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# Maturity Models in Business Process Management

by

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# Maturity Models in Business Process Management

**Abstract:**

**Purpose** – Maturity models are a prospering approach to improving a company's processes and business process management (BPM) capabilities. In fact, the number of corresponding maturity models is such high that practitioners and scholars run the risk of losing track. We therefore provide a systematic in-depth review of BPM maturity models.

**Design/methodology/approach** – The paper follows the accepted research process for literature reviews. We analyze a sample of 10 BPM maturity models according to a framework of general design principles. The framework particularly focuses on the applicability and usefulness of maturity models.

**Findings** – The analyzed maturity models sufficiently address basic design principles as well as principles for a descriptive purpose of use. The design principles for a prescriptive use, however, are hardly met. Thus, BPM maturity models provide limited guidance for identifying desirable maturity levels and for implementing improvement measures.

**Research limitations/implications** – We are confident that this review covers the majority of publicly available BPM maturity models. As the number of corresponding maturity models seems to be constantly growing, exhaustiveness can hardly be guaranteed. Our results stimulate future research. Inter alia, adopters from industry require more elaborate support by means of ready-to-use and adaptable instruments for maturity assessment and improvement. We also reaffirm the need for maturity model consolidation in the field of BPM.

**Originality/value –** As existing literature reviews focus on process improvement or BPM in general, our findings extend current knowledge. They also increase transparency. Our results provide guidance for scholars and practitioners involved in the design, enhancement, or application of BPM maturity models.

**Keywords:** Business Process Management, BPM Capabilities, Maturity Models, Review

**Classification:** General Review

## 1 Introduction

At the latest since Hammer and Champy's (1993) "Manifesto for Business Revolution", the management and improvement of business processes are core tasks of organizational design (e.g., Becker and Kahn, 2010, Buhl et al., 2011, Gartner, 2010, Sidorova and Isik, 2010, Trkman, 2010, vom Brocke et al., 2011, Wolf and Harmon, 2010). Among the various approaches that support business process management (BPM), maturity models receive increasing attention (BPM&O, 2011, Bucher and Winter, 2010, de Bruin et al., 2005). This is in line with the general popularity of maturity models across a wide range of application domains (Weber et al., 2008, de Bruin et al., 2005), the expected increase in adoption by industry (Scott, 2007), and the growing academic interest in such models (Becker et al., 2010).

Maturity models typically include a sequence of levels (or stages) that form an anticipated, desired, or logical path from an initial state to maturity (Becker et al., 2009, Gottschalk, 2009, Kazanjian and Drazin, 1989). An organization's current maturity level represents its capabilities as regards a specific class of objects and application domain (Rosemann and de Bruin, 2005). Maturity models are used to assess as-is situations, to guide improvement initiatives, and to control progress (Iversen et al., 1999). In the BPM field, two types of maturity models can be identified: process maturity models and BPM maturity models (Rosemann and vom Brocke, 2010, Smith and Fingar, 2004). The former refer to the condition of processes in general or distinct process types, the latter address a company's BPM capabilities (e.g., Rosemann and de Bruin, 2005, Lee et al., 2007, Hammer, 2007, Weber et al., 2008).

As a matter of fact, the number of maturity models related to the BPM field is such high that practitioners and scholars run the risk of losing track (Rosemann and vom Brocke, 2010). Although scholars are slowly beginning to identify according research need (Mettler et al., 2010) and BPM experts require "the motley array of maturity models" to be consolidated (Curtis and Alden, 2007, p. 1), potential adopters from industry still encounter high uncertainty. Moreover, scholars struggle with the conceptual enhancement of maturity models. So far, many reviews focus on process improvement or BPM in general (e.g., Zellner, 2011, Sidorova and Isik, 2010). While some authors briefly list BPM-related maturity models (Harmon, 2009, Rosemann and vom Brocke, 2010), a systematic in-depth analysis is lacking. As a first step to address this research need, we focus on BPM maturity models as well as on their practical applicability and usefulness. This is justified by the increasing recognition of BPM capability development as a highly important topic within the BPM community (Rosemann and vom Brocke, 2010). Moreover, applicability and usefulness of maturity models concern both scholars and practitioners. Accordingly, our research questions (RQ) are:

*RQ1: What maturity models exist for BPM?*

*RQ2: To what extent do these models meet the requirements of applicability and usefulness?*

To answer these questions, we follow the accepted research process for literature reviews (Cooper and Hedges, 1994, Tranfield et al., 2003, Webster and Watson, 2002). This process typically comprises the phases (1) problem formulation, (2) identification of relevant literature, (3) evaluation of identified literature, (4) analysis, interpretation, and discussion as well as (5) public presentation. Having formulated the problem of interest by raising the above research questions (phase 1), section 2 outlines the foundations of maturity models and introduces the design principles framework by Pöppelbuß and Röglinger (2011). This framework serves as principal analytical lens throughout the review as it emphasizes applicability and usefulness of maturity models and thus helps address RQ 2. In section 3, we elaborate on how we approached and evaluated the literature in order to identify existing BPM maturity models (phases 2 and 3). We then compile the key features of 10 BPM maturity models and ana-

lyze these models according to the design principles framework (phase 4). The results of this section provide answers to RQ 1 and RQ 2. The paper concludes in section 4 with a summary, limitations, and directions for further research.

