7-1-2013

Current Pitfalls Of Business Process Maturity Models: A Selection Perspective.

Amy Van Looy
University College Ghent, Ghent, Oost-Vlaanderen, Belgium, amy.vanlooy@hogent.be

Amy Van Looy
Ghent University, Ghent, Oost-Vlaanderen, Belgium, Amy.VanLooy@UGent.be

CURRENT PITFALLS OF BUSINESS PROCESS MATURITY MODELS: A SELECTION PERSPECTIVE.

Van Looy, Amy, University College Ghent (Faculty of Business Administration & Public Administration, Department of Management & ICT), Henleykaai 84, 9000 Ghent, Belgium, amy.vanlooy@hogent.be; and Ghent University (Faculty of Economics & Business Administration, Department of Management Information Science & Operations Management), Tweekerkenstraat 2, 9000 Ghent, Belgium, amy.vanlooy@ugent.be

Abstract

Business process management is in high demand, but organisations are still struggling to realise it properly. Hence, maturity models have been developed to support the gradual adoption, use and organisational consequences of business process management, and this for both specific business processes and for the whole process portfolio of an organisation. The success of the so-called business process maturity models (BPMMs) is even so widespread, that their number continues to grow. Consequently, organisations risk selecting a BPMM that does not fit their needs or selecting a BPMM that might be of lower quality. Therefore, this paper aims at providing selection advice to make an informed choice about the best matching BPMM, before starting and investing in business process improvements. The most relevant selection criteria were derived and weighed in an international Delphi study. This paper also focuses on how existing BPMMs cover the identified criteria by means of a content analysis of a large sample of BPMMs for generic processes, supply chains and collaboration processes. The findings give strong evidence for the varying quality among BPMMs, and indicate current pitfalls from a selection perspective.

Keywords: BPM adoption and evolution, Maturity model, Delphi method, Analytical Hierarchy Process.

1 Introduction

Business process maturity models (BPMMs) have become important assets for organisations to increase business (process) performance. The emphasis on improving business processes (or the organisational way of working) is explained by: (1) higher customer expectations in the globalised market, and (2) growing IT possibilities to support business processes (Harrington, 2006; vom Brocke and Rosemann, 2010). In response, many scholars, institutions and consultancy firms have developed their own BPMM (Sheard, 2001). Some well-known examples are CMMI (Ahern, Clouse and Turner, 2004), or the academic models of de Bruin and Rosemann (2007), Hammer (2007), Harrington (2006), and McCormack and Johnson (2001).

To our knowledge, the literature on BPMMs mostly covers design science research. It builds and tests maturity models as information systems (IS) artefacts. For instance, the IS design research cycle has been translated towards maturity models (Becker, Knackstedt and Pöppelbuss, 2009; Mettler and Rohner, 2009). Hevner *et al.* (2004) formulate seven guidelines to evaluate the design of IS artefacts, which have also been translated towards maturity models (Becker, Knackstedt and Pöppelbuss, 2009). March and Smith (1995) distinguish four IS artefact types:

- **construct**: a conceptualisation or vocabulary to describe problems and solutions;
- **model**: a description of problems and solutions, based on the conceptualisation;
- **method**: a set of steps (i.e. algorithms or guidelines) to perform a task;
- **instantiation**: the realisation of constructs, models and methods into a tool.

Translated towards maturity models, Mettler and Rohner (2009) confirm that a common *conceptualisation* is lacking. Consequently, for this research, we describe 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'* (Van Looy, De Backer and Poels, 2011: p.1132-1133). A BPMM may help assess maturity (AS-IS) and find appropriate approaches that can lead to higher maturity (TO-BE). The latter is a collection of capability areas (i.e. areas of related skills and competences) that are needed for a business process to perform excellently. For instance, how capable is your organisation to model its business processes in a graphical design, or to run them without errors? Maturity levels indicate the overall growth through all capability areas together, whereas capability levels indicate the growth per capability area. Furthermore, BPMMs are both *models* and *methods*, as they combine descriptions (e.g. maturity levels) with key practices (e.g. to achieve higher levels) (Mettler and Rohner, 2009). Finally, *instantiations* can be documents or websites to assist organisations in using a BPMM.

Consequently, the BPMM literature is mainly restricted to a design perspective, i.e. by creating a design theory or by designing particular BPMMs, e.g. (de Bruin and Rosemann, 2007). The research cycles, guidelines, and artefact types constitute a theory on the design of maturity models. When designed accordingly, BPMMs are supposed to have a sound methodological foundation. However, not all design criteria are relevant when choosing a BPMM. Moreover, also non-design criteria may come to the foreground during BPMM selection, such as financial or practical considerations. Hence, a design perspective differs from a user's perspective. Therefore, this article focuses on the BPMM selection phase, which increases in importance as the number of BPMMs continues to increase. We are of the opinion that investing in the BPMM selection phase pays off by saving money and efforts afterwards, i.e. for the corrective actions needed if a used BPMM turns out to be no fit for purpose.

