a road map, by taking into account the predefined lifecycle levels with the corresponding architecture, domains and (sub) components. The existing BPMMs strongly vary in terms of the design elements. It is the responsibility of the practitioner to choose a model that best fits the organisational needs.

6. Conclusion
This study has elaborated on the topic of BPMM by means of three research questions. Its final aim was to properly define BP maturity, while reviewing the BPMM scope (RQ1), terminology (RQ2) and design (RQ3).

First, the BPMM scope includes: (1) process modelling, (2) process deployment, (3) process optimisation, (4) process management, (5) the organisation’s culture and (6) the organisation’s structure. In pairs, these six basic components are grouped in a funnel structure, respectively, starting from the definitions of (1) a BP, which is a subset of (2) BPM, and which in turn is part of (3) BPO. The scope thus involves a BP perspective and an organisational perspective.

Second, both maturity and capability are relevant in the BPMM terminology. It turned out that an increase in maturity gradually facilitates an increase in capability by prescribing continuous improvements. Maturity indicates the extent to which an organisation has explicitly and consistently deployed its BPs, by taking into account the basic BPMM components. It systematically assesses and improves the process capabilities within an organisation to deliver higher business (process) performance. On the other hand, capability comprises the competencies to achieve the targeted process results, and thus relates to the expected performance of a BP. It is used to indicate a growth in an individual basic component, instead of an overall growth. As a result, it is more accurate to refer to ‘organisational maturity’ with regard to BP, BPM or BPO, and to ‘process capability’.

Third, a BPMM is more useful if it provides both an assessment and improvement method. The former supports the practitioner in identifying an organisation’s AS-IS level in maturity and capability, and in indicating the gap with the TO-BE situation. The improvement method assists the practitioner with prioritising the necessary improvements, and best practices. It also defines the components to assess, whether to assess maturity and/or capability, and their levels.

As this study is part of a larger BPMM research, we acknowledge some limitations regarding the validation of the results. At present, the BPMM scope draws on the extensive body of BP literature, the findings of which have been repeatedly corroborated by evidence. The BPMM terminology and design are mainly motivated by the detailed definitions of the four main tracks in the BPMM literature, and supplemented by dominant academic contributions. However, future research will provide a comprehensive overview of the existing BPMMs by taking into account the defined scope, terminology and design as elaborated in this article. The actual components of the models will be grouped into the basic BP, BPM or BPO components, to further validate the current research findings. Furthermore, their comprehension of maturity and capability will be compared against the theoretical foundation. Moreover, we will evaluate the usefulness of the existing BPMMs by comparing their assessment and improvement method. In the end, recommendations will be given to assist practitioners on their journey towards process excellence.
Notwithstanding these limitations, the present review adds value for both scholars and practitioners. Three essential gaps (i.e. scope, terminology and design) are addressed between the existing BPMMs and the lacking fundamentals. This unambiguous understanding helps to avoid confusion and inappropriate assumptions in BP literature. It allows clear communication among scholars, and new models based on the identified components. Practitioners are supported in choosing and interpreting useful BPMMs by clarifying the BPMM-related concepts.

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We acknowledge the explicit permission of ISO/IEC, and the permissions of SEI and OMG included in their documents to cite their definitions for academic purposes. We also note that Capability Maturity Model and CMM are registered trademarks in the U.S. Patent and Trademark Office. CMM Integration and CMMI are service marks of Carnegie Mellon University.

References