## 2 Background

### 2.1 Foundations of Maturity Models

Based on the assumption of predictable patterns of organizational evolution and change, maturity models typically represent theories about how an organization's capabilities evolve in a stage-by-stage manner along an anticipated, desired, or logical path (van den Ven and Poole, 1995, Gottschalk, 2009, Kazanjian and Drazin, 1989). Accordingly, they are also termed stages-of-growth models, stage models, or stage theories (Prananto et al., 2003). Early examples of maturity models refer to a hierarchy of human needs (Maslow, 1954), economic growth (Kuznets, 1965), and the progression of IT in organizations (Nolan, 1973, 1979). Nolan's stage hypothesis, for instance, stimulated much research that resulted in conflicting findings as regards its empirical validity (Prananto et al., 2003). The corresponding stage model, however, has been widely adopted and led to hundreds of models based on a staged sequence of levels. Only few maturity models follow other structural designs (Fraser et al. 2002, Rummler and Brache 1990).

The basic purpose of maturity models is to outline the stages of maturation paths. This includes the characteristics of each stage and the logical relationship between them (Kuznets, 1965). As for practical application, typical purposes of use are descriptive, prescriptive, and comparative (de Bruin et al., 2005). A maturity model serves a descriptive purpose if it can be applied for as-is assessments. It serves a prescriptive purpose if it indicates how to identify desirable future maturity levels and if it provides guidance on how to implement according improvement measures. A maturity model serves a comparative purpose if it allows for internal or external benchmarking.

Since their provenance, maturity models have been subject to criticism. They are often characterized as "step-by-step recipes" that oversimplify reality and lack empirical foundation (Benbasat et al., 1984, King and Kraemer, 1984, de Bruin et al., 2005, McCormack et al., 2009). Moreover, they typically neglect the existence of multiple and possibly equifinal maturation paths (Teo and King, 1997). As internal and external characteristics may constrain a maturity model's applicability in its standard version, Mettler and Rohner (2009) require maturity models to be configurable. King and Kraemer (1984) criticize that most maturity models focus on the sequence of levels toward a predefined "end state" instead of the factors that actually influence evolution and change. Further criticism refers to the multitude of similar maturity models, dissatisfactory documentation, non-reflective adoption of the Capability Maturity Model (CMM) blueprint, and missing economic foundation (Becker et al., 2009, Becker et al., 2010, Iversen et al., 1999, Kamprath and Röglinger, 2011, Smith and Fingar, 2004).

To mitigate this criticism, research increasingly deals with maturity models from a design process and a design product perspective. As for the design process, various procedure models have been proposed (e.g., Becker et al., 2009, de Bruin et al., 2005, Maier et al., 2009, van Steenbergen et al., 2010, Solli-Sæther and Gottschalk, 2010, Mettler, 2011). For instance, de Bruin et al. (2005) describe six phases to guide the design of a descriptive maturity model and its advancement for prescriptive and comparative purposes of use. Becker et al. (2009) derive requirements and a procedure model from the design science guidelines by Hevner et al. (2004). As for maturity models as design products, literature deals with qualities, components, and design principles. For instance, Simonsson et al. (2007) as well as Ahlemann et al. (2005) suggest qualities particularly geared to capability assessment models/methods.

Qualities here represent desirable properties or dimensions of value (Moody and Shanks, 1994). According to Simonsson et al. (2007), a good capability assessment model/method has to be valid, reliable, and cost efficient. Ahlemann et al. (2005) postulate empirical foundation, software tool support, standardization, flexibility/adaptability, benchmarking applicability, certification, disclosure of potential for improvement, evidence of correlation between maturity model adoption and performance. As for the components of maturity models, de Bruin et al. (2005) suggest to structure maturity models hierarchically into multiple layers. On a detailed level, Ahlemann et al. (2005) define a meta-model including components such as competence objects, maturity levels, criteria, and methods for data collection and analysis. Fraser et al. (2002) identify the following components: levels, descriptors, descriptions for each level, capability areas (dimensions), activities for each capability area, and a description of each activity as performed at a certain maturity level. Finally, Pöppelbuß and Röglinger (2011) propose a framework of general design principles, i.e., principles of form and function for maturity models (Gregor and Jones, 2007). The framework is intended to serve as a pragmatic, yet well-founded "checklist" for researchers and practitioners involved in the design, enhancement, or application of maturity models. It extends the insights into qualities and components by focusing on the applicability and usefulness of maturity models. As particularly the second feature appears to be promising for answering RQ 2, we adopt this framework as the principal analytical lens for our review of BPM maturity models. Its main components are sketched below.

### 2.2 Design Principles for Maturity Models

The framework of general design principles (DPs) for maturity models comprises three nested groups of design principles (see Figure 1). These are the basic principles, the principles for a descriptive purpose of use, and the principles for a prescriptive purpose of use. Detailed information and the justification of the individual design principles can be retrieved from the original publication (Pöppelbuß and Röglinger, 2011).