Furthermore, the BPMM proliferation (Sheard, 2001) raises questions about the substantial differences between BPMMs. Some comparative overviews have been made, albeit with a small number of BPMMs (Maier, Moultrie and Clarkson, 2012). Mettler (2009) also presents criteria for designing maturity models from a user's perspective, but not specific to the BPMM context and without an

overview of existing models. On the other hand, Röglinger, Pöppelbuss and Becker (2012) present a limited BPMM overview while proposing BPMM design criteria, but without practical advice on BPMM selection. Consequently, organisations have no comprehensive overview of academic and industry-owned BPMMs and an incomplete state of knowledge on how to properly select a BPMM. For this purpose, we elaborate on the decision criteria that (potential) BPMM users can consider when selecting a BPMM, and their coverage in existing BPMMs.

- RQ1. Which criteria help organisations choose a BPMM?
- RQ2. How are the criteria, identified in RQ1, covered by actual BPMMs?

With RQ1, the paper clearly contributes to practice as proper selection of the most appropriate BPMM may help practitioners. It also introduces a selection perspective to the BPMM literature. In addition, RQ2 makes a scientific contribution as both the BPMM literature and particular models could benefit from issues about relevant variances of BPMMs.

The research is conducted conform to section 2. Section 3 describes the criteria and their trade-offs, followed by an evaluation of actual BPMMs. Afterwards, the pitfalls of BPMM designs are discussed in section 4. Finally, the findings are summarised in section 5.

2 Methodology

The decision criteria for BPMM selection were obtained by consulting independent subject-matter experts in an international Delphi study. A Delphi study is an established consensus-seeking decision-making method using '*a series of sequential questionnaires or rounds, interspersed by controlled feedback, that seek to gain the most reliable consensus of opinion of an expert panel*' (Dalkey & Helmer, 1963: p.458). We have chosen a Delphi study as its iterative approach enhances validity, compared to a single questionnaire. Furthermore, according to Van De Ven and Delbecq (1974), it generally results in a higher quantity and quality of ideas than other group decision-making methods. The experts are also anonymous, which minimises group pressures. Moreover, a Delphi study is widely used for exploring ideas and structuring group communication on framework development and rating. Delphi examples are also present in IS research in general (Okoli and Pawlowski, 2004) and business processes in particular (de Bruin and Rosemann, 2007).

In November 2011, the Delphi study started with 22 BPM experts, i.e. 11 academics and 11 practitioners, each from five different continents. The academics had credible BPM(M) publications in academic journals, and the practitioners designed a BPMM, applied BPM(M), or were interested in BPMM selection. The selection procedure conforms to Okoli and Pawlowski (2004), introducing different backgrounds to minimise bias. Consensus conditions were a priori defined for a 7-point Likert scale, based on measures of location (i.e. frequencies) and spread (i.e. interquartile range) (Hasson, Keeney, and McKenna, 2000): (1) 50% of the experts must agree on the two most extreme scores (i.e. either 1-2 or 6-7), (2) 75% must agree on the three most extreme scores (i.e. either 1-2-3 or 5-6-7), (3) the interquartile range must be 1.50 or less, and (4) no opposite extreme score given by any expert (i.e. either 7 for the first case or 1 for the second). Per round, the responses were anonymously analysed by four coders, of which one independent coder was from another university. This codification panel stopped iterating when the consensus conditions were met, or when results became repetitive. Hence, a Delphi study typically takes three to four rounds (de Bruin and Rosemann, 2007; Hasson, Keeney and McKenna, 2000).

After three Delphi rounds, consensus was reached for 14 decision criteria. Other criteria had no trend towards consensus due to condition 4, i.e. at least one expert with an opposite extreme score in multiple rounds. In all rounds, the response rates exceeded the minimum value of 70%, enhancing research rigour and validity (Hasson, Keeney, and McKenna, 2000). Moreover, 95% of the respondents in the third round (N=17) agreed that the set of final criteria is very to extremely important for BPMM selection (i.e. scores 6 or 7), with a median of 6 and an interquartile range of 0. In a subsequent Delphi round, the experts were asked to determine which of these 14 decision criteria

are more important in pairwise comparisons, i.e. by applying the Analytical Hierarchy Process (AHP) (Saaty, 1990). Besides ranking, AHP allows calculating weights for assigning a selection score that evaluates existing BPMMs. In a fifth and final Delphi round, 95% of the respondents (N=20) were satisfied with the obtained weights (i.e. scores 5, 6 or 7), with a median of 6 and an interquartile range of 0. Consequently, the vast majority confirmed the resulting ranking and weighing by AHP.

