Synthesising Business Process Management Maturity Models: Their Anatomy and Assessment

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Abstract

Business Process Management (BPM) is a management paradigm for enhancing organisational efficiency through a focus on business processes. BPM maturity models (BPM-MMs) are often embraced by process-oriented organisations, as a tool to aid in determining the capabilities required to progress in their BPM ambitions. Although widespread in practice, with a diversity of BPM-MMs available and deployed, and similarly profuse and eclectic related research publications, BPM-MMs continue to have many critics. An often-cited issue is the lack of a common foundation; the observed disparity of key components and relationships across different BPM-MMs.

This research comprises two separate artefacts that aim to address some of the most recurrent issues of BPM-MMs. Guided by Design Science, the study initially employs a qualitative content analysis of a representative sample of BPM-MM documents, to identify the salient components- resulting in an evidence-based meta-model of BPM-MMs (Artefact 1). This resultant meta-model is evaluated for completeness, utility, generalisability, and theoretical soundness.

Secondly, this research proposes the development and evaluation of an 'assessment framework' for BPM Strategic Alignment, which is also guided by Design Science Research. Assessments are essential to implement BPM-MMs in organisations, but surprisingly, are often a missing component. This study presents an assessment framework, which consists of a maturity grid (Artefact 2) that aims to enable the qualitative evaluation of capabilities that support the alignment of BPM initiatives with the business strategy, namely BPM Strategic Alignment. The presented maturity grid also includes heuristic guidelines for its application in organisations. The 'maturity grid' and the criteria to assess five capabilities of BPM Strategic Alignment are elicited from documented maturity models. Detailed content analysis is used for developing the grid.

A deeper appreciation of the core/generic components of BPM-MMs and their rationale will aid both researchers and practitioners in the selection, design, evaluation, comparison, and evolution of BPM-MMs. The design of the maturity grid as an 'assessment framework' and the methods to derive it may inspire the development and application of further such assessment tools for existing BPM-MMs focused on other capabilities. The study also provides further insights for future research.

Keywords

Business Process Management, maturity model, maturity grid, capability assessment, meta-model, strategic alignment.

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List of Abbreviations

BPM: Business Process Management

BPM-MM(s): Business Process Management Maturity Model(s)

Maturity models often referred in this document:

APQC7T: American Productivity & Quality Centre Seven Tenets by Heller and Varney (2013)

BPMMFIS: BPM Maturity Model by Fisher (2004)

BPMMM: Business Process Management Maturity Model developed by de Bruin and Rosemann (2005)

BPMMOMG: Business Process Maturity Model developed by Object Management Group (2008)

BPOMM: Business Process Orientation Maturity Model by McCormack and Johnson (2001)

BPOWI: Business Process Orientation by Willaert et al. (2007)

CMM: Capability Maturity Model by Paulk et al. (1993)

CMMi: Capability Maturity Model Integration by CMMI Product Team (2002)

GartnerMM: Gartner Maturity Model by Melenovsky and Sinur (2006)

ISO/IEC 33000: International Organization for Standardization (2015), family of standards

LeonardoMM: Leonardo Maturity Model by Leonardo consulting (2019).

PEMM: Process Enterprise Maturity Model developed by Hammer (2007)

PMMA: Process Management Maturity Assessment by Rohloff (2009c)

QMMC Qualitity Management Maturity grid by Crosby

vPMM: Value based Process Maturity Model by Lee et al. (2009)

BPM SA: Business Process Management Strategic Alignment

GS: General studies (of BPM-MMs)

SM: Specific models (of BPM-MMs)

SAM: Strategic alignment model

Statement of Original Authorship

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

Student Signature: QUT Verified Signature Date: 3rd of June 2021

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Chapter 1: Introduction

1.1 Background

Business Process Management (BPM) is a management paradigm centred on the continuous review and improvement of organisational processes to increase business efficiency. It has the potential to underpin productivity and operational excellence and to lower businesses cost (van der Aalst, 2013). While BPM practices have been widespread for decades, their proliferation has increased exponentially in the current digital era (Van Looy, 2018; Vom Brocke & Schmiedel, 2015). However, implementing BPM can be time-consuming and costly. Hence, organisations need to determine to what extent their capabilities support BPM progression and assess which areas they need to focus on to achieve their process-based goals.

BPM maturity models (BPM-MMs) have emerged as a dominant artefact for organisations to decide which capabilities need to be enhanced and how. Maturity models are tools to methodically assess and develop capabilities, i.e., abilities or competences, to achieve a goal (Van Looy et al., 2011a). They assume predictable patterns represented in predefined stages (or maturity levels) to nurture the growth of capabilities (Mettler, 2011). Maturity, in the BPM context, refers to how developed the organisation's capabilities or processes are, in order to foster optimal process performance and BPM initiatives.

BPM-MMs are used for three primary purposes: (i) descriptive, (ii) benchmarking, and (iii) prescriptive. (Niehaves et al., 2014) explain the descriptive purpose of BPM-MMs as a way to define the status of an organisation reflected in an as-is assessment of their capabilities. BPM-MMs also allow organisations to compare their as-is maturity results against industry standards, across parts of the organisation or over time (Pöppelbuß & Röglinger, 2011). Such benchmarking gives the organisation a reference against which to consider their desired future state. Ultimately, organisations implement maturity models to prescribe a set of actions or to derive a roadmap to guide the business to their desired maturity levels over time (Tarhan et al., 2016). However, how BPM-MMs fulfil these purposes in organisations is uncertain.

Although widely used in practice and despite the many research papers published, BPM-MMs continue to receive much criticism. "Due to the large number of existing maturity models, the question arises whether high quantity goes along with high quality" (Pöppelbuß & Röglinger, 2011, p. 2). Key criticisms include ill-defined capabilities through which the models describe maturity (Tarhan et al., 2016), lack of mutability that prevents the models to adapt to the organisational change in the context they are applied (Mettler et al., 2010) , lack of assessment instruments impeding measuring the maturity before and after applying the model and subsequent prescriptions (Pöppelbuß & Röglinger, 2011; Tarhan et al., 2016), and poorly defined maturity levels (loosely adopted from CMM by Paulk et al., 1993) which descriptors do not align with the capabilities (for further details about the challenges of BPM-MMs, see Section 2.4). These issues hinder the applicability of BPM-MMs, constraining their value.

This research contributes to the resolution of some of the issues linked with BPM-MMs. It involves the development of two artefacts: (1) a meta-model of BPM-MMs and (2) a maturity grid for the maturity assessment of BPM capabilities. In the next sections, these artefacts and their underlying research questions are introduced along with their rationale and expected contribution to knowledge and practice.

1.2 Research problem and significance for Artefact 1: a meta-model

The fact that BPM-MMs are underspecified, having very low conceptual clarity, is a core issue that underlies many of the limitations mentioned. For example, among the hundreds of maturity models in the BPM sphere (Tarhan et al., 2016) there is a multitude of concepts to measure maturity, some of which include the maturity of capabilities, capability areas, process enablers, process areas, dimensions, and categories. The extent to which these concepts differ from each other, to compare results drawn from one model or another is not clear. Some models provide a detailed description of the scientific process behind their main constructs while others lack transparency regarding their methods in the design process. These are only some examples that suggest that the structure of different BPM-MMs tend to be dissimilar and unclear. Therefore, it is difficult to provide general solutions that fit the broad diversity of BPM-MMs. Consequently, discovering the generic structure for BPM-MMs is tackled first in this research.

This research proposes that the generic components of BPM-MMs and their relationships must be synthesized and better understood. The first research question for this study is:

RQ-1: What is the structure of BPM maturity models?

The first outcome of this research is a meta-model (Artefact 1) that contains the structural/generic components of BPM-MMs and their relationships. Adapting definitions from the software engineering domain (Chen & Cheng, 1997; Fettke & Loos, 2007), a 'component' is defined as a self-contained unit that provides a service to its environment. In this case, the researcher defines 'component' as a unit with specific functions that combined with other units justifies and supports the process of determining BPM maturity and further actions derived from it. A 'meta-model' is a "design framework, which describes the basic model elements and the relationships between the model elements as well as their semantics" (Rosemann & Green, 2002, p. 78). The researcher proposes that BPM-MMs should be seen as 'systems' where weak or missing components can affect other components, thereby limiting the overall applicability of the model to obtain maturity results and ambitioned improvements. A meta-model is thus perceived as an appropriate approach to reduce the variability across the plethora of existing BPM maturity models as it helps to identify the most generic components of BPM-MMs systemically. As such, the meta-model provides a unified view to compare, analyse and create effective/comprehensive BPM-MMs.

Meta-models have been used in Information Systems (IS) research and also in the more specific BPM domain. One application of meta-models in IS has been to synthesize and understand a variety of models and to convert them into Information systems (e.g., Beydoun et al., 2009; Othman et al., 2014). In the BPM field, meta-models

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have had practical value, to create new models or to be used as blueprints to perform procedures (e.g., Van Looy et al., 2012). These examples confirm the utility of meta-models as synthesising tools of diverse classes, such as BPM-MMs. Details and examples of these applications of meta-models are presented in Section 3.2.

The meta-model presented in this document is innovative and useful for practice and future research. By presenting the necessary components and their relationships to fulfil the purpose of BPM-MMs, the meta-model brings conceptual clarity. It harmonizes the terminology from existing literature, contextualising, and clustering disparate concepts into distinctive components of maturity models. The meta-model synthesises the generic structure of BPM-MMs, aligning evidence-based descriptors for each component. As a checklist, the meta-model can support BPM-MM developers to improve existing (often incomplete) BPM-MMs and new ones. In industry, decision-makers and consultants can benefit from having a conceptual overview for understanding and evaluating BPM-MMs, identifying weaknesses in the model, informing related decisions, and allocating the resources needed for implementing a maturity model.

1.3 Research problem and significance for Artefact 2: a maturity grid

Once the generic structure of BPM-MMs is known, this research proposes a solution for a key component of the models, the 'assessment framework'.

The 'assessment framework' is a component of maturity models necessary to determine the as-is maturity of the capabilities contained in the model; however, most of the maturity models in the BPM field do not include such assessment instruments and guidelines for their utilisation in industry. This hinders the applicability of the model from achieving its descriptive purpose, subsequently disabling its prescriptive and comparative purposes. Maturity models with assessment instruments are desirable but generally not accessible. This limitation could be motivated by commercial purposes (Becker et al., 2009), i.e., when consultants develop and adopt assessment tools to evaluate the BPM maturity of their business clients. Tarhan, Turetken, et al. (2015) suggest that BPM-MMs should include practical self-assessment to be performed by the organisations themselves with limited effort required, and not relying on external expertise, but they should consider pre-requisites to apply them. In light of the hundreds of maturity model for BPM capabilities that lack high quality 'assessment frameworks' for their effective operationalisation, the researcher is motivated to bridge this gap that affects research and practice. Hence, the driving research question for this artefact is:

RQ-2a: How can an 'assessment framework' to measure BPM maturity be developed with rigour?

Maturity grids have supported the application of maturity models in organisations since their origins. The maturity model for Quality Management developed by Crosby (1979), one of the first maturity models for business practice (Tarhan, Türetken, et al., 2015; Van Looy et al., 2011a), uses a maturity grid. The construct of maturity as a stage of growth, development or being complete (Crosby, 1979; Nolan, 1973), was adopted later for the popular CMM by Paulk et al. (1993) that further inspired the design of the vast majority of maturity models in the BPM domain and beyond (Cronemyr & Danielsson, 2013). However, it has been found in the results of assessments of a number of companies reported in the literature, that the use of maturity grids have been eclipsed by models following the scale of the widely known capability maturity model CMM that does not provide a grid (e.g., Ahlemann et al., 2005; de Bruin & Rosemann, 2005; McCormack & Johnson, 2001; Object Management Group, 2008) (Maier et al., 2012). Yet, according to Maier et al. (2012), for self-assessments of maturity, companies often seek for tools that are fast to apply and inexpensive, which makes maturity grid assessments especially a suitable alternative.

The use of maturity grids is similar to the use of scoring rubrics in academia. They are matrices in which one dimension represents the criterion, and the other one represents a scoring scale (Sadler, 1987). 'Criterion' is defined as "a distinguishing property or characteristic of anything, by which its quality can be judged or estimated, or by which a decision or classification may be made" (Sadler, 1987, p. 194). The cells at the intersection of the criterion and the scale are filled with descriptors as standards for the criterion at different scores. Standards are "a definite level of excellence or attainment, or a definite degree of any quality viewed as a prescribed object of endeavour or as the recognised measure of what is adequate for some purpose, so established by authority, custom, or consensus" (Sadler, 1987, p. 194). A popular example of a grid-based maturity model in the BPM domain is the one developed by Hammer (2007) in which the criteria is represented by capabilities that are described through a scale of four maturity levels. However, there is a lack of evidence of assessment frameworks, including maturity grids for BPM-MMs that has been systematically developed following scientific methods. For example, Hammer (2007) acknowledges that the capabilities that represent the criteria of his grid were based on his experience performing assessments. As opposed to maturity grids built based on tacit knowledge of experts, the researcher aims to develop a grid following rigorous methods.