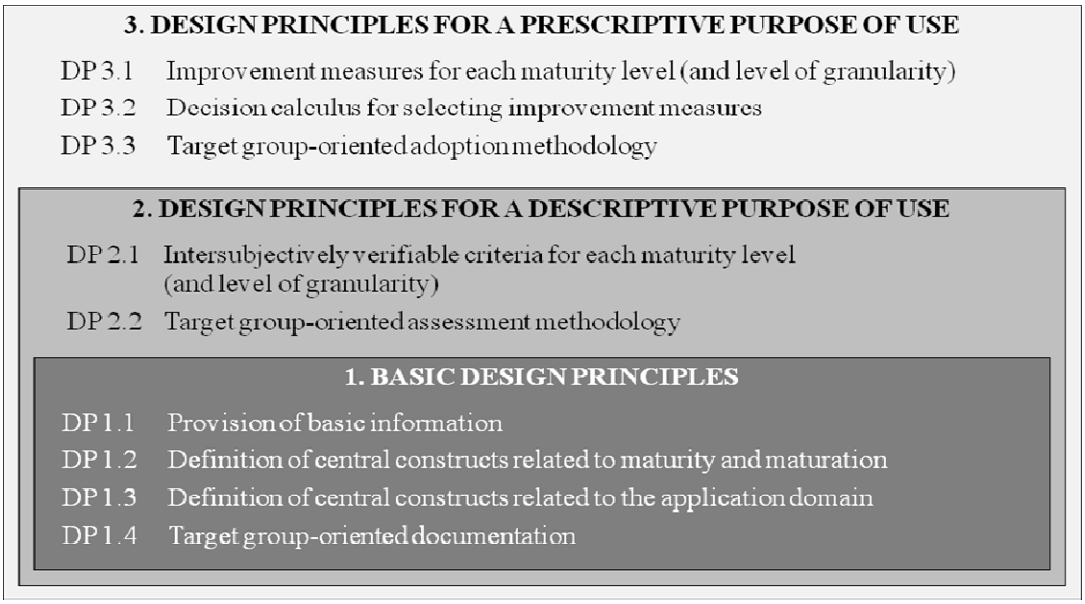


**Figure 1.** Framework of general DPs for maturity models (Pöppelbuß and Röglinger, 2011)

*Basic Design Principles*

DP 1.1: Maturity model documentations have to provide basic information about the application domain (e.g., BPM), the prerequisites or limitations of application (e.g., certain conditions internal or external to the organization under assessment), the supported purposes of use, the target group and audience (e.g., consultants or professionals within the organization) as well as the class of maturing entities (e.g., operational processes or BPM capability). Differences compared to related maturity models should be disclosed as well. Moreover, the design process should to be documented including the extent to which the model has been subject to empirical validation.

DP 1.2: The central constructs related to maturity and maturation need to be defined. This includes a definition of the underlying notion of maturity, available capability areas and maturity levels, descriptors for each capability area and maturity level, possible maturation paths, the rationale behind maturation as well as the levels of granularity on which maturation can be observed. Finally, maturity models should explicate their underpinning theoretical foundations concerning organizational capability evolution and change.

DP 1.3: Maturity models have to define the central constructs of the application domain they refer to. These include common terms and definitions that are relevant to the setting which the maturity models are supposed to be applied in (e.g., in the form of a glossary that defines terms like business process).

DP 1.4: The basic information and the central constructs need to be documented in a target group-oriented manner. That is, the documentation needs to be accessible and comprehensible for the maturity model's target group.

*Design Principles for Descriptive Purpose of Use*

DP 2.1: Maturity models intended for a descriptive purpose of use need to provide intersubjectively verifiable assessment criteria for each stage and level of granularity. According to de Bruin et al. (2005), maturity models can be structured hierarchically into multiple layers referring to different levels of granularity of maturation. A low level of granularity provides a simple means for comparing and documenting maturity levels (e.g., on corporate level) as it is often intended for the communication with external stakeholders. A high level of granularity enables to determine differentiated maturity profiles within complex application domains. This provides better help in structuring assessment criteria and in choosing among improvement measures. The BPM Maturity Model (BPMMM) by Rosemann et al. (2006), for instance, comprises three levels of granularity of BPM maturity, namely success factors, capability areas, and detailed questions.

DP 2.2: An assessment methodology needs to feature a procedure model as well as advice on how to elicit the assessment criteria and on how to adapt or configure the criteria according to organization-specific situational characteristics. Assessment methodologies should also share knowledge from previous applications – if available.

*Design Principles for Prescriptive Purpose of Use*

DP 3.1: Maturity models following a prescriptive purpose need to include improvement measures in the sense of good or best practices for each stage and – if available – level of granularity.

DP 3.2: Prescriptive maturity models should include a decision calculus. According to decision theory (Peterson, 2009), a decision calculus helps decision makers to evaluate different alternatives – i.e., different sets of improvement measures – with respect to given objectives and to identify which alter-

native satisfies the objectives best. As most maturity models refer to a business context, it generally is corporate performance that determines the objective system of improvement measure selection.

DP 3.3: An adoption methodology needs to be provided that features a procedure model, advice on how to concretize and adapt improvement measures as well as on how to adapt and configure the decision calculus. It is expected to be accessible and comprehensible for the model's target group and favorably also reports knowledge gained from previous applications.

The nine DPs introduced above serve as main analytical lens for assessing the applicability and usefulness of BPM related maturity models below.

## 3 Maturity Models in Business Process Management

### 3.1 Identification of Relevant Literature

We refer to two recently published collections of BPM-related maturity models as the starting point for our sample selection. First, Harmon (2009) gave a summary of 14 articles and columns on process maturity models published on BPTrends.com between 2003 and 2009. Second, Rosemann and vom Brocke (2010) compiled a list of nine maturity models from the BPM field. In addition, we conducted a focused web search for relevant BPM literature. On the one hand, we specifically searched the online database of the Business Process Management Journal using "maturity" as search term as well as title and abstract search fields. On the other hand, we consulted Google Scholar (http://scholar.google.com) using "BPM maturity" as search term. We screened the resulting hits for relevance, that is, we checked if BPM maturity is addressed. By doing so, we were able to identify some further models that were not included in the previously mentioned collections (e.g., Rohloff, 2009b, Willaert et al., 2007, McCormack et al., 2009, Magdaleno et al., 2008). Further publications attracted our attention in our prior research on maturity models (e.g., McCormack, 2007, Zwicker et al., 2010).