The resulting criteria were alphabetically published in Van Looy (2013). They are now supplemented by AHP and an evaluation of existing BPMMs regarding the ideal weights, as assigned by the experts. We therefore conducted a content analysis on a large sample of 69 BPMMs (N=69) that covers academic and non-academic maturity models for generic business processes, but also for supply chains and collaboration processes to include end-to-end value chains. As we draw general conclusions, a detailed overview per collected BPMM is out-of-scope, but can be obtained on request.

3 Results

Table 1 presents the final set of most relevant criteria that users can consider when selecting a BPMM. For reasons of comprehensiveness and to facilitate weighing, they were grouped: (1) assessment criteria, i.e. how maturity is measured and by whom, (2) improvement criteria, i.e. what is measured as maturity, particularly the capability areas and their improvements to reach successive levels, and (3) non-design criteria, i.e. other criteria not directly related to assessment and improvement.

BPMM selection (100%)					
Assessment criteria	30.46%	Improvement criteria	52.14%	Non-design criteria	17.40%
Rating scale	7.78%	Capability areas	17.03%	Purpose	7.41%
Data collection technique	7.44%	Architecture type	10.55%	Validation	6.57%
Assessment duration	3.91%	Architecture details	10.28%	Costs	3.42%
Assessment availability	3.82%	Type of business processes	8.31%		
Functional role of respondents	3.82%	Number of business processes	5.97%		
Number of assessment items	3.69%				

Table 1. The most prominent decision criteria for BPMM selection, including relative weights.

In general, the experts argued that improvement criteria should be more decisive for BPMM selection (i.e. representing a higher overall weight in Table 1) than assessment criteria or non-design criteria. This finding reflects that ratings given by BPMMs are not an end goal, but capability improvements and performance improvements are. Hence, the capability areas received the highest weight as they ultimately represent what is being measured and improved. Costs have the lowest weight to avoid that an organisation selects a free model that measures the wrong scope of capabilities for that particular organisation (and becomes useless as such). Nonetheless, all criteria of Table 1 reached consensus of being of utmost important for BPMM selection.

Although the assigned weights may differ from those of particular organisations, the experts' point of view allows a critical view on the strengths and weaknesses of BPMMs. Per group, we describe the criteria and their trade-offs (derived from the Delphi discussions), followed by a comparison between the assigned weights and the actual coverage in BPMMs. To avoid bias, the content analysis of sampled BPMMs was conducted before the weights were assigned, and the experts did not know the coverage of existing BPMMs when assigning weights.

3.1 Assessment criteria

3.1.1 Description and trade-offs (RQ1)

- **Rating scale:** the type of data that is collected during an assessment.
  - Quantitative data (i.e. discrete, interval or ratio scales) can be statistically analysed and compared, independent of the assessors' interpretation. On the other hand, qualitative data (i.e. nominal or ordinal scales) provide more in-depth descriptions by delving into details. However, they depend more on the assessors' skills. Also a combination of rating scales is possible, depending on which data and skills are available.
- **Data collection technique:** the way information is collected during an assessment.
  - Objective techniques involve document reviews, and give an idea of how organisations work, without interrupting individuals or activities. They minimise biased results of (particularly internal) assessors and respondents. On the other hand, subjective techniques gather information about how organisations actually work, e.g. by questionnaires, interviews or observations. As it rather concerns personal beliefs, some precautions can be taken, e.g. a third party lead assessor, multiple assessors and respondents, data collection training, or a combination with objective techniques.
- **Assessment duration:** the maximal duration of a particular assessment.
  - Some BPMMs only take one day (e.g. a quick scan within 15 minutes), whereas other BPMMs present a more profound analysis of one week or longer. As time is money, the user must consider how much time he wants to spent on the assessment alone.
- **Assessment availability:** whether the assessment questions and corresponding level calculation are publicly available (instead of only known to the assessors).
  - BPMMs do not always provide full details. This particularly counts for non-academic models, e.g. in consultancy. The user must decide whether this limited availability is an issue for the organisation. For instance, fully known BPMMs (i.e. either free or charged) can be used for educating process team members or for earning credibility.
- **Functional role of respondents:** the explicit recognition to include people from outside the assessed organisations as respondents.
  - If only internal respondents (i.e. managers and/or staff of the assessed organisations) are questioned, the user assumes that they fully know their stakeholders' needs. However, by also involving stakeholders, an organisation recognises the need for an outside-in perspective by explicitly listening to stakeholders.
- **Number of assessment items:** the maximal number of questions to be answered during an assessment.
  - More questions provide more insight to develop a road map, but may be less feasible and/or take longer. Less than 20 questions are rather used as a teaser or a quick scan.

3.1.2 Ideal weights and actual coverage in BPMMs (RQ2)

Table 2 highlights the strengths and weaknesses in coverage of actual BPMMs compared to the relevance of assessment criteria from the experts' point of view.