To address *RQ-2a,* it was necessary to define which BPM maturity is to be assessed since the notion of maturity can vary from model to model. Furthermore, the constructs in the models highly differ; in particular, the items within the 'capability framework', another key component of BPM-MMs that presents the capabilities to be assessed and enhanced. Therefore, it is necessary to scope the assessment to the context of one specific model and one set of capabilities.

The maturity model selected for this research is the BPMMM (Business Process Management Maturity Model) from de Bruin and Rosemann (2005). The selection criteria included citations in academic papers, model validation, rigour in its development, accessibility to its documentation, and evidence of its current relevance. The capabilities that this model considers for assessing maturity are based on explored six BPM success factors that groups capabilities. From this model, the Strategic Alignment (SA) factor was selected. Strategic Alignment is defined as "the continual tight linkage of organisational priorities and enterprise processes enabling achievement of business goals" de Bruin and Rosemann (2006, p. 4). This factor has been identified as a success factor in a number of studies (e.g., Bandara et al., 2007; Hernaus et al., 2012; Neubauer, 2009; Trkman, 2010). More details about the rationale for the model and factor selection are given in Section 4.3.1. However, in the selected model, the SA capabilities are not described through the maturity scale the model utilises (CMM maturity scale).

Given the selection of the model selected and of the Strategic Alignment factor to develop a maturity grid for, *RQ-2a* is scoped to *RQ-2b*:

RQ-2b: How can BPM Strategic Alignment capabilities be described at different levels of maturity?

Figure 1 organises the research questions for Artefact 2 positioning *RQ-2a* as the leading research question to be partially answered by developing one specific type of assessment, a maturity grid, for a particular domain, BPM strategic alignment. Therefore, by designing the maturity grid for SA, the researcher is providing an instantiation of the development of an assessment framework to measure BPM maturity.

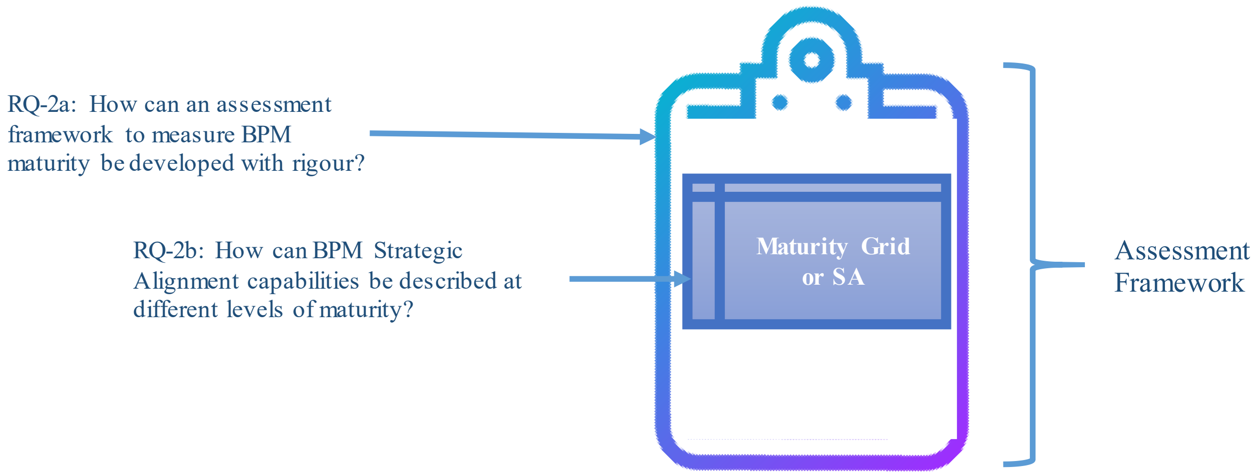

Figure 1. Hierarchy of the research questions for Artefact 2

The maturity grid is expected to contribute to academic knowledge by synthesising a specific capability (SA), aligning evidence-based descriptors for each capability area to a maturity scale. The grid is meant to reduce ambiguity in findings regarding applications by adding standards to define maturity at specific levels rather than the low-medium-high or poor-good categories of results as in the existing literature.

The maturity grid has the potential to contribute to practice by providing standard criteria to assess the maturity of Strategic Alignment and the standards to reach each of the levels in the maturity scale. Such information may facilitate the maturity assessment for practitioners.

1.4 The overarching research design for this research

The researcher employs a Design Science Research (DSR) approach. DSR is a research method where "knowledge and understanding of a problem domain and its solution are achieved in the building and application of the designed artefact" (Hevner et al., 2004, p. 75). DSR projects aim to solve 'wicked problems', characterised by incomplete and changing requirements, complex interactions among subcomponents of the problem and its environment, and dependence on human creativity to produce solutions difficult to foresee (Rittel & Webber, 1973). Fixing BPM-MMs seems to be a wicked problem. The number of BPM-MMs has grown while their issues remain regardless of the many papers that identify their problems and critique them. Therefore, DSR is a suitable method for this research that aims to contribute to resolving some of the problems behind BPM-MMs, by designing two artefacts; a meta-model to identify BPM-MMs' structure and components, and a maturity grid to provide a solution for one of the often missing components, the 'assessment framework'.

Knowledge contribution is a fundamental aspect of DSR projects. As such, Gregor and Hevner (2013) developed a DSR Knowledge Contribution Framework to better position the outcomes of DSR projects. The framework considers two dimensions to classify the contribution. The first dimension, 'Application domain maturity', refers to the degree to which the problem has been explored, being 'high' when the problem is known and 'low' when the problem is new. The second dimension labelled as 'Solution maturity' represents the level of novelty of the solution, being 'high' when the solution is known and 'low' when it is novel. These dimensions are combined in a 2x2 matrix that results in four categories: routine design, exaptation, improvement, invention. Figure 2 presents the representation of the DSR Knowledge Contribution Framework with the descriptions for each category of knowledge contribution.

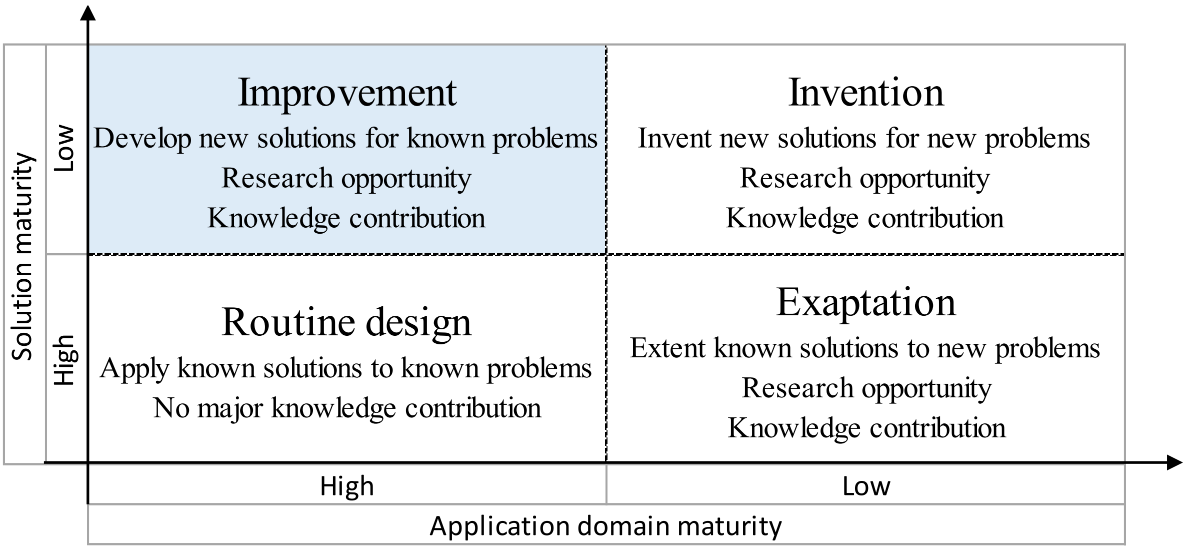

Figure 2. DSR Knowledge Contribution Framework adapted from Gregor and Hevner (2013)

The solution proposed in this thesis fits in the 'improvement category' in per the above framework (see Figure 2).

The upper left quadrant highlighted in Figure 2, i.e., knowledge contribution as improvements represents problems that are well known in the domain (high application domain maturity) but with few solutions discovered (low solution maturity). The two artefacts developed in this research belong to this category since the issues of maturity models are known, but the solutions are scarce. A meta-model to clarify the structure of BPM-MMs has not being published to the best of the knowledge of the researcher. A maturity grid for SA and the methods to build it are also novel in the BPM domain as a solution for one component of BPM-MMs.

This DSR project follows the seven guidelines of Hevner et al. (2004). These guidelines have been often employed in maturity models literature (e.g., Becker et al., 2009; Mettler, 2011; Pöppelbuß & Röglinger, 2011;

Röglinger et al., 2012; Van Looy et al., 2012). A summary of the utilised guidelines and their instantiation in this study are presented in Appendix A for Artefact 1 and Appendix B for Artefact 2.

The specific method for data collection in this research to develop both artefacts was Content analysis. "Content analysis is a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use" (Krippendorff, 2013, p. 18). Since BPM-MMs are one of the most common BPM artefacts, embraced by process-oriented companies and BPM consultants (Tarhan et al., 2016; Van Looy et al., 2013), there is an abundance of documents available in academia and industry. This enables the researcher to identify themes from a representative sample of documents and analyse them in a timely and comprehensive process supported by computer software (NVivo 12). The sample utilised ranged from documents that analyse and compare BPM-MMs to the official documentation of maturity models from both academia and industry.

The selected Content analysis framework was the qualitative content analysis process proposed by Elo and Kyngäs (2008). This framework is one of the most cited and has the advantage of parsimony, being summarised in one comprehensive document. Another strength of this framework is that it distinguishes different types of reasoning when performing the content analysis, such as inductive and deductive reasoning, both of which approaches are employed at different stages in this research. The details of how the content analysis process was performed, including documents sampled and units of analysis, are contained in the methods sections for each of the artefacts (Chapter 3 for the meta-model and Chapter 4 for the maturity grid).

Following the seminal guidelines of Hevner et al. (2004), the design of each artefact is supported by two phases: Development and Evaluation. The development phase is the core process for building the first workable version of the artefact. In this phase, each artefact is designed via content analysis in combination with relevant methods for the artefacts, respectively. For the meta-model, after identifying the components of BPM-MMs using content analysis, the meta-model is elicited utilising meta-modelling techniques, and the design of concept maps to represent the structure of BPM-MMs. For the maturity grid, the content analysis enables the researcher to find descriptors to populate the cells of the grid. However, this research also borrows guidelines from assessment theory to develop reliable scoring rubrics (e.g., Petkov & Petkova, 2006; Sadler, 1987).

When designing an artefact, it is important to consider feedback loops to enhance the solution. Hevner et al. (2004) point out that the evaluations provide feedback and a better comprehension of the problem that can help to improve not only the quality of the product but also the design process. Venable (2006) distinguishes two types of evaluations: artificial evaluation and naturalistic evaluation. In the 'Artificial evaluation', the product is tested internally in a controlled environment or scenario. If the artefact does not pass the test, then it returns to the design cycle for refinement. On the other hand, the 'Naturalistic evaluation' implies testing the artefact in a real organisation. According to Gregor and Hevner (2013), there is some flexibility to determine to what extent the evaluation of an artefact is needed. Because of the conceptual nature of the work presented in this research and the time constraints of the program of study, only artificial evaluations are conducted.

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Figure 3, illustrates the overall research design, framed in DSR to address the research questions that lead to two separate artefacts: the meta-model and the maturity grid. The meta-model is presented in Chapter 3, including the development and evaluation phases. Equivalent content for the maturity grid is displayed in Chapter 4. Figure 3 also shows the inputs required to execute the research methods employed for each artefact.

1.5 Thesis structure

In this thesis, the researcher focuses on BPM maturity models (BPM-MMs) rather than maturity models more broadly. Hereafter the terms 'maturity model', 'MM' or 'model' are used interchangeably to refer to BPM-MMs, except when explicitly indicated otherwise. The remainder of this thesis is structured as follows. Chapter 2 presents a literature review to introduce the reader about the basics of BPM-MMs. The review also includes the key challenges of BPM-MMs, some of which are taken as a motivation for the development of the artefacts presented in this thesis. Then, Chapter 3 describes Artefact 1: the meta-model, in detail, including detailed methods and results. In Chapter 4, one of the components from the meta-model is taken to produce an artefact. As a result, that chapter presents Artefact 2: the maturity grid, as a proposed solution for one component of the meta-model, including its methods and results. Chapter 5 contains the discussion and conclusions drawn from the development, evaluations, and final results from both artefacts. A research agenda is also included in this chapter.