In the following, we only considered maturity models that had been published in English language and for which a reasonable amount of documentation was freely available. Some maturity models are not publicly accessible in their complete version (e.g., including detailed assessment criteria and guidelines). This is especially the case for maturity models that are considered as intellectual property by consulting companies and research institutes who sell the service of maturity assessments to organizations (e.g., Willaert et al., 2007, Melenovsky and Sinur, 2006). Furthermore, as the review focuses on BPM maturity models, we excluded those models from our sample that either only evaluate process conditions or refer to specific process types. These models are the Process Condition Model (DeToro and McCabe, 1997), the maturity model for the fulfillment of the 48-h-serivce promise in the public sector (Zwicker et al., 2010), the collaboration maturity model (Magdaleno et al., 2008) and the different constellations (addressing either development, acquisition, or service processes) of the Capability Maturity Model Integration (CMMI) (SEI, 2011). Instead, we kept those generic process maturity models that do not refer to a specific process type and that cover the condition of BPM practices as well. We further excluded the Strategic Alignment Maturity Model (Luftman, 2003) and the SOA Maturity Model (Inaganti and Aravamudan, 2007), which we considered only distantly related to BPM although they were part of the collections by Harmon (2009) and Rosemann and vom Brocke (2010).

The origins of the resulting sample of 10 maturity models are diverse as they comprise academia, industry, and international consortia. The models also differ regarding their scope. Some address the mastery of processes, others focus on the mastery of BPM. The first are process maturity models that basically refer to the condition of a process, i.e., the extent to which instances of a distinct process type are managed, documented, and performed (de Bruin and Rosemann, 2007). In contrast, BPM maturity

models refer to the condition of an organization's BPM capabilities (Rosemann and de Bruin, 2005) in terms of process discovery, design, deployment, and execution (Smith and Fingar, 2004), strategic alignment (Rosemann and vom Brocke, 2010) as well as user and system inclusion (Smith and Fingar, 2004). In a few models, the maturity of business processes conflates with the maturity of process management practices (Smith and Fingar, 2004). Process maturity and BPM maturity are not considered as separate maturation concepts by these models.

| | Scope* | Lowest Maturity Level | Upmost Maturity Level |
|---|---|---|---|
| **BPM Maturity Model (BPMMM)** (Rosemann and de Bruin, 2005, Rosemann et al., 2006) | BPM | *Initial State:* Attempts towards BPM are non-existent or very uncoordinated and unstructured (ad-hoc, individual efforts). | *Optimized:* BPM is core part of both strategic and operational management within the organization. |
| **Process Performance Index (PPI)** (Rummler and Brache, 1990, Rummler-Brache Group, 2004) | BPM | *Process Management Initiation:* Organizations are "neophytes to process [management]". There is a strong desire to learn about process management. | *Process Management Mastery:* BPM is a way of life for organizations. Process owners are rewarded on process performance. Every employee understands the processes. |
| **BPR Maturity Model (BPRMM)** (Maull et al., 2003) | BPM | *Group 1:* Organizations are in the early phase of business process reengineering (BPR) project planning. | *Group 5:* Organizations use the knowledge gained from BPR projects to re-engineer the whole business. |
| **Business Process Maturity Model (BPMM-Fisher)** (Fisher, 2004) | BPM | *Siloed:* Individual groups work to optimize their own piece of the organization. Information tends to be siloed. | *Intelligent Operating Network:* Optimal efficiency throughout the end-to-end value chain and free-flow of real-time information is achieved. |
| **Process Management Maturity Assessment (PMMA)** (Rohloff, 2009a, b) | BPM & P | *Initial:* Processes are not defined; success depends on certain specialists; schedule, quality and costs are not predictable. | *Optimizing:* Processes are analyzed, optimized and adjusted to changes in market requirements systematically. Benchmarking and mistake avoidance is pursued. |
| **BPO Maturity Model (BPOMM)** (McCormack, 2007, McCormack et al., 2009) | BPM & P | *Ad-hoc:* Processes are unstructured and ill-defined. No process measures exist. Organizational structures are based on traditional functions. | *Integrated:* The organization cooperates with vendors and suppliers on process level. Organizational structures are based on processes. There are deeply imbedded process measures. |
| **Process and Enterprise Maturity Model (PEMM)** (Hammer, 2007) | BPM & P | *P-1/E-1 (examples):* The process has not been designed on an end-to-end basis. Fragmented legacy IT systems support the process. | *P-4/E-4 (examples):* Process design fits with customer and supplier processes. Modular IT architecture exists. |
| **Process Maturity Ladder (PML)** (Harmon, 2004, 2007) | BPM & P | *Initial:* Processes are not defined. | *Optimizing:* Processes are measured and managed. Process improvement teams exist. |
| **Business Process Maturity Model (BPMM-OMG)** (Weber et al., 2008) | BPM & P | *Initial:* There is "fire-fighting management". Success depends on the competence and heroics of individuals and not on the use of proven processes. | *Innovating:* There is "change management". Approaches to defect and problem prevention as well as continuous and innovative improvements are in place. |
| **Business Process Maturity Model (BPMM-Lee)** (Lee et al., 2007) | BPM & P | *Initial:* Processes are managed in an ad-hoc manner. | *Optimizing:* Processes are proactively monitored and controlled. Process performance data is systematically used for improvements. |