For only two of the six assessment criteria, the Delphi preferences are almost similar to the actual BPMM coverage (Table 2). It concerns an appreciation for the assessment availability of most BPMMs, without an excessive list of assessment items. On the other hand, the experts prefer a combination of qualitative and quantitative scales, and of objective and subjective data collection techniques to obtain results that are closer to reality. Nevertheless, the large majority of BPMMs only cover qualitative scales with subjective techniques, which are easier for respondents. The fact that only one BPMM merely uses quantitative scales and only four BPMMs merely use objective techniques for data collection emphasises the importance of the organisational context. For instance, some capability

areas (like management or culture) are hard to measure with numbers and theoretical documents alone. Hence, many BPMMs still have opportunities to enhance the accuracy of their assessments by combining different rating scales and data collection techniques. Another difference in opinion concerns the assessment duration. The experts prefer an assessment that takes between one day and one week, as it must be seriously undertaken. On the other hand, the actual assessments of BPMMs can be more frequently conducted within a single day, responding to the busy life of managers. We must, however, note that 43 out of 69 sampled BPMMs do not mention the expected assessment duration in their design documents, indicating a considerable planning issue for practitioners. Finally, the experts suggest the inclusion of external respondents in assessments to allow a complete 360-degree feedback, whereas the large majority of BPMMs are still restricted to internal respondents.

Assessment criteria	Options	Weight (%)	BPMM coverage (N=69)
Rating scale	Qualitative	3.57	**41**
	Quantitative	2.98	1
	Both	**7.78**	14
	(Missing value)		*(13)*
Data collection technique	Objective	3.58	4
	Subjective	2.28	**41**
	Both	**7.44**	11
	(Missing value)		*(13)*
Assessment duration	Day	1.63	**18**
	Week	**3.91**	9
	Longer	1.41	7
	(Missing value)		***(43)***
Assessment availability	Fully known	**3.82**	**31**
	Partially known	**3.31**	23
	Fully unknown	1.27	15
	(Missing value)		*(0)*
Functional role of respondents	Only internal	2.10	**46**
	Also external	**3.82**	9
	(Missing value)		*(14)*
Number of assessment items	0-19	1.66	**17**
	20-49	**3.69**	**16**
	50-99	**3.10**	6
	100-299	1.34	7
	>=300	0.53	3
	(Missing value)		*(20)*

Table 2. The assessment criteria for BPMM selection.

3.2 Improvement criteria

3.2.1 Description and trade-offs (RQ1)

- **Capability areas:** the capabilities to be assessed and improved.
  - BPMMs differ in the capabilities they actually address. They generally vary from basic capabilities related to the traditional business process lifecycle, i.e. modelling, deployment, optimisation, and management, to the addition of organisational capabilities, i.e. to create a process-oriented culture and structure. In theory, all presented capability areas are required for fully mature business processes. However, in practice, an organisation can opt for only a subset of capability areas, e.g. depending on the degree of top management support, IT background of

the user, prior BPM experience, organisation size, etc. For instance, organisations with local, bottom-up initiatives or with limited BPM experience might wish to start with the basic capability areas, limited to the traditional business process lifecycle. Additionally, the culture capability area requires a minimum level of management support to promote business processes and granting (financial) rewards to process performance. Finally, structural configurations inherently require top management support. The latter is particularly recommended if you already have some BPM experience or if your ambition is to standardise processes across large departments or divisions. As capabilities are core to BPMMs, the user must select a set of capability areas that best fits its organisational needs.

- **Architecture type:** the possibility to define a road map per capability, a road map for overall maturity, or both.
  - It concerns linking (maturity of capability) levels to capability areas in a step-by-step plan, which explains how to reach each consecutive level. A continuous architecture provides capability levels per capability area, i.e. one road map per area. It allows organisations to assess and improve each capability area separately, and thus to improve areas at a different pace or to limit their scope to only those capability areas they are interested in. As not all capability areas are necessarily taken into account, there is a risk for suboptimal optimisations (in terms of overall maturity). On the other hand, a staged architecture provides maturity levels linked to all capability areas together, i.e. one road map for overall maturity. The emphasis is on simultaneous advancements, instead of individual capability advancements.
- **Architecture details:** the degree of guidance that a BPMM gives on your journey towards higher maturity.
  - It concerns the extent to which the road map (i.e. step-by-step plan) explains which criteria (i.e. goals and best practices) must be satisfied before reaching each particular level: (1) descriptive, (2) implicit prescriptive or (3) explicit prescriptive. A descriptive road map is limited to high-level descriptions. As it gives less support, it is suited for organisations wishing to become acquainted with BPMMs, or for organisations which are highly experienced with process improvements. An implicit prescriptive road map has criteria interwoven in the assessment questions, i.e. with an ordinal scale or a matrix, that explain all capability areas per level. Assessors can derive the criteria from the assessment questions. Finally, an explicit prescriptive road map gives most guidance by separately listing criteria from the assessment questions.
- **Type of business processes:** whether the BPMM is generic (i.e. for business processes in general) or domain-specific (e.g. for business processes in supply chains or collaboration situations).
  - The terminology used in generic BPMMs, e.g. in the assessment questions, is likely more holistic. Benchmarking becomes possible across business domains. Accordingly, domain-specific BPMMs use terminology adapted to their domain, which might be less abstract to respondents and thus better understandable. However, benchmarking remains limited to organisations within the same domain. Hence, also this choice requires strategic considerations.
- **Number of business processes:** the number of business processes to be assessed and improved: (1) one, (2) more or (3) all.
  - For BPMMs focusing on a single business process, the process boundaries must be defined by the user, e.g. whether a business process is assessed and improved as a sub process or as a separate process. BPMMs can also focus on more than one, but not all business processes within the assessed organisations. Assessment questions then deal with a particular business domain or value chain and all its (sub) processes. Furthermore, BPMMs can cope with all business processes in the assessed organisations. As such, assessment questions take a management perspective by focusing on how organisations deal with business processes in general, without focusing on particular processes. However, by improving the BPM mastery, it is likely that particular processes are indirectly improved too. Only few BPMMs combine specific processes (i.e. one or more) with the overall BPM mastery.