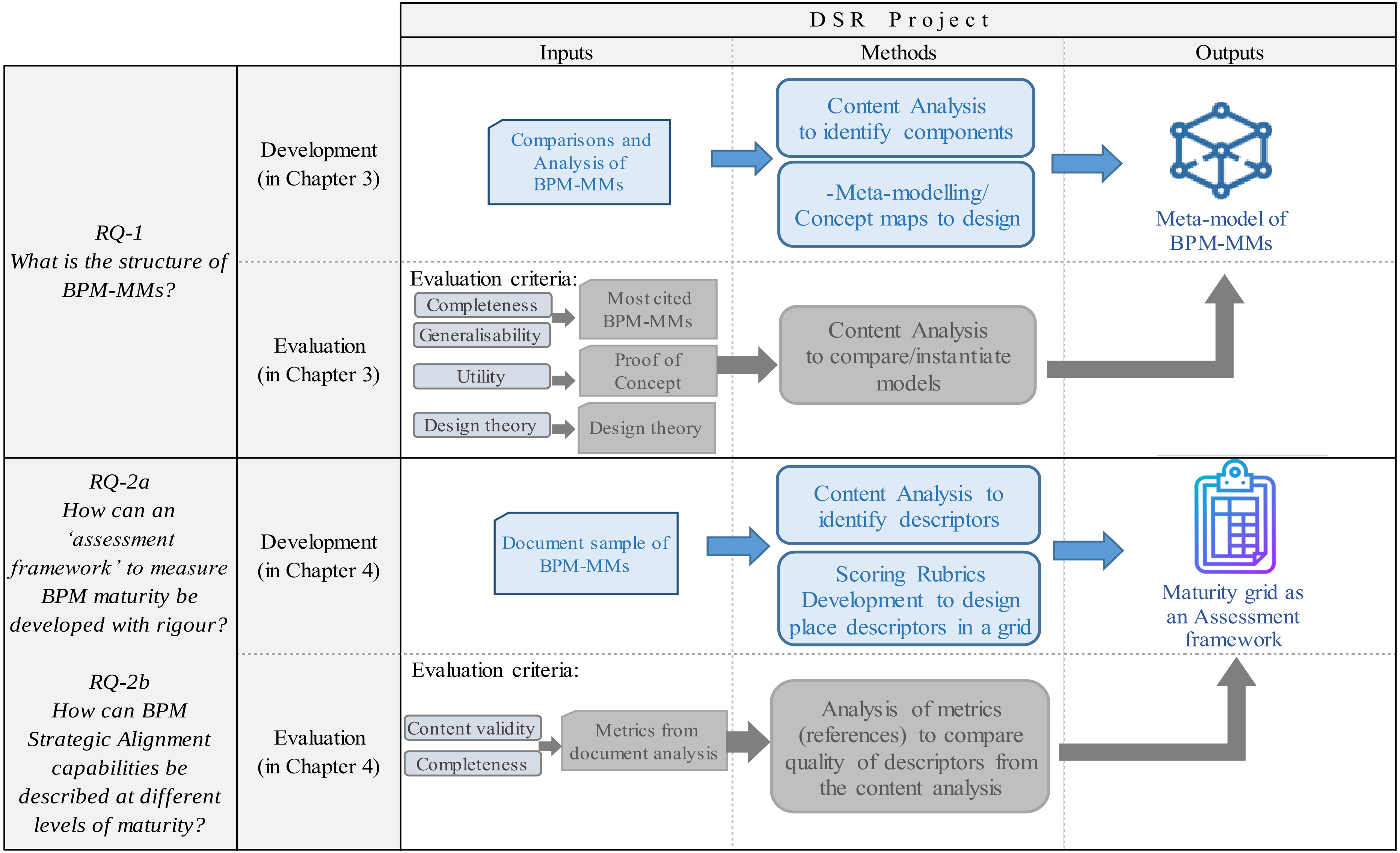

Figure 3. Research design as a DSR project

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Chapter 2: Literature review on BPM Maturity Models

2.1 Chapter Introduction

This chapter provides an overview of the common aspects of existing BPM-MMs; and identifies key challenges of BPM-MMs that serve as motivation for developing the artefacts explained in the subsequent chapters.

The literature review presented in this chapter serves to provide background about BPM maturity models and highlights their main challenges. This chapter also introduces the BPMMM by de Bruin and Rosemann (2005) through examples from the model in the sections of this chapter. The BPM Strategic alignment (BPM SA) factor is described too because the assessment framework contained in Chapter 4 is scoped to BPM SA.

2.2 Overview of BPM Maturity models and basic components

This section provides an overview of BPM-MMs, summarising the common aspects presented in existing BPM-MMs, including some key concepts in BPM-MMs like the maturity, capability and assessment frameworks, design approaches in BPM-MMs. The section closes by presenting a comparison between five popular BPM-MMs.

2.2.1 Maturity frameworks

A maturity framework is one of the most recognisable parts of BPM-MMs. The models usually depict three to five stages (also termed 'groups' or 'levels') through which organisations proceed to BPM and/or process mastery (Röglinger et al., 2012). The most common framework for maturity levels has been adopted from the CMM (Capability Maturity Model) developed by Paulk et al. (1993) designed for improving software development processes (von Scheel et al., 2015). Maturity models from different domains typically adapt the maturity levels descriptions from CMM. For example, in the BPM sphere, the lowest levels of BPM maturity describe symptoms presenting in organisations, such as isolated projects, low BPM skills, and manual operations; while high maturity levels characterise organisations that exhibit coordinated BPM activities through a Centre of Excellence (CoE), process automation, and innovation among other features (Rosemann et al., 2004). The number of levels, their labels and their descriptions vary from model to model. For example, in the BPMMM by de Bruin and Rosemann (2005) arguably the most cited BPM-MM in academia, the maturity framework mainly refers to the CMM scale that considers five levels of maturity: initial, repeatable, defined, managed, and optimising. Figure 4 gives descriptions of the maturity levels adopted from CMM.

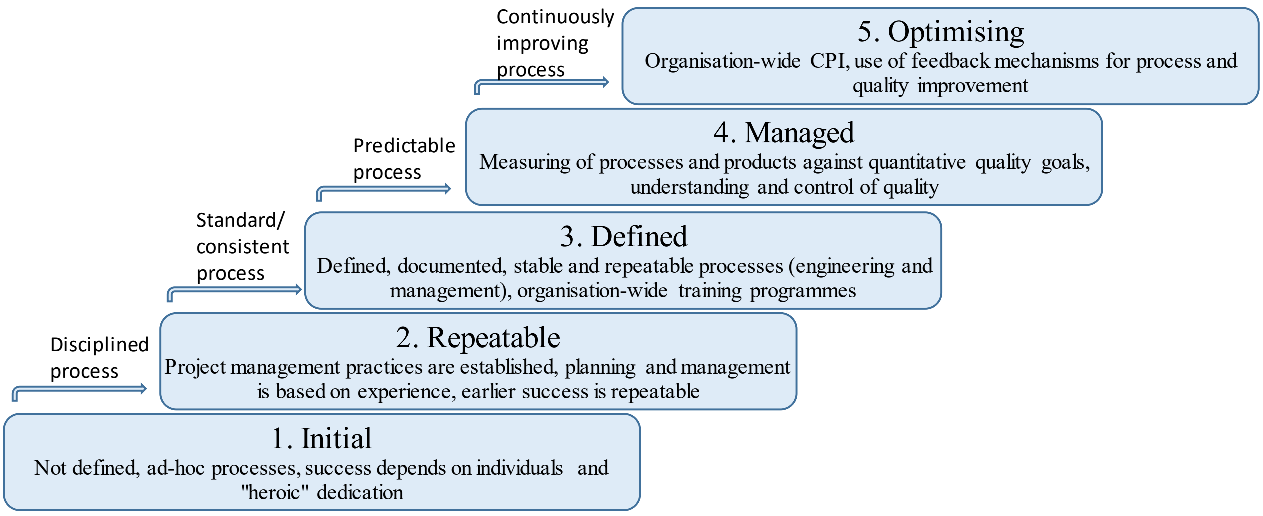

Figure 4. Descriptions of CMM levels as presented in de Bruin (2009)

Most BPM-MMs assume better organisational outcomes are associated with higher levels of maturity. Niehaves et al. (2014, p. 91) state, "having reached the highest maturity level suggests being most effective and most efficient at BPM". Hence, a number of maturity models assume that the higher the maturity level obtained, the better the organisational impact (Niehaves et al., 2014). However, scholars question this logic, suggesting that organisational context such as size, capabilities, industry; and resource consumption are important factors to be considered before aiming for higher maturity. Niehaves et al. (2014) state that the 'optimal' level of BPM capabilities can only be assessed within the specific organisational environment, while also considering costs or tangible and intangible resources required. Niehaves et al. (2014) emphasise that pursuing highly mature capabilities impacts the cost structure during and after the implementation due to the maintenance required to sustain the process change. According to Ulrich and Smallwood (2004, p. 7), investors seldom seek to reach an average or superior development in each area; rather, "they want the organization to have a distinct identity that aligns with its strategy". Therefore, organisations should aim to achieve an adequate level of maturity, considering context and costs, as well as benefits.

Regarding their structure, the maturity framework of the models can be classified in two groups: continuous representation and staged representation. Models with the continuous representation suggest that the BPM and the process capabilities of the organisation that implements the model can be at different levels of maturity (Britsch et al., 2012; Forstner et al., 2014; Rosemann & vom Brocke, 2015). This concept is in line with the ideas described in the previous paragraph. These models are more descriptive in nature, meaning that the diagnosis (determination of the as-is maturity) is the baseline to guide improvement actions (prescriptions) to increase the maturity of the capabilities independently. Popular examples of continuous BPM-MMs are the BPMMM and Process Management Maturity Assessment by Rohloff (2009c). On the other hand, the staged representation of the models fixes a combination of BPM capabilities and process practices as requirements to achieve a certain maturity level (Britsch et al., 2012; Forstner et al., 2014; Rosemann & vom Brocke, 2015). Therefore, these models are prescriptive in nature because missing the suggested improvements in one capability may impede progress in the overall maturity. Examples include the BPMMOMG developed by the

Object Management Group (2008) and the BPOMM by McCormack and Johnson (2001). The PEMM by Hammer (2007) is often labelled as a staged model because of the author's indication that the average maturity is equivalent to the lowest capability maturity and the organisation should always target the weakest capabilities first to progress in maturity (de Bruin, 2009; Rosemann & vom Brocke, 2015). However, because of the simple structure of the model (a maturity grid), there is no impediment to descriptively using its maturity scale as continuous for all the capabilities. Similarly, the order of the improvement action to progress in maturity is decided by the organisation using one of the two representations (Object Management Group, 2008).

The researcher has identified two issues that have not been flagged in the current literature concerning the 'maturity framework' of BPM-MMs. Firstly, regardless of the popularity of the CMM, the existing literature is lacking critical analysis to determine to what extent its level-definitions are accurate and relevant to the different contexts where BPM-MMs are used (industry, size, level of technology, the cost structure of organisations, organisational goals, etc.). Secondly, in spite of the importance of determining the adequate level of maturity for an organisation, to what extent BPM-MMs support decision-makers in an organisation to determine the target maturity is unclear. In general, there is "lack of guidance in industry about which capabilities an organization should develop to what extent" (Forstner et al., 2014).

2.2.2 Capability frameworks

Every maturity model has a collection of elements to be assessed to define the maturity of an organisation. This configuration, called the 'capability framework' (Tarhan et al., 2016), is a core component of a BPM maturity model. The set of capabilities varies from model to model and is profoundly influenced by its domain. Being BPM a multi-disciplinary domain, the capabilities in BPM-MMs can be broad to assess the organisation as a whole (i.e., Enterprise-wide BPM-MMs) considering multiple perspectives or have a narrower focus on processes or specific functional area. For example, the BPMMM by de Bruin and Rosemann (2005) presents Enterprise-wide capabilities that involve a variety of domains, from leadership and change management under the people and culture capabilities, to project management and some examples of optimisation techniques have been cited like Six Sigma under methods capabilities (Rosemann & vom Brocke, 2015). On the other hand, the Business Process Maturity Model by Object Management Group (2008) (BPMMOMG) focuses on processes that become relevant for certain maturity levels. An example of a BPM-MM which capabilities are selected based on the domain of a specific functional area is the Supply Chain Management Maturity Model by Lockamy III and McCormack (2004). Regardless of the various domains that the capabilities of a model can cover, in BPM-MMs they are contextualised for the BPM domain.

Up to date, the most impactful capability framework is the one contained in the BPMMM by de Bruin and Rosemann (2005). According to Tarhan et al. (2016), this model is the most cited in academia. Furthermore, this framework has been in force since its development. Supported by rigorous methods to determine the capabilities of the model (Delphi studies, panels, case studies, interviews) (e.g., de Bruin, 2009; de Bruin & Doebeli, 2015), after ten years it is still a reference point for newer capability frameworks in academia (e.g., Dumas et al., 2018; Kerpedzhiev et al., 2017). The capability framework of the BPMMM assesses maturity against holistic organisational ‘factors’ (success factors) containing ‘capability areas’, such as strategic alignment, culture, governance, information technology, people and methods. In this model, each of the factors is decomposed into five capability areas. Table 1 is a representation of this capability framework.