* BPM = Business Process Management, P = Processes in general

**Table 1.** Overview of the maturity model sample

Table 1 gives an overview of our maturity model sample including each maturity model's scope as well as short descriptions of the lowest and the upmost maturity levels. These models describe the development from immature and initial to highly developed BPM practices and superior process conditions. The level descriptions serve as a good indicator of whether the models rather address the condition of BPM practices, the condition of processes, or both. Although many of the level descriptions read similar, different conceptions of the term BPM become obvious, too. Some models (e.g., BPRMM) focus on the idea of business process reengineering (BPR) that rather implies a project-character of radical and revolutionary process innovation. Many of the other maturity models (e.g., PML, BPMM-OMG) understand BPM as a more incremental and evolutionary approach that targets at continuous process improvement.

### 3.2 Analysis and Interpretation

We analyzed our sample of maturity models by means of the design principles framework as presented in section 2 (see Table 2 and Table 3).

*Basic Design Principles*

*Ad DP 1.1:* Basic information can be retrieved from almost all maturity model documentations. The designated target groups generally include companies (Hammer 2007), but also organizations from the public sector (Rosemann and de Bruin 2005). None of the maturity models restricts the application domain, i.e., the models are expected to be useful to organizations independent of size, location, or specific industries. Concerning designated users, the BPMM-OMG specifically mentions members of appraisal teams, members of process engineering groups, managers, and professional staff (Weber et al. 2008). All models disclose the covered purposes of use (PoU) and they completely intend to allow for descriptive uses. Six models also claim to be of prescriptive nature (i.e., BPMMM, BPMM-Fisher, BPOMM, PEMM, BPMM-OMG, BPMM-Lee; see also DP 1.1 in Table 2). In concordance with this categorization, the maturity models of our sample are also evaluated against the two other DP groups. None of the maturity models explicitly states prerequisites for application. As for the maturity model development process, a few documentations provide background information on design choices and the development history. For instance, the foreword of the BPMM-OMG report refers to roots in CMM, CMMI, and People-CMM (Weber et al., 2008). Similarly, Harmon (2004, 2007) states that he de-formalized and interpreted the CMM for his process maturity ladder. The design process of the BPMMM can be traced in multiple research papers (e.g., Rosemann and de Bruin, 2005, Rosemann et al., 2006, de Bruin and Rosemann, 2007) and finally a PhD thesis (de Bruin, 2009, access is restricted). As for empirical validation of the 10 maturity models, rather limited information is available. As observable from the reviewed sources, the BPRMM and the PPI proved useful in empirical studies on BPM. According to Hammer (2007), the PEMM was also subject to extensive tests and revisions. In case of the BPMMM, de Bruin and Rosemann (2007) conducted a Delphi study with international BPM experts to identify central model elements. As for the PEMM and PMMA, examples from real-life applications are given. In only very few documentations, maturity models are differentiated against other maturity models. Rohloff (2009b), for instance, compares his approach (PMMA) with three other maturity models (BPMM-OMG, BPMMM, and PEMM). He mainly highlights similarities, but also points to deficiencies of the other models (e.g., in Rohloff, 2009b, on p. 139: "The important role of IT support is not covered in the BPMM[-OMG]"). Hammer (2007, p. 10) emphasizes that his PEMM is different to the CMMI and other process maturity frameworks because it "applies to companies in any industry and doesn't specify what a particular process should look like."

*Ad DP 1.2:* All models define the maturity levels they comprise as well as their structural components. The maturity models distinguish three to five stages (also termed "groups" or "levels") through which organizations proceed to BPM and/or process mastery. The PEMM comprises two sub-models (process maturity and enterprise maturity) each of which comprises four stages. Apart of that, all models outline a single path of sequenced stages. In a few cases, the models borrowed the maturity level labels from the CMM or CMMI (e.g., BPMMM, BPMM-OMG, BPMM-Lee, PML, and PMMA). However, the central term of maturity is seldom defined explicitly, which also makes it difficult to clearly distinguish whether BPM or process maturity is mainly addressed. The general concepts of process or BPM maturity of most models from our sample are further structured according to different capability areas and levels of granularity, which are represented in various ways, e.g., by means of "capability areas", "categories", "key success factors", "factors", "levers of change", "process areas", "enablers", "maturity vs. capability", or "enterprise capabilities" (de Bruin and Rosemann, 2007, Hammer, 2007, Weber et al., 2008, Fisher, 2004, Rohloff, 2009b, Rummler-Brache Group, 2004). They often span a "maturity-grid" (Fraser et al., 2002) with cell descriptions that detail the high-level explanations of maturity levels. In the BPMM-OMG, five so-called process area threads are used to link process areas across different maturity levels (Weber et al., 2008). Rosemann et al. (2006) present a theoretical model that shows the interrelation of their factors with BPM and business success.

*Ad DP 1.3:* In addition to their essential structural elements, some maturity models provide further definitions on constructs of the setting they are applied in. For instance, Rosemann et al. (2006) introduce BPM as a holistic management practice, McCormack (2007) discusses the notion of business process orientation, and Maull et al. (2003) elaborate on approaches to and types of BPR. The BPMM-OMG includes a separate section for terms and definitions that also highlights the differences in meaning compared to other OMG specifications apart from the BPM field (Weber et al., 2008). Since the PMMA originates from a BPM initiative at Siemens AG, Rohloff (2009b) gives background information about BPM at this specific organization.