3.2.2 Ideal weights and actual coverage in BPMMs (RQ2)

A direct comparison of the weights for improvement criteria and the content analysis is given below.

Improvement criteria	Options	Weight (%)	BPMM coverage (N=69)
Capability areas	Modelling	2.69	56
	Deployment	2.54	**68**
	Optimisation	2.58	**68**
	Management	**4.47**	**67**
	Culture	2.84	57
	Structure	1.91	30
	(Missing value)		*(0)*
Architecture types	Continuous	7.28	14
	Staged	7.50	**31**
	Both	**10.55**	24
	(Missing value)		*(0)*
Architecture details	Descriptive	5.93	21
	Implicit prescriptive	**10.28**	**30**
	Explicit prescriptive	5.84	18
	(Missing value)		*(0)*
Type of business processes	Generic	**8.31**	**37**
	Domain-specific	4.44	32
	(Missing value)		*(0)*
Number of business processes	One	1.83	7
	More	4.35	**36**
	All	4.62	24
	Combination	**5.97**	2
	(Missing value)		*(0)*

Table 3. The improvement criteria for BPMM selection.

For three of the five improvement criteria, the Delphi preferences are almost similar to the actual BPMM coverage (Table 3). First, the capability areas are in line with the expectations of the Delphi experts. Almost all sampled BPMMs cover the areas related to the traditional business process lifecycle (i.e. modelling, deployment, optimisation and management), plus culture. Structural reconfigurations in the organisation chart or the formal introduction of a Centre of Excellence are less frequently addressed by BPMMs, and are also considered as less relevant by the experts (compared to the other areas). Generally, good management by a professional process owner is considered essential for improving business (process) performance. Secondly, most BPMMs offer an implicit prescriptive roadmap. Also the experts are of the opinion that BPMMs must offer sufficient guidance, while allowing organisations to make their own choices instead of being too restrictive. Thirdly, the experts rated generic BPMMs higher than domain-specific BPMMs, as the former can be applied to any process type. Also the collected BPMM sample contains slightly more generic models, which might suggest that generic models are easy to find.

In strong contrast is the number of business processes to be assessed and improved. Table 3 shows that most BPMMs cope with multiple, specific processes in a certain business domain, followed by models that cope with all processes in an organisation. Although the experts agree that a combination of specific and all processes would be more beneficial to organisations, only two sampled BPMMs cover this combination. This discrepancy appears to indicate a substantial gap in existing BPMM designs, which can be explained by the historical evolution of BPMMs. As from the 1980s, the CMM(I) tradition has inspired many maturity models to cover specific processes (Ahern, Clouse and Turner, 2004). The focus on the BPM mastery of an organisation is only introduced in the 2000s, e.g. in (de

Bruin and Rosemann, 2007; Hammer, 2007; McCormack and Johnson, 2001). A next logical step in the BPMM evolution might be to simultaneaously examine specific and all business processes in an organisation. Finally, most BPMMs offer maturity levels, possibly in combination with capability levels, whereas the experts recommend combining both lifecycle levels to obtain a refined overview.