Later in Chapter 4, Section 4.3.1 of this thesis, this model is selected as a reference to develop an Assessment framework for the Strategic Alignment capabilities.

Factors	Strategic Alignment	Governance	Methods	Information Technology	People	Culture
Capability areas	Process Improvement Planning	Process Management Decision Making	Process Design & Modelling	Process Design & Modelling	Process Skills & Expertise	Responsiveness to Process Change
	Strategy & Process Capability Linkage	Process Roles & Responsibilities	Process Implementation & Execution	Process Implementation & Execution	Process Management Knowledge	Process Values & Beliefs
	Enterprise Process Architecture	Process Metrics & Performance Linkage	Process Monitoring & Control	Process Monitoring & Control	Process Education	Process Attitudes & Behaviours
	Process Measures	Process Related Standards	Process Improvement & Innovation	Process Improvement & Innovation	Process Collaboration	Leadership Attention to Process
	Process Customers & Stakeholders	Process Management Compliance	Process Program & Project Management	Process Program & Project Management	Process Management Leaders	Process Management Social Networks

Table 1. Representation of the capability framework of the BPMMM by de Bruin and Rosemann (2005)

Other popular BPM-MMs offers different arrangements of their capabilities. The PEMM considers two groups of characteristics that are needed for business processes to perform well and to sustain that performance: ‘process enablers’ and ‘enterprise capabilities’ (Hammer, 2007). The ‘process enablers’ defined by Hammer are the process design, process performers, process owners, process infrastructure, and process metrics. These enablers are capabilities to be assessed for individual processes. Leadership, culture, expertise, and governance are enterprise capabilities because improving them enables the company to achieve higher performance over time across a number of processes. The one developed by Fisher (2004) discusses ‘levers of change’, i.e., strategy, control, process, technology and people, to assess the capabilities of any organisation; while the model created by McCormack and Johnson (2001) uses the term ‘dimensions’ for business process view, structures, process jobs, management and measurement systems, and values and beliefs. The PMMA (Rohloff, 2009c) defines nine ‘categories’ that can be linked to the ‘factors’ of BPMMM. The highly deployed BPMMOMG (Object Management Group, 2008) was inspired by CMM and inherited the concept of ‘process areas’, which according to Forstner et al. (2014), is closely related to ‘capability areas’. As shown, there is a range of concepts that seem to be closely related to ‘capabilities’ such as factors, enablers, levers, dimensions and categories. However, the relationships between these concepts and capabilities have not been explicitly explained, nor the justification for naming them differently. This inconsistency makes it difficult to understand and compare BPM-MMs. Furthermore, as most of BPM-MMs lack a theory-basis to determine the capabilities, they are idiosyncratic, resulting in different conceptualisations (Tarhan et al., 2016). As a result, each BPM-MM describes maturity through different capabilities, and this idiosyncrasy impedes comparisons between maturity results from one model to another.

Mettler et al. (2010) propose another property for the practical development of maturity models, namely mutability. Mutability is described as the capability of a maturity model to be modified in terms of the requirements to achieve a certain maturity level, given the changing nature of capabilities in the organisational context, such best practice and technology evolution (Mettler et al., 2010). According to this idea, BPM-MMs should be configurable to adapt to organisational evolution and business change. However, no guidance is given as to which capabilities should be configurable and how to capture the contextual changes into the models.

Although the problem of the diverse conceptualisation and mutability of the models goes beyond the 'capability frameworks', it is in this feature of BPM-MMs where the issues are more evident because most of the models and related papers focus on this aspect of the models.

2.2.3 Assessment frameworks

The assessment instruments of BPM maturity models are the primary input tool to appraise the maturity of the capabilities (or enablers, factors, levers, categories, dimensions) as defined by the model (Pöppelbuß & Röglinger, 2011). Unfortunately, the existing literature provides minimal details of assessment instruments for BPM-MMs. Most of the maturity models' appraisals are based on questionnaires, but the details of the questions are not provided. A few BPM-MMs include self-assessment sheets (e.g., Hammer, 2007), while others require external consultants (who have their own proprietary approach and tools) to assess the maturity because of the lack of guidance and tools to assess capabilities.

The absence of assessment instruments in the majority of BPM-MMs limits their applicability. Tarhan et al. (2016) suggest that there should be a clear separation between the capability framework and the assessment component to determine the level of maturity. Different assessments should be able to determine the maturity level according to the selected capability framework. Besides, Tarhan, Turetken, et al. (2015) suggest that BPM-MMs should include practical self-assessment to be performed by the organizations themselves with limited effort required, and not rely on external expertise. Such instruments can lower the initial resistance and barriers to BPM-MMs (Tarhan, Turetken, et al., 2015). One example of a BPM-MM that includes a self-assessment instrument is the widely used PEMM by Hammer (2007). However, not having sufficient specification of the minimum requirements for self-assessment, such as the number of necessary respondents, can result in subjectivity and inaccurate maturity result. Tarhan, Turetken, et al. (2015) propose that the pre-requisites of the self-assessment should be cautiously considered.

2.2.4 Design approach of BPM Maturity Models

The design approach of BPM-MMs, including the evaluation phase, brings transparency and trust to the model. According to Becker et al. (2009, p. 216) "the design process of the maturity model needs to be documented in detail, considering each step of the process, the parties involved, the applied methods, and the results".

Every maturity model should be evaluated once designed, using verification and validation (Mettler, 2011). Verification means that the model accurately represents the conceptual description of the model and its specifications (Conwell et al., 2000). Validation, on the other hand, refers to the extent the model depicts the reality in which it was intended to be used (Conwell et al., 2000). For example, some models provide details about the design approach that resulted in the model (e.g. BPMMM in (de Bruin & Rosemann, 2007) while others do not specify any scientific approach to building the model (e.g. PEMM by Hammer (2007). A systematic literature review of BPM-MMs performed by Röglinger et al. (2012), showed that only a few models were linked to articles referring to empirical validation. Tarhan et al. (2016) confirmed that in a sample of 20 relevant BPM-MMs, only 9% of the research articles aim to validate the models in contrast with the 42% that focus on the development. In addition, the models have been highly criticised for lacking rigour in the evaluation phase (de Bruin, 2009; Mettler & Rohner, 2009). Tarhan et al. (2016) revealed a lack of studies validating the models, but rather focusing on development and implementation, which explains the significant number of models and their variety. This issue encumbers the decision-making process for practitioners when selecting a BPM-MM (Van Looy et al., 2013).

2.2.5 Examples of BPM-MMs

Tarhan et al. (2016) study paint a vivid picture of the landscape of BPM-MMs, comparing different BPM-MMs with regard to evidence of validity and also uptake. From this article, the researcher has selected the five most relevant BPM-MMs in terms of citations; (i) BPMMM by de Bruin and Rosemann (2005), (ii) BPMOMG by Object Management Group (2008), (iii) BPOMM by McCormack and Johnson (2001), (iv) PEMM by Hammer (2007) and (v) PMMA by Rohloff (2009c). Table 2 gives a comparative view of the selected BPM-MMs.

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Short name	BPMMM	BPMMOMG	BPOMM	PMMA	PEMM
Reference	de Bruin and Rosemann (2005)	Object Management Group (2008)	McCormack and Johnson (2001)	Rohloff (2009)	Hammer (2007)
Descriptive	Yes	Yes	Yes	Yes	Yes
Comparative	Yes	Yes	Yes	Yes	Yes
Prescriptive	Implicit to levels	Detailed roadmap	Implicit to levels	No	Implicit to levels
Maturity levels	Initial Defined Repeatable Managed Optimised	Initial Managed Standardised Predictable Innovating	Ad hoc Defined Linked Integrated	Initial Managed Defined Quantitatively managed Optimising	For enterprise capabilities: E-1, E-2, E-3, E-4 For process enablers: P-1, P-2, P-3, P-4
Capability arrangement	The capabilities grouped in 6 factors that contain 5 'Capability areas' each. The factors are: Strategic alignment, governance, methods, technology, people, and culture For example, within Strategic alignment some Capability areas are: Strategy and process capability linkage, enterprise process architecture, and process customers and stakeholders	Best practices (specific practices and institutionalisation goals) are listed to assess and improve the capabilities of each 'Process area': -Org. business governance -Org. Process leadership -Work unit requirement management -Work unit planning and commitment -Work unit monitoring and control -Work unit performance -Sourcing management -Work unit change management -Process and product assurance	The capabilities are represented by 'Categories': -Process view -Structures for processes -Process jobs -Management and measurement systems -values and beliefs (culture) Each category contain specific dimensions	9 categories (1-3 subcategories each): Process portfolio and target setting, process documentation, process performance controlling, process optimisation, methods & tools, process management organisation, program management, data management, and IT structure	Separated in two groups: Enterprise capabilities: -Leadership -Culture -Expertise -Governance Process enablers: -Design -Performers -Owners -Infrastructure -Metrics
Assessment tool	Detailed questions not available	4 types of appraisals, process area templates	Detailed questions not available	Detailed questions not available	Self-assessment sheets available

Table 2. A comparison of the most cited BPM-MMs

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2.3 Strategic Alignment capabilities and BPM

As mentioned in Chapter 1, one of the goals of this research was to create a maturity grid for BPM Strategic alignment (BPM SA) as an 'assessment framework' for a popular model. This section introduces the concept of BPM SA that is relevant to Chapter 4, were the maturity grid is presented.

Porter (1996) describes 'strategy' as a business asset composed of a unique set of activities that brings value to the business in order to outperform competitors. According to Porter (1989, p. 1), there is no consensus about what corporate strategy is nor how to formulate it but, in general, it is "the overall plan for a diversified company". Porter (1989) explains that diversified companies have two levels of strategy: business unit strategy and corporate strategy; where business units are "a collection of discrete activities ranging from sales to accounting that allow it to compete" Porter (1989, p. 4). Corporates strategies provide synergy to achieve competitive advantage through the business units. Davies (2000) states that the strategy mandates how the company's goals and objectives will be attained, what business units will be used to reach the company's goals and objectives, and how to arrange those units and allocate resources. Therefore, the business strategy should be a common foundation for business units, projects, and activities, including BPM projects.

The notion of 'Alignment' can have different denominations such as fit, coordination, synchronisation, or orchestration between two or more parties. In the scientific literature, 'Strategic Alignment' per se mostly refers to the fit between the overall corporate strategy and the information technology (IT) strategy. In their seminal work, Henderson and Venkatraman (1999) developed the Strategic alignment model (SAM) for IT and business strategy alignment. Similarly, in the BPM arena, Strategic alignment refers to the fit of BPM initiatives with the business strategy. de Bruin and Rosemann (2006, p. 4) define BPM SA as "the continual tight linkage of organisational priorities and enterprise processes enabling achievement of business goals". Melenovsky (2005) provides two vivid examples of BPM alignment to achieve business goals: (i) Wal-Mart strategy focuses on lowering costs to deliver quality goods at low prices. The BPM strategy to fit the corporate strategy was synchronizing its supply chain, purchasing, inventory, accounting and retail processes directly with its points of sale. (ii) Dell follows a "high-quality, low-cost business model" that aims to customise each computer to the customer needs. By process metrics, Dell continuously enhanced its build-to-order business process, so it could precisely predict the components it needed to order to the point where inventory costs are absorbed by the suppliers. In these cases, the strategy was operationalised by BPM initiatives.

However, the relationship between the business strategy and the BPM initiatives of an organisation is not unilateral. The alignment is mutual because the BPM should aim to reach the organisational goals, but the business strategy can also be shaped by the BPM approaches and the strengths and weakness of the capabilities and processes (Rosemann & vom Brocke, 2015). This bidirectional influence is encapsulated in the 'Strategy and process capability linkage' capability area in the BPMMM. At this capability, on the one hand, the processes are resourced and developed to meet the strategic goals. On the other hand, the strategy identifies the limitations of the processes to plan the strategy according to the process capacity. This view is similar to

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the double loop learning theory proposed by Argyris and Schön (1997) which emphasises that organisational learning consists in taking the negative results as inputs for revisions of the strategy before taking remedial actions (the typical single loop).

The alignment between BPM initiatives and the business strategy has been recognised as a critical success factor (CSF) in a number of studies. Bandara et al. (2007) identified that BPM projects disconnected from the business strategy represent a significant flaw in BPM implementation. Hernaus et al. (2012) empirically reinforced the idea that organisations that set a strategic approach to BPM (i.e., top management of the firm commits to operationalise the strategy through business processes) enable an adequate deployment and execution of the corporate strategy. However, the results of the "Status Quo of BPM" study conducted by Neubauer (2009) show that a high percentage of organisations either do not have a defined business strategy or ignore the alignment between their strategy and business processes. The most common reason revealed in the Status Quo Survey was the lack of commitment of the top management level. Similarly, Minonne and Turner (2012) report that a lack of support from the leadership team, and missing or inaccurate information of the business strategy, are the most significant barrier in developing a process-based organisation. In the Harmon (2018, p. 9), of a representative sample of organisations with ongoing BPM projects, only "twenty-nine per cent said their organizations had an initial commitment to a limited number of mid- or low-level projects, and 23% said their organization's executives had made a major strategic commitment".