*Ad DP 1.4:* The amount of publicly available documentation differs between the reviewed models. The most comprehensive documentation is the BPMM-OMG specification including 496 pages. The PPI was published in a brief research report. Some models are available from BPTrends.com articles and columns, an outlet that specifically addresses BPM professionals (BPMM-Fisher and PML). Hammer's (2007) PEMM was published in Harvard Business Review. Many of the others maturity models are published in peer-reviewed research articles that often do not leave enough space for detailed assessment criteria and guidelines, and that we consider generally limited in their potential to address possible maturity model adopters from practice (BPMM-Lee, BPMMM, BPOMM, BPRMM, and PMMA).

*Design Principles for Descriptive Purpose of Use*

*Ad DP 2.1:* All models of this sample intend to allow for descriptive purposes of use. The according assessment criteria for each maturity stage and level of granularity are typically presented as general textual descriptions. These descriptions are supposed to provide a sufficient basis for determining the maturity level that best mirrors the organization or process under assessment. More detailed assessment criteria for an as-is analysis are provided for the BPMM-OMG, the PPI, and the PEMM. In the BPMM-OMG, for example, the "specific practices" are phrased as clear statements to avoid misconceptions. Unfortunately, the third and most detailed level of the BPMMM (assessment kit with detailed questions) is not publicly available yet. This holds true for the PMMA and BPOMM as well.

*Ad DP 2.2:* Some maturity models provide further advice on how to conduct the as-is assessment and thereby provide the possibility of self-assessments. The BPMM-OMG, for instance, includes process area templates that can be used during assessment. Blank assessment sheets are also available for the PPI and the PEMM. With regard to maturity model configuration and adaptation, the model documentations hardly provide advice on how to adjust a model to situational characteristics. Only the BPMM-OMG provides general guidelines on how to make it domain-specific. In his book, McCormack (2007) provides an alternative version of his maturity model that is specifically tailored for supply chain management. Experiences from previous maturity model applications are also hardly shared except for the BPRMM, the PMMA, and the PEMM. Hammer (2007), for instance, gives assessment results of a U.S. company for each of the two PEMM maturity grids. He also reports about the effects of an assessment conducted at the global tire manufacturer Michelin.

*Design Principles for Prescriptive Purpose of Use*

*Ad DP 3.1:* For those six models (i.e., BPMMM, BPMM-Fisher, BPOMM, PEMM, BPMM-OMG, and BPMM-Lee; we did not apply DP 3.1 to 3.3 to those models that only claim to serve a descriptive purpose of use) that intend to give normative advice for improvement measures, this advice often stays implicit to the textual level descriptions. This is different for the BPMM-OMG that clearly articulates which "specific practices" of new process areas have to be implemented at each maturity level (Weber et al., 2008).

*Ad DP 3.2:* None of the models provides a defined mechanism that allows adopters from practice to adapt the decision calculus for the selection of improvement measures to organization-specific strategies and objectives. All models implicitly expect organizations to eventually reach the top of the "maturity ladder." They neither consider cost-benefit relations nor the relevance of organization-specific objectives.

*Ad DP 3.3:* As regards the target group-oriented adoption methodology, Hammer (2007) is one of the few who gives explanations on how to use the PEMM for a prescriptive purpose of use. However, his main advice is that organizations "must focus on tackling the red areas [in the maturity grid] first." Fisher (2004) recommends advancing all levers of change equally because they are mutually dependent. More substantive guidance, e.g., in terms of procedure models, is not provided.

### 3.3 Discussion

First, the analysis shows that the *basic* design principles are generally covered well by the maturity models from the selected sample. That is, the maturity model documents generally make statements regarding their scope, their purpose of use, and their development background. They describe the structure of the models including the stages, possibly existing levels of granularity and according maturity dimensions. However, there is still room for improvement. Maturity model developers or the publishing institutions could state more clearly, for instance, in which settings, by whom, and how the models should be applied. Moreover, the underlying understanding of maturity frequently stays obscure. Often, it can only be deduced from the textual maturity level descriptions. In particular, the documentations frequently miss to state whether there is a focus on process mastery, BPM mastery, or deliberately both. Accordingly, means (BPM practices) and ends (well-working business processes) sometimes get mixed up. Second, the design principles for the *descriptive* purpose of use are generally covered to a sufficient degree. This means that assessment criteria are provided that allow for determining the as-is situation of an organization. However, these assessment criteria are often only presented as textual descriptions and in not in the form of comprehensive, well-structured and easily ap-

plicable assessment checklists. The detailed elements of maturity models are sometimes even not published at all (e.g., in case of the BPMMM), a circumstance that inhibits self-assessments by adopters from industry. Finally, the design principles for the *prescriptive* use (if applicable) are only scarcely addressed. Therefore, we argue that the guidance provided by our sample of maturity models for selecting and prioritizing improvement measures is rather limited. Adopters from practice are frequently forced to speculate about appropriate measures with only having the textual descriptions of generic target states as a basis.

The presented framework of general design principles suggests experiences from maturity model application and evidences for their empirical validity to be shared. In this regard, maturity models for BPM still seem to suffer from a "lack of actual applications" (Rosemann and de Bruin, 2005, p. 3) as these have been scarcely reported for the sample we reviewed. Accordingly, a problem that potential adopters from industry encounter is the selection of an adequate maturity model based on little information about realistic benefits. Even worse, one could argue that there is already an inflation of maturity models in the area of BPM and according to Curtis and Alden (2007, p. 1) "precious few of these […] have the power of the original Capability Maturity Model (CMM) for guiding improvement."