3.2.3 Non-design criteria

3.2.4 Description and trade-offs (RQ1)

- **Purpose:** the purpose for which a BPMM is intended to be used.
  - The basic purpose of any BPMM is assessing and identifying process improvements, i.e. raising awareness. The key is recognising deficiencies, creating willingness to act and to follow-through on the findings. Besides raising awareness, BPMMs can also allow benchmarking with other organisations (i.e. for comparing with competitors and sharing best practices) or certification (i.e. for external recognition of the assessment results, in line with the ISO quality certificates).
- **Validation:** Whether or not empirical evidence is given that the BPMM helps to enhance the efficiency and effectiveness of business processes.
  - Most BPMMs do not provide any proof of validity (or success). If they do, evidence is frequently limited to enumerating other organisations applying the model. Only few BPMMs give evidence for the performance outcomes. The user must decide whether some proof of validity is required, depending on the planned investments. However, we strongly discourage the use of non-validated BPMMs. They can result in frustrations, time and money losses afterwards, i.e. if they appear to be flawed or unusable after you start using it.
- **Costs:** the direct costs to access and use a BPMM.
  - Not all BPMMs are free of charges. Particularly non-academic models may ask a one-off access fee or a required training to be followed. Recurring costs rather serve to pay a third party lead assessor, certification or benchmarking. The user must decide which budget can be spent, and adapt his expectations accordingly: you often get what you pay for. However, academic models can be free if they use your data for enhancing their research.

3.2.5 Ideal weights and actual coverage in BPMMs (RQ2)

Table 4 compares the obtained weights for non-design criteria with their coverage in sampled BPMMs.

Non-design criteria	Options	Weight (%)	BPMM coverage (N=69)
Purpose	Awareness	**7.18**	**46**
	Also benchmarking	**7.41**	20
	Also certification	2.33	3
	(Missing value)		*(0)*
Validation	Application	2.04	**25**
	Outcomes	**6.57**	19
	(Missing value)		*(25)*
Costs	Free	**3.42**	**31**
	Charged	1.47	13
	(Missing value)		*(25)*

Table 4. The non-design criteria for BPMM selection.

For two of the three non-design criteria, the Delphi preferences are almost similar to the actual BPMM coverage (Table 4). Regarding the purpose, the experts agree that BPMMs aim at improving the

internal way of working, which can be better stimulated by benchmarking. Certification as an external recognition is perceived as rather an unnecessary effort. Similarly, only few existing BPMMs issue a certificate. However, BPMMs would profit more from introducing benchmarking possibilities. Secondly, many BPMMs can be accessed and used free of charges, which is also appreciated by the experts. Finally, the experts highly value the validation of outcomes, whereas this is only guaranteed by a minority of BPMMs. The latter indicates a great challenge for BPMMs.

4 Discussion

Figure 1 illustrates that the improvement criteria are addressed by all sampled BPMMs, whereas their design documents generally do not mention the assessment and non-design criteria. This particularly applies to the assessment duration (with 43 missing values out of 69 BPMMs), validation and costs (both with 25 missing values). We recall that improvement criteria represent the direction of a BPMM with theoretical building blocks needed to improve, independent of a practical assessment. Another explanation for the missing values is that each of the presented design studies covers less than half of our criteria (Mettler, 2009; Röglinger, Pöppelbuss and Becker, 2012). This leads to a first pitfall:

Pitfall 1. Designers are encouraged to provide information on all identified selection criteria to facilitate the user's choice.

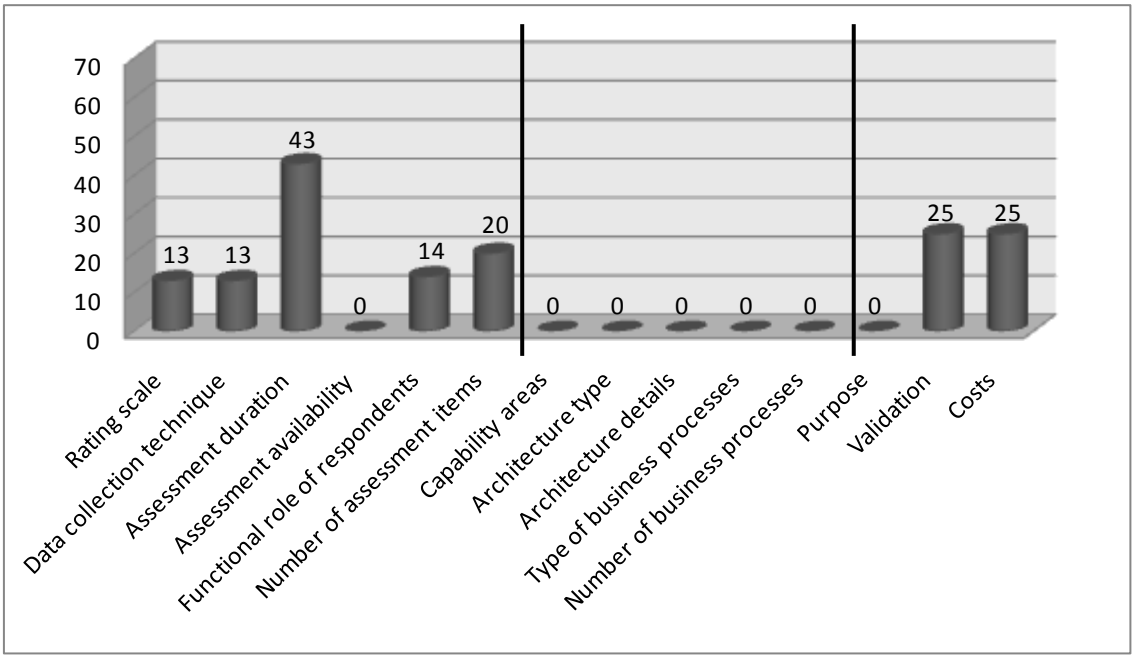

Figure 1. The number of BPMMs with missing values per selection criterion (N=69).