In the same study, it was reported that key challenges to implementing BPM initiatives are that multiple BPM projects compete between each other entangling the decision making of the top management to select them when they often have other priorities. Elzinga et al. (1995) point out that being BPM a strategic endeavour with long-term outcomes, standard economic methods are less evident to justify its implementation. In other words, top management support is often considered to be the most important critical success factor for BPM. In short, "in order to reach long-term success and improved performance, BPM must be linked to the organisational strategy" (Trkman, 2010, p. 128) and the involvement of the top management level to provide strategic direction is critical (Hernaus et al., 2016). Therefore, BPM SA is a critical success factor that requires top management support for BPM initiatives to have an impact on business performance.

Strategic alignment is not an isolated factor. For example, it is related to in the facets of business structure and compliance that appears under Governance in the BPMMM and many other maturity models. For example, in Grisdale and Seymour (2011, p. 30) "the business lacked a formalised structure for business process management which inhibited the organisation's ability to execute strategy. Senior management wanted to achieve the goals, but there are no dedicated roles like a BPM structure". One of the underlying assumptions of the BPMMM is that there is a strong correlation between the capability areas within a factor and between the factors (de Bruin, 2009). This implies that the levels of maturity in the capabilities of Strategic Alignment may influence the maturity of other factors. For example, Spanyi (2003), argues that to achieve the desired performance with BPM methods (another factor in the BPMMM) such as Total Quality Management (TQM), Six Sigma, or Activity Based Costing, the business strategy needs to be tightly integrated with BPM. Linking the strategy with business processes facilitates the implementation and communication for such projects that require cross-functional processes to succeed.

SA appears explicitly or implicitly in other BPM-MMs; Strategic alignment (or related denominations such as strategic fit, strategy planning, BPM strategy development) has been considered a key factor in some of the most popular maturity models in the BPM domain (e.g., de Bruin & Rosemann, 2005; Fisher, 2004; McCormack & Johnson, 2001; Rohloff, 2009a). In other models, the capability areas of Strategic alignment are partially and implicitly included but grouped with other capabilities such as governance and culture. For example, the development of a process architecture appears in many BPM-MMs (E.g., Fisher, 2004; Hammer, 2007; Harmon, 2009; McCormack & Johnson, 2001; Object Management Group, 2008; Rohloff, 2009c). This suggests the need for assessing the capability areas related to Strategic Alignment.

However, "despite this wide-spread support, little is known about how the strategic alignment of BPM can be actually operationalised" (de Bruin & Rosemann, 2006, para. 1). In the arena of BPM maturity models, "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" (Röglinger et al., 2012, p. 339). Yet, after more than ten years of the BPMMM release and the related paper on BPM Strategic Alignment from de Bruin and Rosemann (2006), accurate descriptions of how the BPM Strategic alignment capabilities are manifested at a different level of maturity and procedure, and instruments to operationalise it remain elusive.

2.4 Challenges of BPM-MM and related work

In the literature review, the researcher identifies the core limitations of current BPM-MMs. These limitations are articulated as four challenges that motivate the completion of this research program.

C1: Ill-defined capabilities

Existing BPM-MMs employ diverse terms to address seemingly synonymous or overlapping phenomenon– i.e., terms closely related to 'capabilities' such as factors, enablers, levers, dimensions and categories. Seldom is the use of alternative terminology justified. This disparity is confusing for both BPM researchers and practitioners. A root cause of this situation is that BPM-MMs lack a shared theory base (Tarhan et al., 2016). As a result, each model describes maturity in terms of quite different capabilities, and this idiosyncrasy impedes comparison for evaluation and selection.

C2: Lack of 'mutability'

Mettler et al. (2010) propose an important property for the practical development of maturity models, namely 'mutability'. Mutability is described as the potential of a maturity model to be modified depending on the requirements to achieve a certain maturity level, given the changing nature of capabilities in the organisational context such as emerging best practice and technology evolution (Mettler et al., 2010). While

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there is an agreement that BPM-MMs should be configurable and adaptable to organisational evolution and business change, there is little guidance on which capabilities should be configurable and how to configure BPM-MM change in a changing context.

C3: Absence of assessment instruments

According to Pöppelbuß et al. (2011, p. 519), "one of the main challenges for users is to identify a reliable, fitting, and ready-to-use model" because most BPM-MMs do not provide an assessment instrument and related guidance for applying the instrument. The absence of assessment instruments severely limits the applicability of the models. In addition, Tarhan et al. (2016) suggest that there should be a clear separation between the capability framework and the assessment component to determine the level of maturity; thus, the maturity of capabilities for BPM can be appraised by using different assessments tools.

C4: Maturity levels not clearly defined nor guided

The success of the Capability Maturity Model (CMM) developed for improving software development processes (Paulk et al., 1993), inspired a plethora of maturity models (Becker et al., 2009). The maturity levels that the CMM uses have been adopted in most maturity models with limited rationale or explanation. The existing literature lacks critical analysis of the accuracy and relevance of the CMM model's level-definitions across the different contexts where BPM-MMs are deployed (industry type, organisational size, level of technology, the cost structure of organisations, organisational goals, type of processes, etc.). Moreover, the descriptions of each maturity level commonly adapted from the CMM describe the overall organisation without distinguishing the relevant capabilities for the models. Further, maturity assessments are meant to guide organisations to establish an adequate level of maturity (for prescriptive purposes), yet current BPM-MMs offer little support for determining target maturity levels.

Some attempts have been made to address these challenges. Scholars have proposed guidance to address the issues from different perspectives. Pöppelbuß and Röglinger (2011) elaborated a framework of general design principles for maturity models. The authors identified and grouped components of BPM-MMs into three categories: (1) basic design principles. (2) Design principles for the descriptive purpose of use, (3) Design principles for the prescriptive purpose of use. Van Looy et al. (2011b) questioned the design principles of BPM-MMs, pointing out the heterogeneous nature of the models and organisations that implement them. The researchers also indicate that some components described by Pöppelbuß and Röglinger (2011) such as the Decision Calculus are non-existent in current BPM-MMs. Furthermore, Van Looy et al. (2013) propose a selection tool for choosing BPM maturity models according to a number of characteristics, including organisational features and objectives. Regardless of these attempts, the challenges of BPM-MMs remain unresolved to date.

Considering the potential of a meta-model to address most of the challenges listed, it was prioritised as Artefact 1. However, the meta-model itself falls short in addressing C3, one of the greatest barriers for practitioners

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when they want to implement BPM-MMs. The researcher embraces this challenge because providing guidance about how to develop assessment frameworks for BPM-MMs can support the enhancement and application of a wide variety of maturity models. The related artefact for this study is contained as Artefact 2.

2.5 Chapter summary

In this chapter, the main characteristics of BPM-MMs were introduced, namely the maturity, capability and assessment frameworks and design of maturity models. This overview gives a foundation to better understand BPM maturity models and remaining of this thesis. Examples of popular maturity models were discussed, especially the BPMMM by de Bruin and Rosemann (2005), which is the model selected for the maturity grid in Chapter 4. Consequently, the BPM Strategic alignment capabilities were introduced as the selected factor to be provided with a maturity grid in Chapter 4.

Chapter 3: The Anatomy of Maturity Models in Business Process Management: A Meta-model

3.1 Chapter Introduction

This chapter presents the development, methods and results for Artefact 1, a meta-model for BPM maturity models.

In Chapter 2, Section 2.4, some common challenges regarding maturity models in the BPM field were posed. The author proposes a meta-model to identify the generic components of BPM maturity models, thus supporting scholars and practitioners to link the current challenges with specific components of BPM-MMs to find solutions in both the development and application of maturity models. As stated in Chapter 1, the leading research question for the development of this artefact is: *What is the structure of BPM maturity models?*

A well-developed meta-model would address Challenge 1 (C1) by incorporating generic components derived through harmonising otherwise disparate concepts across existing models. Identification of these core, generic components is prerequisite to advancing the configurability of BPM-MMs, so they can mutate according to the context where they are applied. In attention to (C2), the role of contextual factors and how they should influence the adaptation of BPM-MMs can also be encapsulated in a meta-model. A meta-model will depict the relationships between the components of the models and diverse organisational contexts, to guide developers and practitioners of BPM-MMs on how they need to consider the alignment between related components (C1 and C2). A meta-model can demonstrate important missing components such as assessment tools and guidance to target maturity, contributing to C3 and C4 (and to identify other missing aspects). A meta-model can be an instrument to gauge the effects of the missing component in the overall operability of the maturity model; it can be taken as a 'checklist' to identify components when developing BPM-MMs or to evaluate and compare them when selecting and implementing existing ones. A well-defined meta-model can help to clarify the incorporation of any maturity framework (like the CMM model's levels and scales) (contributing to C4), and it can also help to identify related components that are required to determine the target maturity level; taking into consideration target maturity criteria and other influential elements such as organisational specificities which can also support the customisation of BPM-MMs (C2 and C4).

This chapter is structured as follows. In Section 3.2, the rationale for the meta-modelling approach to solving the problem is given. In Section 3.3, the target audience for the artefact is presented and its implications in the design principles. Section 3.4 is related to the methods to derive the meta-model. Because of the progressive nature of this work, some preliminary results are presented as outcomes of the steps of the method, that becomes inputs for the following steps. Section 3.5 poses the main research outcomes, including the meta-model and the descriptions for its components. Then, Section 3.6 details the evaluation phase. This chapter concludes in Section 3.7 with the chapter summary.

3.2 Meta-modelling and the research problem

Meta-models have been mostly used in the Information System (IS) domain to synthesize a variety of models and understand them to convert them into Information systems. Beydoun et al. (2005) developed and evaluated a meta-model as a representational infrastructure to unify the work product component of multi-agent systems (MAS) methodologies. The resulting meta-model enabled the authors to compare two relevant models in the field and assess their completeness, validating the utility of the meta-model. Similarly, Othman et al. (2014) adapted the methodology from Beydoun et al. (2005) to develop a meta-model to build a unified view for Disaster Management (DM) models and share knowledge. They claim the meta-model generalises most of the concepts used in existing DM practices as described in prevailing models. The authors validated the model by comparing the meta-model with ten existing models, examining the frequency of concepts of the meta-model appearing in the ten models used for comparison, and tracing through the meta-model a specific disaster scenario (bushfire) to check the logical sequence of the concepts in the model. These examples suggest that meta-models are useful artefacts to compare two or more models and find their commonalities.

Meta-models have also been used in the domain of maturity models. Ingalsbe et al. (2001) designed a meta-model for the SW-CMM (Capability Maturity Model for Software). This meta-model represents an orthogonal view of SW-CMM, containing seven fundamental concepts (common types), which are not exclusive to SW-CMM and are related to each other within all the key process areas of the SW-CMM. The authors claim that the meta-model has been used to build a model for each key process area and an idealized model for the full SW-CMM. The meta-model can also define the fundamental capabilities an organization must instantiate across all key process areas of the model. In the BPM sphere, Van Looy et al. (2012) designed a meta-model (labelled as a conceptual map) that mostly represents the Assessment framework perspective. This meta-model can be used to guide the application of a maturity model. These examples show that meta-models have practical value to create new models or to be used as blueprints to perform procedures.

This research uses meta-modelling as a technique to reduce the conceptual variability surrounding BPM-MMs. The identification of generic components of the models and their relationships can be synthesized to provide a better understanding of the models. The meta-model presented herein contains the structural/generic components of BPM-MMs and their relationships.

3.3 Target audience and preliminary design principles for the meta-model

The researcher has set a few preliminary design principles upfront as requirements that the intended artefact needs to meet. The design principles that are principles of form and function to fulfil the purpose of the artefact (Gregor & Jones, 2007) are inspired by the broad target audience for the meta-model; including scholars and

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practitioners that compare develop and apply BPM-MMs. This audience can belong to the IS domain or not. Therefore, simplicity is required so the meta-model can be read by any researcher or practitioner with basic knowledge of maturity models.

Simplicity as a design principle has a trade-off. The Occam's razor postulates that "entities should not be multiplied beyond necessity" (Tornay as cited in Domingos, 1999, p. 1). This implies that for a parsimonious meta-model, some components need to be excluded. The researcher aims to reflect the overall structure of BPM-MMs and the meta-model should reflect that, leaving details such sub-components out of the representation. Similarly, the meta-model cannot capture all the relationships but the most direct and generic ones across a number of models. Consequently, the meta-model must be accompanied by textual descriptions to capture supporting information (sub-components, example) that is not presented in the model.

Another implication for simplicity is that the researcher needs to look for alternative modelling languages to the more standard Universal Modelling Language (UML), specifically Class diagrams, as in the majority of the examples given in Section 3.2.