Organizations searching for an adequate maturity model must therefore be aware about their intentions, i.e., the purpose of use and the scope they want to apply the model for. As for descriptive uses, most models seem to be capable of providing a basic diagnosis of organizations and processes. However, organizations should consider in advance whether the condition of processes or the condition of process management practices is in scope. As regards the prescriptive purpose of use, organizations should be especially careful as "[m]ost of these models give little guidance on the specific steps that should be taken to improve and move between the maturity levels." (Curtis and Alden, 2007, p. 1). Correspondingly, the respective design principles were hardly met by the maturity models from our sample. Surely, this estimation raises the question to which degree such guidance can be expected from generic maturity models or whether the involvement of experts and consultants is inevitable. Nevertheless, we are convinced that – according to the design principles – maturity models claiming to serve a prescriptive purpose of use should at least provide a catalog of generic improvement measures (DP 3.1) as well as basic selection guidelines (DPs 3.2, 3.3) that can be adapted to organization-individual needs and specific settings.

| Design Principles | | BPMMM | PPI | BPRMM | BPMM-Fisher | PMMA |
|---|---|---|---|---|---|---|
| (1) BASIC | **1.1** | Scope: BPM (BPM maturity); *Descriptive* (as-is assessment) and *prescriptive* PoU (roadmap for improvement, future BPM strategy formulation); Design process is documented in research articles. | Scope: BPM (process management in US firms); *Descriptive* PoU (evaluation of an organization's process management environment); Report commissioned by Rummler-Brache Group. | Scope: BPM (BPR project maturity); *Descriptive* PoU; was part of an empirical study on organizations that undertake BPR projects. | Scope: BPM (business process maturity, capabilities of any particular organization); *Descriptive* and *prescriptive* PoU (identify current gaps and specific actions to overcome these). | Scope: BPM & P (maturity of BPM and the processes); *Descriptive* PoU (assessment of the implementation of BPM); company-specific (Siemens AG); Comparison with other models: OMG BPMM, BPMMM and PEMM. |
| | **1.2** | 5 stages; 6 factors with 5 capability areas each; Underlying theoretical model. | 3 stages of process management maturity; 10 key success factors (KSF). | 5 groups of organizations with different BPR project maturity. | 5 levels; 5 levers of change (LoC). | 5 maturity levels according to CMMI; 9 categories with 1-3 subcategories each. |
| | **1.3** | BPM as a holistic management practice. | Not available. | BPR; Themes and dimensions of BPR; Types of BPR projects. | Not available. | BPM initiative at Siemens; BPM implementation topics. |
| | **1.4** | Research articles and PhD thesis. | Report. | Research article. | BPTrends article. | Research articles. |
| (2) DESCRIPTIVE | **2.1** | Textual descriptions of stages, factors and capability areas. | Statements for the 10 key success factors. | Textual descriptions of groups. | Textual descriptions of levels; Maturity grid spanned by the levels and levers of change. | Textual descriptions of all levels; Description of PMMA categories only given for maturity level 3. |
| | **2.2** | Detailed questions (assessment kit) to measure each capability area not available to public. | Process Performance Index (PPI) scorecard is provided; Maturity levels are assigned to score ranges. | Advice for assessments not available; Experiences made during the study are shared. | Assessment means to identify which cell description fits for each of the LoC. | No assessment questionnaire available; Experiences from first assessment at Siemens given. |
| (3) PRESCRIPTIVE | **3.1** | Implicit to levels. | Not applicable. | Not applicable. | Implicit to cell descriptions. | Not applicable. |
| | **3.2** | Not available. | Not applicable. | Not applicable. | Eliminate the gaps between the current state and the desired state; Advance equally across LoC. | Not applicable. |
| | **3.3** | Not available. | Not applicable. | Not applicable. | Not available. | Not applicable. |

**Table 2.** Maturity model synopsis

| Design Principles | | BPOMM | PEMM | PML | BPMM-OMG | BPMM-Lee |
|---|---|---|---|---|---|---|
| (1) BASIC | 1.1 | Scope: BPM & P (business process orientation maturity); *Descriptive* and *presciptive* PoU (evaluate level of BPM and prescribe actions that could improve this level); Developed in the late 1990s. | Scope: BPM & P (individual processes and enterprise-wide capabilities); *Descriptive* (assessment) and *prescriptive* PuO (determination of where and how to improve). | Scope: BPM & P (maturity of an organization or process)*; Descriptive* PoU (audit organizations to determine the current status of their BP efforts); De-formalization and interpretation of the CMM. | Scope: BPM & P (practices applied to the management of processes); *Descriptive* and *prescriptive* PoU; Foreword gives development history; Roots in CMM, CMMI and P-CMM; Different model uses given. | Scope: BPM & P (processes, product and/or service operations); *Descriptive* and *prescriptive* PoU (measuring and improving business process competence). |
| | 1.2 | 4 stages; 3 components of maturity (process view, process jobs, process management and measurement). | Separation of 5 process enablers (PE) and 4 enterprise capabilities (EC). | Concept of maturity; 5 levels according to the CMM; Applicable to (sub-)processes and organizations. | 5 stages similar to CMM; Process areas (PA); Informative content. | 5 process maturity levels like the CMMI; Process areas (PA) are structured into input, output, mechanism and control quadrants. |
| | 1.3 | Business Process Orientation. | Process-based transformations. | Interrelations of functional units, value chains, and processes; Measurement issues. | Terms and definitions. | Not available. |
| | 1.4 | Book section; Research articles. | Harvard Business Review Article. | Book; BPTrends article. | 496 pages of documentation. | Research Article. |
| (2) DESCRIPTIVE | 2.1 | Textual descriptions of maturity stages. | Level statements for fine-grained enabler components (#13) and capability elements (#13). | Textual descriptions of levels. | Statements of goals/practices (these can be true or false). | Characteristics of maturity levels; Process areas are structured by levels and quadrants. |
| | 2.2 | Assessment guide to determine maturity scores is not available; Specific model available for supply chain maturity. | Self-assessment sheets are provided; Evaluation to which degree statements are true; Example of application in practice is given. | Checklist; Worksheet template. | 4 types of appraisals; Process area templates are provided; Creation of domain-specific BPMMs is explained. | Not available. |
| (3) PRESCRIPTIVE | 3.1 | Implicit to levels. | Implicit to levels. | Not applicable. | Practices of process areas are described. | Implicit to levels. |
| | 3.2 | Not available. | Companies must focus on tackling the red areas first. | Not applicable. | Process areas indicate where an organization should focus to improve its processes. | Not available. |
| | 3.3 | Not available. | Not available. | Not applicable. | Not available. | Not available. |