Figure 2 gives further evidence for the varying quality of BPMM design documents. Based on the relative weights, a selection score was calculated for each sampled BPMM (ranging from 0 to 100). Per criterion, a BPMM scores the weight that corresponds to the option to which it applies.

Figure 2 shows that the selection scores in our BPMM sample range from 40 to 90, with a mean of 67.14 and a standard deviation of 10.35. Particularly, 51 BPMMs have a score between 60 and 80, whereas 4 BPMMs have a higher score and 14 BPMMs have a lower score. Hence, no BPMM in our sample covers all the ideal options, as stipulated by the Delphi experts. This is no pitfall, as the preferences of specific organisations may still differ from the assigned weights. On the other hand, our second pitfall refers to BPMMs with the lowest selection scores (i.e. possibly with many missing values and/or a combination of less preferred options):

Pitfall 2. Designers are encouraged to think through the different options per selection criterion, and possibly make their design more flexible by providing alternative options to offer a better fit for purpose.

The third pitfall refers to the wide range of selection scores:

Pitfall 3. Organisations, as potential BPMM users, are encouraged to develop a critical attitude towards the fit for purpose of BPMMs, instead of taking quality for granted.

Consequently, the study indicates ample opportunities for designers to improve their BPMM design documents, and warns organisations to choose not just any BPMM.

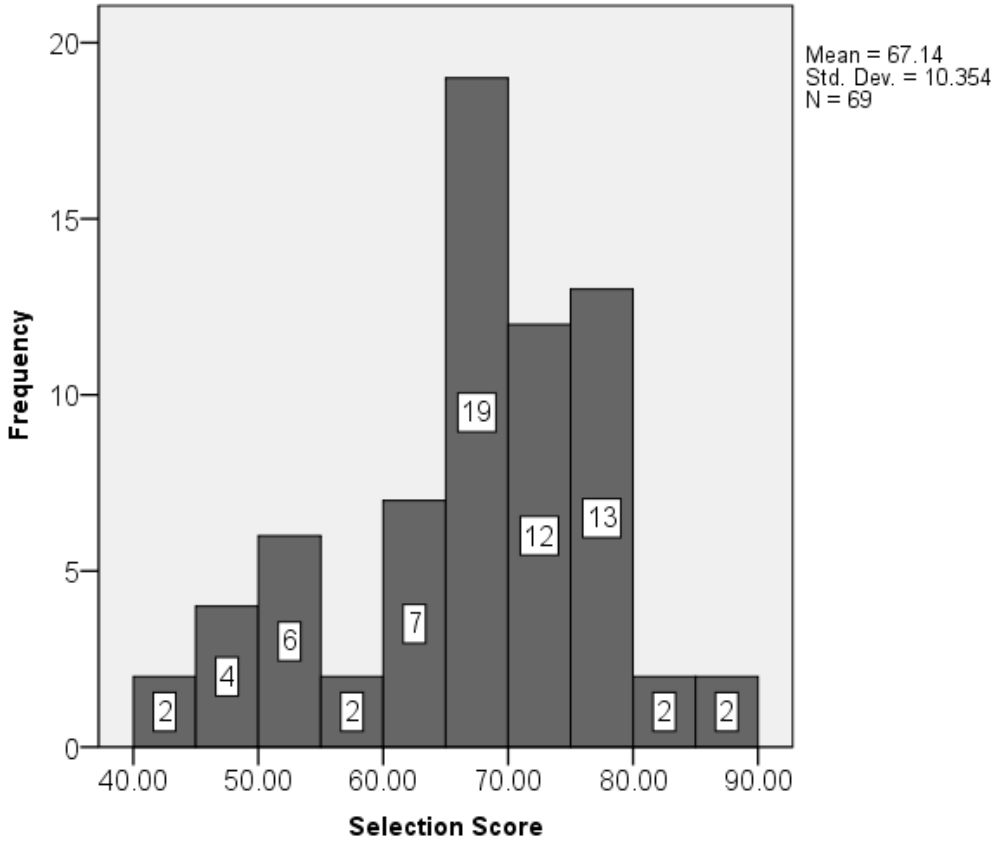

Figure 2. The frequency distribution of selection scores across BPMMs (N=69).