To balance these implications of simplicity, the meta-model considered an evaluation for completeness, meaning that the meta-model should include all the generic components of BPM-MMs as quality criteria. These design principles of simplicity and completeness are suitable to inform the methods to derive the meta-model and its evaluations. Further specific design principles are given in the methods sections, in particular in Section 3.4.2 (meta-model design). Such knowledge can be used for instantiating other artefacts of the same class (Sein et al., 2011); this case, other meta-models.

3.4 Research approach for Artefact 1

The researcher employed a Design Science Research (DSR) approach to discover the structure of BPM-MMs and to represent that structure as a meta-model, i.e., the design-artefact, following the seven guidelines of Hevner et al. (2004). These guidelines have often been employed in maturity models literature (e.g., Becker et al., 2009; Mettler, 2011; Pöppelbuß & Röglinger, 2011; Röglinger et al., 2012; Van Looy et al., 2012). A summary of the utilised guidelines and their instantiation in this study is presented in Appendix A. The development phases for the research artefact are presented in this section, while the methods related to the evaluation of the meta-model are presented in Section 3.6 after the research outcomes in Section 3.5.

This research adapted the qualitative content analysis process proposed by Elo and Kyngäs (2008) and apply it at different phases of this study, including development and evaluation steps. As explained in Chapter 1, this framework was chosen because it is parsimonious and considers the three types of reasoning, i.e., inductive, deductive, and abductive. Figure 3 summarises the overall meta-model development and evaluation, considering 3 phases and 16 steps.

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	Input	DSR Phases / Steps	Output	Reasoning
DEVELOPMENT	-General studies (GSs) of BPM-MMs	**Phase 1: Component Identification** Step 1: Select the sample: General studies of BPM-MMs (Tarhan et al., 2016) Step 2: Code potential components/sub-components/attributes found inductively in GSs of BPM-MMs Step 3: Code potential components/sub-components/attributes deductively from GSs of BPM-MMs Step 4: Analyse and categorise the codes into 'Components' (categories) to obtain the generic components Step 5: Describe the identified components examining the qualitative data collected	-Coding schema for Codes and Components -List of components -Descriptions	Inductive coding
DEVELOPMENT	-List of components -Descriptions of components	**Phase 2: Meta-model Design** Step 6: Identify relationships between components by observing: a) From descriptions from Step 5 b) Patterns of presentation of components in the sampled documents c) Logical instantiation of components in a BPM-MMs lifecycle Step 7: Decide the modelling language to build the meta-model Step 8: Design the meta-model using a graphical tool Step 9: Check meta-model against descriptions from Step 5 Iterative	-Meta-model (components and relationships)	Abductive design
EVALUATION	-Specific models (SMs) of BPM-MMs -Coding schema from Phase 1 -The meta-model and the descriptions of the components	**Phase 3: Evaluation of the meta-model** (Feedback) **Evaluation for completeness\generalisability** Step 10: Select the sample: Documents of the five most cited BPM-MMs (Tarhan et al., 2016) Step 11: Code documentation of BPM-MMs using coding schema resulting from Step 4 Step 12: Compare and analyse differences between codes referencing components from the general studies against the five most popular BPM-MMs **Evaluation for utility: Proof-of-concept** Step 13: Build a tool (proof-of-concept) to evaluate the components of BPM-MMs Step 14: Instantiate the evaluation tool with different BPM-MMs separately Step 15: Compare and analyse the results from the evaluation tool **Evaluation for theoretical foundation** Step 16: Instantiate the current study with the 'Theory Design' template from Gregor & Jones, 2007)	-Demonstration of completeness and generalisability (missed components identified if detected) -Demonstration of utility of the meta-model as an evaluation tool for BPM-MMs -Demonstration of theoretical foundation of the meta-model	Deductive coding (using coding schema from Phase 1 and identified relationships from Phase 2)

Figure 5. Development and evaluation phases of the DSR design.

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In the following sub-sections, the researcher presents in detail, the steps for developing the meta-model (Phase 1 and Phase 2), along with the intermediate results derived from each phase. The researcher chose this structure for this paper because the intermediate results can serve the reader as examples of the outputs for each phase, enhancing the description of the methods the researcher employed.

3.4.1 Phase 1: Component identification

To fulfil the development phase of the meta-model, the researcher firstly focused on identifying the components, recognised as a primary step in other meta-modelling studies in the IS domain (e.g., Ahlemann et al., 2005; Beydoun et al., 2009; Ingalsbe et al., 2001; Othman et al., 2014). To identify the components, the framework by Elo and Kyngäs (2008) to conduct Content analysis was utilised.

Following Elo and Kyngäs (2008), it is required to define the unit of analysis before starting the coding process. The researcher defined as the unit of analysis to be coded as the 'fragments' of information contained in the sampled documents presented in the form of sentences, paragraphs or images that refer to a 'potential components'. Considering the novel and exploratory nature of this research, the word 'potential' reflects the level of uncertainty during the early stages of the coding process where the researcher was not able to determine if the fragments were referring to a component, sub-component (a component that is part of a major component) or an attribute (property, characteristic or aspect of a component). Moreover, at the beginning of the study, different fragments could refer to one component but were coded as different components or vice versa. The coding process was supported by NVivo 12, using 'codes' (nodes in NVivo) labelled as the potential components, sub-components or attributes.

The goal of Phase 1 was to identify the key generic components that can represent any BPM-MM. The researcher sought to learn from and build on prior studies that had already attempted meta-analysis of BPM-MMs, as they had already conceptualised (at least to some degree) the key components of BPM-MMs in their attempts to compare different BPM-MMs. The researcher called these studies General Studies (GSs) of BPM-MMs[1]; which included research articles that describe, analyse, compare, classify or map two or more BPM-MMs. The rationale behind the use of prior BPM-MM general studies was that these articles enabled the researcher s to detect components from a broader range of BPM-MMs in an efficient way, as opposed to analysing each specific model directly (the derived components were later cross-checked against the actual models as described in Section 3.6). Moreover, some GSs helped to maximise the component identification by comparing different aspects of the models and propositions for improvements such as the design principles by Pöppelbuß and Röglinger (2011) and organisational/environmental aspects to consider like in Van Looy et al. (2013).

[1] Referred as meta-analysis studies in Tarhan, A., Turetken, O., & Reijers, H. (2016). Business process maturity models: A systematic literature review. *Information and Software Technology*, *75*, 122-134. https://doi.org/10.1016/j.infsof.2016.01.010 . It was preferred the term 'General studies' to avoid confusion with terms used like 'meta-model'.

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The sample for this *Step 1* was taken from Tarhan et al. (2016), whose systematic literature review identified 21 papers published between 1990 and 2016 that focuses on a meta-analysis of BPM-MMs, including comparisons, classifications and theoretical studies. The researcher sought for more recent work post Tarhan et al. (2016), applying the same search strategy they had described, and did not find any new documents aligned with this research topic, except for the Tarhan, Turetken, et al. (2015) study, which the researcher decided to include, yielding a total of 22 documents. The complete list of documents sampled for Phase 1 is included in Appendix C.

In *Step 2*, the aim was to collect the explicitly mentioned ‘potential components’. The researcher applied an inductive coding approach to identify the BPM-MM components from the selected 22 papers. For example, studies which had comparative tables between BPM-MMs (e.g., Britsch et al., 2012, Table 1; Röglinger et al., 2012, Table II; Tarhan, Turetken, et al., 2015, Table I) pointed out explicit components of the models. Therefore, the coding scheme was progressively built when discovering ‘potential components’.

Given that the aim was to identify all the relevant components across the sample, in *Step 3*, the researcher also sought implied components by examining the coded fragments and coded the ‘potential components’ from them. For example, if a paper states that the main purpose of maturity models is to help organisations to bridge the gap between the as-is maturity and the desired maturity through prescriptions (fragment coded as ‘Purpose’), then the models must require a ‘Maturity result’ (as-is maturity), a method to determine a ‘Target BPM maturity’ (desired maturity), and a set of ‘Prescriptions’ to close the gap. Therefore, these three components were found implicit under the descriptions of the ‘Purpose’ of the models.

One important coding rule to perform in *Step 2* and *Step 3* was to limit the coding of ‘potential components’ only to text that is contextualised as part of a model. This was a way to avoid coding fragments of the studies that were related to existing BPM-MMs but not part of them. For example, each ‘general study’ (GS) positions itself in the BPM domain with introductory sentences. Most of these studies also provide information about the CMM as part of the history of maturity models in general. In these exemplary cases, the fragments were not coded when they were not mentioned as part of any BPM-MM.

In *Step 4*, after having completed the inductive coding process of the sample, the researcher proceeded to analyse the fragments gathered in the codes of ‘potential components’ to classify them considering the context, similarities, overlaps and differences. As a result, categories of ‘Components’ were created to represent the generic components of BPM-MMs to be depicted in the meta-model. For instance, in the GSs different models define as their unit of analysis ‘capabilities’, ‘factors, ‘dimensions’ or ‘levers’ among others, but by analysing the coded fragments it was possible to determine that they were all related to capabilities; therefore, they would be all part of the generic component ‘Capability framework’. Some sections of the documents were richer containing information to be code. For example, comparative tables in papers (e.g., Britsch et al., 2012, Table 1; Röglinger et al., 2012, Table II; Tarhan, Turetken, et al., 2015, Table I) were especially helpful to cluster fragments into components (codes). The components were labelled in a way that made them generic, given the coded fragments, but more important, in a manner that avoid ambiguous labels that can have many meanings

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for different contexts. For example, the word 'dimension' is more generic than capabilities but also more ambiguous because it can represent different things in different models, while the word 'capability' is less generic but more accurate. Examining word frequencies within the components helped to achieve that balance between inclusiveness (generic terms) and accuracy (unambiguous terms). The meta-model was designed to be semantically intuitive, indicating what it is about without requiring the reader to look at all the details in the descriptions to understand it.

Table 3 presents the resulted coding schema totalling 98 codes categorised as a bottom-up approach into 12 components that represent the basis for the meta-model. The 'potential component' codes filled the matrix and were categorised considering their similarities described by the fragments to make up a component (headers of each column).

Table 4 is an adaptation of the Matrix Coding from NVivo that provides evidence of how the GSs referred to each of the generic components of BPM-MMs (referring through the codes of Table 3). The number of references from a paper was considered irrelevant for this study because the goal was to identify the components and not the number of codes referring to them within the same GS. The rationale for this decision is that scattered fragments across many sentences which refer to a 'potential component' would not necessarily contribute more to identify a component than compacted fragments in a few articulated sentences.

In Table 4, the column 'Source' lists the GSs (references for each GS is presented in Appendix C) and are displayed in 22 rows. The next columns are each of the twelve components discovered in the 'Component identification phase'. The last column, labelled as 'GS coverage', indicates the frequency and percentage of components referred per GS. The row 'Reference to components' indicates the frequency and percentage of GSs referencing to each component. The last row, 'approach' indicates if each component was mostly found explicitly or implicitly. In the matrix, the rows are marked with an "X" for each component referred in each GS at least once. GS06 (Röglinger et al., 2012) referenced to the twelve identified components (100% of coverage) (although not all explicit references as explained in Section 3.4.1). By observing the row 'Reference to components', the researcher could imply that the 22 GSs referenced to the 'Capability framework' and 'Maturity results' (although in most of the cases this last one was implicit under 'Purpose' of BPM-MMs as explained in the example depicted in Section 3.4.1 *step 3*.