**Table 3.** Maturity model synopsis (continued)

## 4 Summary, Limitations, and Outlook

We set out to identify BPM maturity models (RQ 1) and to analyze them against a recently published framework of general design principles for maturity models that focuses on applicability and usefulness (RQ 2). Based on two existing collections of maturity models compiled by BPM scholars and an additional focused web search, we were able to identify a set of 10 maturity models that specifically address BPM. These models describe the development of BPM in organizations, typically starting from immature and initial to highly developed BPM practices and superior process performance. The models vary in their scope as some of them focus on the condition of BPM practices, the condition of processes, or both. As for the evaluation of these models, we find that the basic principles and those for the descriptive purpose of use are covered sufficiently in general. Nevertheless, there is room for improvement with respect to more detailed descriptions of appropriate application settings and the provision of easy-to-use assessment guidelines. As for the prescriptive purpose of use, however, little concrete and documented guidance could be identified. This means that maturity model adopters from practice still face a challenging task when searching for the right measures to improve their BPM capabilities from the level they already have achieved.

The presented findings are beset with some limitations. As for our search for BPM maturity models, we draw on existing collections as provided by sources that are popular to the BPM domain. We also searched the BPM literature to identify additional models. Due to the ever increasing number of maturity models, however, we cannot exclude that we missed single BPM-related models. Moreover, we defined selection criteria that led to the exclusion of some models. Nevertheless, we are confident to have covered the most prominent examples (provided that they are publicly available). We analyzed the models against a framework of design principles and thus mainly conducted an evaluation against principles of form and function. Nevertheless, there has been prior research that for instance deals with core elements and success factors of BPM maturity (e.g., the six core elements identified by Rosemann and vom Brocke, 2010). In the current review, it has not been checked to what extent the BPM maturity models under investigation take these success factors and core elements into account. As this would apparently also influence their usefulness, we consider a more detailed review of the maturity models' contents to be promising as well.

Future research on maturity models in BPM should aim at providing more transparency and better support for adopters from practice. We agree with Rosemann and vom Brocke (2010, p. 111) who point at the need for "a clear distinction [...] between process maturity models and [BPM] maturity models." To date, this clear distinction is often not observable. And indeed, these two perspectives complement each other very well. They even seem hard to be separated as they conflate in many of the maturity models we reviewed. In case that existing maturity models are developed further, the developers should strive for more clarity concerning the concepts or entities they consider to be subject to their assessment models. Furthermore, we see great potential for future work with respect to the integration and consolidation of the many existing maturity models. Curtis and Alden (2007) even argue that only a small set of powerful maturity models is needed. At the same time, integration and consolidation seems to be a very difficult task as it actually requires bringing together the different viewpoints on BPM and/or process maturity observable from the existing models. We consider future research also to be needed in the area of "situational maturity models" (Mettler and Rohner, 2009) in order to make maturity models capable to better fit organization-specific needs. In this regard, research on adaptation and configuration mechanisms could provide promising merits. Finally, efforts to advance existing models by the development of ready-to-use instruments for maturity assessment and improvement are needed. This would also help to counteract the "lack of actual applications" (Rosemann and de Bruin, 2005, p. 3). We therefore consider the design principles related to prescription as par-

ticularly helpful. We are convinced that the practical applicability and usefulness of maturity models will benefit if these design principles are taken into account. The possibly resulting increase of actual applications would in turn provide new opportunities for researchers to conduct longitudinal studies that could shed light on the relation of BPM maturity model adoption and corporate success.

Finally, we consider this review to be of great value to practice as it is the first systematic in-depth review of BPM maturity models. Practitioners can benefit from a comprehensive overview of existing BPM maturity models that are more or less ready-to-use. By providing a concise review of these models based on a framework of design principles, we help adopters from practice decide which maturity model they could potentially apply in their own organization. When choosing a maturity model for assessing and improving their organization, they may be well-advised to also consider further academic works on maturity models in order to derive selection criteria and to inform themselves of potential benefits and pitfalls of maturity model application in practice (e.g., Ahlemann et al., 2005, Becker et al., 2009, de Bruin et al., 2005, Simonsson et al., 2007, Becker et al., 2010, Mettler, 2011).

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