5 Conclusion

The study gave strong evidence for the varying quality of many BPMMs that go around these days, based on an international Delphi study with 22 subject-matter experts and a content analysis of a large sample of 69 BPMMs. Fourteen criteria were proposed as being most relevant to motivate your choice for one or another BPMM, including trade-offs: six assessment criteria, five improvement criteria, and three non-design criteria (RQ1). Nevertheless, existing BPMMs do not equally address all criteria in their design documents. If present in the design documents, half of the criteria cover options that are also considered as ideal or most preferable by the Delphi experts (RQ2). As the preferences of particular organisations might differ from the Delphi experts, the assigned weights were primarily used to illustrate our quality discussion (instead of focussing on individual BPMMs). Particularly, three pitfalls in current BPMMs were derived by focussing on the selection phase, i.e. regarding the missing values in BPMM design documents, the low selection scores based on weights assigned by the

experts, and the wide range of selection scores. The first two pitfalls are a call-to-action for designers to address all 14 decision criteria (as stipulated by the Delphi study), and this by well-considering or even combining the different options per criterion. The third pitfall is a call-to-action for organisations to make an informed choice when selecting a BPMM to start with. Future research could formalise our selection advice by means of an on-line questionnaire. Such a questionnaire would consist of 14 questions, reflecting the 14 identified criteria and their trade-offs. By filling out the questionnaire, organisations are navigated to the BPMMs in our sample that best fit their responses (i.e. their needs).

References

Ahern, D. M., Clouse, A. and Turner, R. (2004). CMMI distilled. Boston: Pearson Education.

Becker, J., Knackstedt, R. and Pöppelbuss, J. (2009). Developing maturity models for IT management. A procedure model and its application. Business & Information Systems Engineering, 1 (3), 213-222.

Dalkey, N. and Helmer, O. (1963). An experimental application of the Delphi method to the use of experts. Management Science, 9 (3), 458-467.

de Bruin, T. and Rosemann, M. (2007). Using the Delphi technique to identify BPM capability areas. Proceedings of the 18th Australasian Conference on Information Systems, 5-7 December, (pp. 642-653). Toowoomba.

Hammer, M. (2007). The process audit. Harvard Business Review, (4), 111-123.

Harrington, H. J. (2006). Process management excellence. California: Paton Press.

Hasson, F., Keeney, S. and McKenna, H. (2000). Research guidelines for the Delphi survey technique. Journal of Advanced Nursing, 32 (4), 1008-1015.

Hevner, A. R., March, S. T., Park, J. and Ram, S. (2004). Design science in information systems research. MIS Quarterly, 28 (1), 75-105.

Maier, A. M., Moultrie, J. and Clarkson, P. J. (2012). A review of maturity grid based approaches to assessing organizational capabilities. IEEE Transactions on Engineering Management, 59 (1), 138-159.

March, S. T. and Smith, G. F. (1995). Design and natural science research on information technology. Decision Support Systems, 15 (4), 251-266.

McCormack, K. and Johnson, W. C. (2001). Business process orientation. Florida: St. Lucie Press.

Mettler, T. (2009). A design science research perspective on maturity models in information systems. Report BE IWI/HNE/03. St. Gallen: Institute of Information Management.

Mettler, T. and Rohner, P. (2009). Situational maturity models as instrumental artifacts for organizational design. Proceedings of the 4th International Conference on DESRIST, May 7-8, (p. 9). Malvern.

Okoli, C. and Pawlowski, S. D. (2004). The Delphi method as a research tool: an example, design constructions and applications. Information & Management, 42, 15-29.

Röglinger, M., Pöppelbuss, J. and Becker, J. (2012). Maturity models in business process management. Business Process Management Journal, 18 (2), 7-7.

Saaty, T. L. (1990). An exposition of the AHP in reply to the paper "remarks on the analytical hierarchy process". Management Science, 36 (3), 259-268.

Sheard, S. A. (2001). Evolution of the frameworks quagmire. IEEE Computer, 34 (7), 96-98.

Van De Ven, A. H. and Delbecq, A. L. (1974). The effectiveness of nominal, Delphi, and interacting group decision making processes. The Academy of Management Journal, 17 (4), 605-621.

Van Looy, A. (2013). Looking for a fit for purpose. Business process maturity models from a user's perspective. In G. Poels, Enterprise Information Systems of the Future, CONFENIS 2012, LNBIP 139 (pp. 182-189). Berlin Heidelberg: Springer.

Van Looy, A., De Backer, M. and Poels, G. (2011). Defining business process maturity. A journey towards excellence. Total Quality Management & Business Excellence, 22 (11), 1119-1137.

vom Brocke, J. and Rosemann, M. (2010). Foreword. In J. vom Brocke and M. Rosemann, Handbook on Business Process Management 2 (pp. vii-ix). Berlin Heidelberg: Springer.