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Components	Maturity framework	Target BPM maturity	Capability framework	Assessment framework	Model's attributes	Maturity results	Prescriptions	Comparisons	Scientific methods	Underlying theories/facts	BPM Domain	Organisational inputs
Codes (components, sub-components or attributes)	Maturity framework	Desired maturity level	Capability framework	Assessment instrument	Purposes of use	Organisational maturity	Prescriptions	Comparison	Design approach	Competitive advantage	BPM Success factors	Target group
	Maturity levels	Target mat. criteria	Capabilities	Unit of analysis	Terms and definitions	Maturity results	Improvements	Benchmarking	DSR	Dynamic capabilities	BPM initiatives	Assessors
	Structure/architecture	Appropriate maturity	Categories/areas	Unit of observation	Type	Capability results	Improvement prioritisation	Capability comparison	Delphi studies	Resource-based view	Lifecycle and progression	Respondents
	Continues maturity levels	To-be maturity	Dimensions	Data collec. instruments	Platform	Unit of analysis maturity	Decision calculus	Area/branch comparison	Refinement	Organisational change	BPM viewpoint	Unit of observation
	Staged maturity levels		Levers	Assessment duration	Certification	Current maturity	Roadmap	Longitudinal comparison	Validation	Quality management	Success stories	Organisational capabilities
	CMM levels		Factors	Requirements	Community support	As-is maturity		Organisational comparison	Verification	Limitations of MMs	Related domains	Organisational goals
	Definition of maturity		Capability areas	Conversion into levels	Maintenance/ Updates	Model findings			Evaluation	Underlying theories	Scope	Performance goals
	Inherited mat. framework		Process areas	Availability of assessment	MM's authors					Justificatory knowledge		Type of processes
			Inherited cap. framework	Normative content	Availability					Link with performance		Industry
			Configuration		Compatibility					Kernel theories		Size
					Configuration					Success of MMs		Budget
					Direct cost					Benefits		

Table 3. Coding schema resulted from the Component identification phase

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Source	Maturity framework	Target BPM maturity	Capability framework	Assessment framework	Model's attributes	Maturity results	Prescriptions	Comparisons	Scientific methods	Underlying theories/ facts	BPM Domain	Organisation al inputs	CS Coverage	
GS01	X		X	X	X	X	X	X	X			X	9	75%
GS02		X	X		X	X			X			X	6	50%
GS03	X	X	X	X		X	X			X	X		8	67%
GS04	X		X		X	X	X						5	42%
GS05	X	X	X	X	X	X	X		X	X	X	X	11	92%
GS06	X	X	X	X	X	X	X	X	X	X	X	X	12	100%
GS07			X		X	X	X	X	X				6	50%
GS08	X	X	X	X		X	X	X	X	X	X		10	83%
GS09			X			X	X						3	25%
GS10			X		X	X	X	X			X		6	50%
GS11	X		X	X	X	X	X	X	X	X		X	10	83%
GS12	X		X	X	X	X	X	X	X			X	9	75%
GS13	X	X	X		X	X	X	X		X	X	X	10	83%
GS14		X	X		X	X	X	X				X	7	58%
GS15	X	X	X	X	X	X	X	X	X	X		X	11	92%
GS16	X		X	X	X	X	X	X			X	X	9	75%
GS17	X	X	X	X	X	X	X	X	X			X	10	83%
GS18	X	X	X	X	X	X	X	X	X			X	10	83%
GS19	X		X		X	X	X		X		X		7	58%
GS20	X		X	X	X	X	X						6	50%
GS21	X	X	X	X	X	X	X	X	X		X		10	83%
GS22			X	X		X						X	4	33%
Reference to components	16	11	22	14	18	22	20	14	13	7	9	13		
	73%	50%	100%	64%	82%	100%	91%	64%	59%	32%	41%	59%		
Ref. Type	Explicit	Implicit	Explicit	Explicit	Explicit	Implicit	Implicit	Implicit	Explicit	Explicit	Explicit	Explicit		

Table 4. Matrix coding query: Component identification results from GSs.

On the other hand, the components 'Underlying theories/facts' (27%) and 'BPM domain' (41%) were less referenced in the GSs. Having a deep analysis of the data, these components received fewer references in the coding process due to the coding rule explained in Section 3.4.1 to filter out fragments that were not referring to a component of a BPM-MM, such as the background sections in GSs. The work led by Van Looy (GS11-GS18) surrounding a decision tool for selecting BPM-MMs considering the characteristics and goals of the organisations, contributed to identify the 'Organisational input' component.

In *Step 5*, the researcher described the identified generic components based on the qualitative data gathered through the codes in NVivo. The descriptions captured the most representative codes labels based on the recurrence in the literature, and synonyms were identified and merged (based on the fragments within the related codes) in order to simplify the diverse language. As the descriptions of the components are part of the primary outcome for this research, they are presented in Section 3.5, along with the meta-model.

3.4.2 Phase 2: Meta-model design

Having identified in Phase 1 the generic components to build the meta-model, the aim of Phase 2 was to organise them in a model that shows their relationship in an intuitive way to an audience of practitioners and academics. In *Step 6*, the relationships between the components were identified by observing the descriptions obtained in *Step 5* (and presented in Section 3.5). The following three patterns were found that associated the components:

a) The cross-references between the components: Textual descriptions that refer to other components (the descriptions resulted from Phase 1 were explicitly given in *Step 5)*. For example, the models describe their capabilities through their maturity scale (E.g., de Bruin & Rosemann, 2005; Hammer, 2007; Object Management Group, 2008). These relationships between components were translated as connections in the layout as in most of the modelling languages.

b) The proximity of the components: the researcher observed patterns regarding where and in which order the components were presented in the literature to determine the proximity between components in a layout. For example, some components were repeatedly presented in the background or introductory sections of the sampled studies while others were described in specific sections directly related to the components identified in Phase 1 or referenced to a specific type of studies. Components often presented in the same or subsequent sections may be more closely related, and therefore should be displayed closer in a diagram than components presented in separated sections.

c) The logical sequence of instantiation of the components: The researcher aimed to determine when the components are instantiated considering the lifecycle of BPM-MMs as tools created to be deployed in organisations for capability/process analysis and action (improvements). By observing patterns of the lifecycle in the reviewed literature, the researcher observed that models are created and validated following scientific methods (de Bruin et al., 2005; Pöppelbuß & Röglinger, 2011; Tarhan, Turetken, et al., 2015). Then, the

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documentation of the models is offered in either academic outlets or by the industry (e.g., by consultancy firms) (Tarhan, Turetken, et al., 2015; Van Looy, 2013b). Later, the models are implemented in organisations for either making interventions (consultancy) or academic research (Cronemyr & Danielsson, 2013; de Bruin & Doebeli, 2015; McCormack & Johnson, 2001). Finally, the results of maturity are analysed, implying that they need to be firstly obtained, then compared and used for prescribing improvement plans (Niehaves et al., 2014; Pöppelbuß & Röglinger, 2011; Tarhan et al., 2016).

Considering the described lifecycle, the researcher employed abductive reasoning to align the components to this lifecycle. According to Peirce, as cited in Fischer and Gregor (2011), abductive reasoning is the only logical operation that introduces a new idea and requires a creative process. In this case, the alignment resulted in the creation of layers: 'Scientific layer', 'Core model layer', 'Applicability layer', and 'Outcome layer'. This alignment is represented in Figure 6.

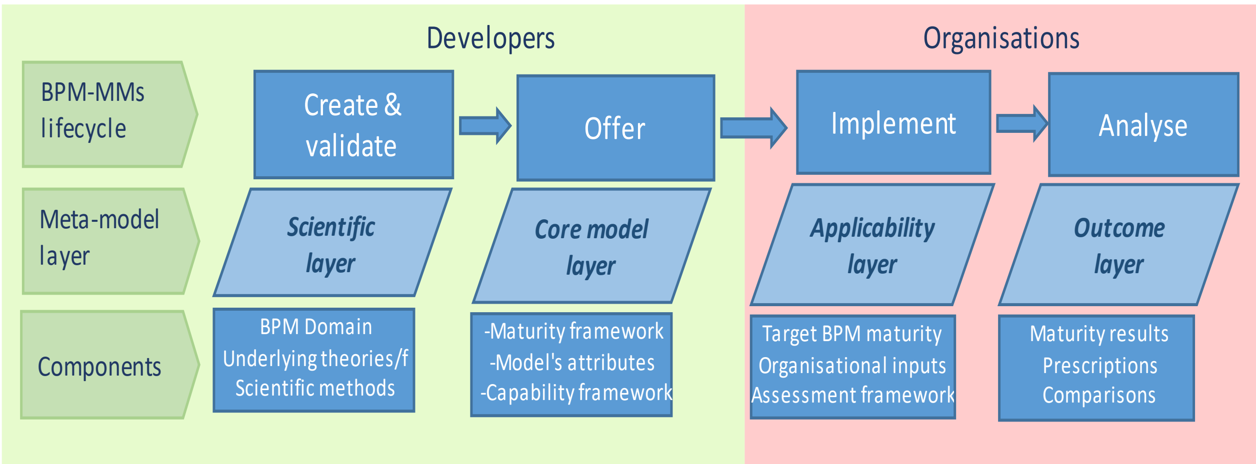

Figure 6. Components within layers in the BPM-MMs lifecycle

As shown in Figure 6, under the 'Scientific layer', the researcher included those components that often appear in the background sections of BPM-MM's literature ('BPM domain', 'Underlying theories/facts') and in specific papers about their development ('Scientific methods'). These components are instantiated by developers before and during the design of the models. Then, the components that represent the model itself are under the 'Core model layer' that includes 'Maturity framework', the 'Model's attributes' and the 'Capability framework'. These components are the result of the 'Scientific methods' and made available when the models are released (published or put available for practitioners). The next components are instantiated when the organisations implement the model, and this layer was labelled as the 'Applicability layer'. It contains the 'Target BPM maturity', the 'Organisational inputs' required for the operationalisation of the model and the 'Assessment framework'. Finally, once the model is implemented, the organisation proceeds to analyse the results and define further actions, contained in the 'Outcome layer', which comprises the 'Maturity results', 'Prescriptions' and 'Comparisons'.

The three types of relationships discovered (cross-reference, presentation patterns in literature, and instantiation sequence) gave insights to determine the shape and flow of the components in graphic representation and build the meta-model.

In *Step 7*, the researcher made a decision regarding the modelling language to be used. Most of the meta-models in the IS domain, including BPM, follow the Universal Modelling Language (UML) standards, especially the Class Diagrams (e.g., Ahlemann et al., 2005; Beydoun et al., 2005; Beydoun et al., 2009; Ingalsbe et al., 2001; Othman et al., 2014; Van Looy et al., 2012). However, Class Diagrams are mainly used for designing databases or information systems and thus, covering a technical perspective that mostly targets a rather technical audience such as Information Technology (IT) developers. In contrast, the meta-model was designed to help practitioners and decisions makers in an organisation to use BPM-MMs as well as academics to develop new ones or enhance existing ones. The target audience is unlikely to be familiar with Class diagrams since BPM-MM development and implementation is not exclusively an information systems activity. Nevertheless, modelling in a different, simplistic, and more intuitive language does not impede to translate the model into a Class Diagram in the future. Therefore, the researcher looked for simplicity and intuitiveness when selecting the language. As a result, 'Concept maps' created by Novak (1977) were chosen. 'Concept maps' are graphic tools with a strong theoretical foundation to represent knowledge (Cañas & Novak, 2014). Originally developed as tools to enhance the learning process in schools, they have been applied in a variety of environments from academia to organisations (Cañas & Novak, 2014). The guidelines and software CMapTools explained in Cañas and Novak (2014) were utilised to design the meta-model. In traditional 'Concept maps' the relationships between components are represented by the connections (arrows) between them and labels (verbs).

In *Step 8,* the researcher 'abducted' the components and relationships discovered in previous steps to draw the meta-model as a concept map. To design the model, the properties of completeness and simplicity were balanced. The researcher designed the meta-model to provide accurate information regarding all the identified components and their relationships, but at the same time, to be easy to read in a logical sequence. To achieve this balance, the model was restricted to capture only the more direct/stronger connections (relationships) considering *Step 6,* avoiding depicting an over-complex model that could be read and interpreted in many different ways and cause confusion. In a practical sense, the number of connections was minimized in the representation to prevent having arrows crossing from one extreme to the other affecting the readability of the meta-model. The indirect/weaker connections were only captured in the descriptions of the components to be attached to the meta-model.

In *Step 9,* the meta-model was checked against the descriptions, and relationships between the components to ensure that the representation fits the findings from the literature. As a creative process, *Step 8* and *Step 9* involved many iterations in refining the meta-model given the multiple possibilities to modelling the components while keeping a balance between completeness and simplicity considering the target audience (see Section 3.3).

3.5 Study Outcomes: the meta-model and its components

Section 3.4 presented an overview of the phases and steps undertaken to derive the BPM maturity model meta-model (Artefact 1). Sections 3.5.1 to 3.5.4 presents the four resulting layers in detail, while the next section - Section 3.6 presents the steps for evaluating the meta-model and subsequent results.

Once the four layers were identified, the researcher proceeded to display the 12 components, considering the direct relationships among them and their logical sequence for instantiation. The meta-model is displayed in Figure 7.

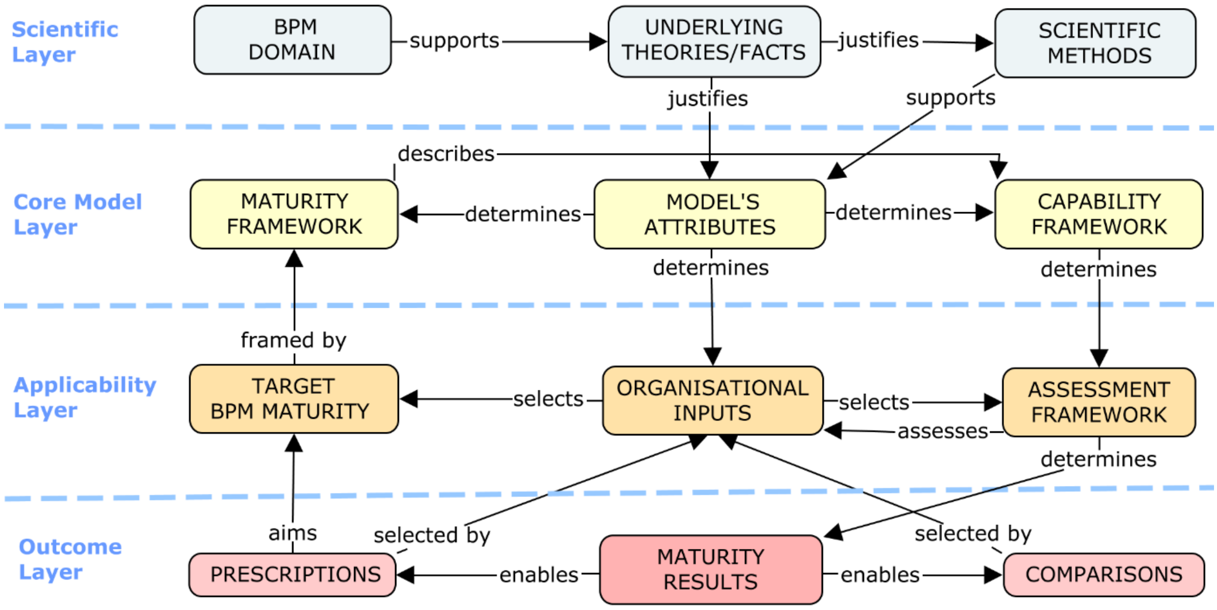

Figure 7. The meta-model of BPM-MMs.

The following paragraphs present the descriptions for each component of the meta-model, underlining verbal words that denote the relationships with other components. The descriptions were initially obtained by summarising the coded fragments from the GSs and refined with specific conceptual literature about the component. Then, they were enriched with the information gathered from the Specific Model (SM) documents utilised for evaluation purposes (see Section 3.6).

3.5.1 The Scientific layer and its components

The scientific layer supports the actual model by providing theoretical background considering the 'BPM domain' point of view, the 'Underlying theories/facts' or justificatory knowledge for the design and development of the model and the 'Scientific methods' to create it.

BPM Domain: It contextualises the model by describing the specific (in this case, BPM) and related domains and application fields. This component scopes the domain by presenting a specific viewpoint related to the BPM domain. For example, some models have a narrow process focus examining capabilities directly linked with the processes like 'process modelling' or 'process implementation' (Van Looy et al., 2010) (GS14). Other models see BPM as a holistic approach targeting the process orientation through organisational capabilities such as culture, team work, governance, among many others, that influence the process initiatives (Van Looy et al., 2010) (GS14). Furthermore, being BPM a multi-disciplinary domain, some models present a more specific domain linked to the BPM field such as change management, project management, knowledge management, supply change management, quality management, among others. Such specific domains under the BPM umbrella are expressed explicitly or contained implicitly in the 'capability framework' of the model. Nonetheless, if the model fails to explain the link between the specific domain(s) and BPM, it can be hardly classified as a BPM-MM. The 'BPM Domain' component can also present success stories of BPM considering the link with the organisational performance (Tarhan, Turetken, et al., 2015; Van Looy et al., 2010) (GS08, GS14). The 'BPM domain' is typically included in the background/introductory sections of the documents. This component is decided before the development of the model and supports the 'Underlying theories/facts' by giving context to the problem.

Underlying theories/facts: This component provides justification to the 'Scientific methods' of the models by giving informed explanatory knowledge to the design process about how the goals of developing the artefact (in this case a BPM-MM) can be accomplished by incorporating the selected components and their arrangement (Gregor & Jones, 2007). For example, the relevance of implementing BPM-MMs is highlighted with organisational benefits ("Business process maturity models (BPM-MMs) have become important assets for organisations to increase business (process) performance" (Van Looy, 2013a, p. 2). A number of studies present CMM success as a justification to adopt its maturity levels (e.g. "This practice was made popular by the CMM and appears to have wide practical acceptance" (de Bruin et al., 2005, p. 7) (GS2). Additionally, the purpose of focusing on Capabilities is often justified. For instance, "Capability development is an essential task of organizational design and corporate decision-making, particularly in a world where numerous organizations face strong competition and a progressively dynamic environment" (Pavlou & El Sawy, 2011; Wernerfelt, 1984 as cited in Forstner et al. (2014, p. 128) (GS03). "The idea behind this segmentation is that organizations need to offer supportive environments in order to develop high-performance processes" (Britsch et al., 2012, p. 4). Limitations of existing BPM-MMs and applications of BPM-MMs to increase organisational performance are other examples of 'Underlying theories/facts'.

As with the 'BPM domain' component, the 'Underlying theories/facts' component was found in background/introductory sections of the documents. However, it was possible to classify the fragments of the literature as 'Underlying theories/facts'.

Scientific methods: These describe the development process of the BPM-MM and support the inclusion of the different 'Model's attributes' and components that make the model. The main elements of the 'Scientific methods' are the 'Design approach' and the (empirical) 'Validation'. The literature suggests that development of BPM-MMs has flourished with the use of DSR methods (Pöppelbuß & Röglinger, 2011; Röglinger et al., 2012; Van Looy, 2013a, 2013b; Wendler, 2012) (GSs: 5, 6, 11, 12, 21). An example of a 'Design approach' to identify the relevant BPM capabilities a model should include is the 'Delphi Method'.

"In the case of the BPMMM, de Bruin and Rosemann (2007) conducted a Delphi study with international BPM experts to identify central model elements" (Röglinger et al., 2012). Concerning the validation, Mettler (2011) suggests that every maturity model should be evaluated once designed, involving validation (Mettler, 2011). "Whilst maturity models are high in number and broad in application, there is little documentation on how to develop a maturity model that is theoretically sound, rigorously tested and widely accepted" (de Bruin et al., 2005, p. 2) (GS02). According to Van Looy (2013b, p. 188) "most BPM-MMs do not provide any proof of validity (or success). If they do, the evidence is frequently limited to enumerating other organizations applying the model". The 'Design Method' component has the role of bringing transparency and trustworthiness to the model. In some BPM-MMs, the 'Scientific methods' is documented in separated papers with an emphasis on the approach or case studies for empirical validation.

3.5.2 The Core model layer and its components

This presents the components of the released BPM-MMs, i.e., the 'Maturity framework', the 'Model's attributes' and the 'Capability framework'. These components are the result of the development process of the model and fixed once the model is released and put available for its use.

Model's attributes: This component collects a number of characteristics of the BPM-MM such as its purposes, type of model, structure or architecture, and the platform to display the model. The most salient attribute of BPM-MMs is the 'Purposes of use' of the model. BPM-MMs are used for three main purposes: (i) to describe current maturity, (ii) to compare maturity levels, and (iii) to prescribe progression (Pöppelbuß & Röglinger, 2011) (GS05). The descriptive purpose aims to diagnose the actual maturity and/or capability level (AS-IS maturity) (Van Looy et al., 2011a) (GS15). "A maturity model serves a comparative purpose if it allows for internal or external benchmarking" (Röglinger et al., 2012, p. 330) (GS06). Prescriptive purpose of use considers "improvement criteria (i.e., what is measured as maturity, particularly the capabilities and their improvements to reach the successive levels" (Van Looy et al., 2013, p. 473) (GS18). Some studies consider other purposes, such as implementing BPM-MMs for certification purposes (Van Looy et al., 2012) (GS17).

The type of BPM-MM is another attribute pointed out in the literature and defined by its scope. For instances, "whether the BPM-MM is generic (i.e., for business processes in general) or domain-specific (e.g. for business processes in supply chains or collaboration situations)" (Van Looy, 2013a, p. 7) (GS11). "de Bruin and Rosemann (2007) distinguish two types of maturity: (1) maturity of specific business processes and (2) maturity of business process management in general, i.e., of all business processes in the organisation" (Van Looy et al., 2014, p. 189) (GS13).

The attribute architecture type is also included in this component. "A continuous architecture provides capability levels per capability, i.e., one road map per capability. It allows organizations to assess and improve each capability separately, and thus to improve capabilities at a different pace or to limit their scope to only those capabilities they are interested in. As not all capabilities are necessarily taken into account, there is a risk for suboptimal optimizations (in terms of overall maturity). On the other hand, a staged architecture provides maturity levels linked to all capabilities together, i.e., one road map for overall maturity. The emphasis is on simultaneous advancements, instead of individual capability advancements" (Van Looy, 2013b, p. 186).

Other attributes that the models generally have are the definitions of the central constructs, such as 'maturity' and 'capabilities', the platform where they are displayed (in most of the cases in paper but can be online), community support to maintain the model updated, detailed normative content to implement it, availability of the model and direct cost (Britsch et al., 2012; Pöppelbuß & Röglinger, 2011; Röglinger et al., 2012; Tarhan, Turetken, et al., 2015; Van Looy et al., 2013) (GS: 01, 05, 06, 08, 18). The 'Model's attribute' is the most heterogeneous component across BPM-MMs. The attributes can be found through the sections in the documents. Some of them may have explicit sections to describe them while others are combined. The arrangement of all the attributes of the model determines the 'Maturity framework', and 'Capability framework' components to be used and the 'Organisation inputs' to be instantiated by the organisation that applies the model.

Maturity framework: This depicts the levels (also termed 'groups' or 'stages') through which organisations proceed to BPM and/or process mastery (Röglinger et al., 2012) (GS06). Typically, the models include 4 or 5 levels. The most common framework for maturity levels has been adopted from the CMM (Capability Maturity Model) (Röglinger et al., 2012) (GS06). In the BPM sphere, the lowest levels of BPM maturity describe symptoms presenting in organisations such as isolated projects, low BPM skills, and manual operations; while high maturity levels characterise organisations that exhibit coordinated BPM activities through a Centre of Excellence (CoE), process automation, and innovation among other features (Rosemann et al., 2004). In many cases, the models have borrowed the maturity level labels from the CMM or CMMI (e.g., BPMMM, BPMMOMG, vPMM, 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 (Röglinger et al., 2012) (GS06).
The number of levels, their label and their descriptions vary from model to model. There are two prevalent approaches to design the maturity framework of the models: continuous representation and staged representation. Models with the continuous representation suggest that the BPM and the process capabilities of the organisation that implements the model can be at different levels of maturity (Britsch et al., 2012; Forstner et al., 2014; Rosemann & vom Brocke, 2015). These models are more descriptive in nature, meaning that the diagnosis (determination of the as-is maturity) is the baseline to guide improvement actions (prescriptions) to increase the maturity of the capabilities independently. Popular examples of continuous BPM-MMs are the BPMMM and Process Management Maturity Assessment by Rohloff (2009c). On the other hand, the staged representation of the models fixes a combination of BPM capabilities and process practices as requirements to achieve a certain maturity level (Britsch et al., 2012; Forstner et al., 2014; Rosemann & vom Brocke, 2015). Therefore, these models are prescriptive in nature because missing the suggested improvements in one capability may impede progress in the overall maturity.

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Examples include the BPMMOMG developed by the Object Management Group (2008) and the BPOMM by McCormack and Johnson (2001). The PEMM by Hammer (2007) is often labelled as a staged model because of the author's indication that the average maturity is equivalent to the lowest capability maturity and the organisation should always target the weakest capabilities first to progress in maturity (de Bruin, 2009; Rosemann & vom Brocke, 2015). However, because of the simple structure of the model (a maturity grid), there is no impediment to descriptively using its maturity scale as continuous for all the capabilities. Similarly, the order of the improvement action to progress in maturity is decided by the organisation using one of the two representations (Object Management Group, 2008).

The main purpose of the component is to describe the 'Capability framework' through its different levels.

Capability framework: A set of capabilities, or organisational capacities, that the model identifies to underpin BPM initiatives. Each model defines its capabilities considering the 'BPM Domain', including the specific domains intertwined with it in the view of the authors and the 'Underlying theories/facts' that justifies their inclusion. This component includes the unit of analysis to be measured in terms of maturity and in which order and structure. Different dimensions and levels of granularity are represented through capability areas, factors, process areas, enablers, or enterprise capabilities (de Bruin and Rosemann 2007, Hammer 2007, Weber et al. 2008 as cited in Pöppelbuß and Röglinger (2011) (GS05). For instances, in the BPMMOMG, "five process area threads link process areas across different maturity levels" (Pöppelbuß & Röglinger, 2011, p. 9) (GS05). The BPMMOMG was inspired in CMM and inherited the concept of 'process areas', which, according to Forstner et al. (2014) (GS03), are closely related to 'capability areas'. As presented in the models, there is a range of concepts that seem to be closely related to 'capabilities' such as factors, enablers, levers, dimensions and categories. However, the relationships between these concepts and capabilities have not been explicitly unveiled nor the justification for calling them differently. Based on the descriptions of the concepts and their overlaps, 'capabilities' appears to be a common factor behind the multiple denominations, supported by a higher word frequency. Consequently, this component is labelled as 'Capability framework'.

The arrangement of the 'Capability framework' can differ depending on the architecture of the model. For example, BPMMOMG aims to mature the capabilities of the organisation by improving the Process areas that contain best practices required to reach certain maturity level (Röglinger et al., 2012) (GS06). The BPMMM, on the other hand, focuses on (success) factors that contain capability areas (Rosemann & vom Brocke, 2015) (GS07) which can be assessed and progressed separately.

The 'Capability framework' determines the 'Assessment framework' by pre-defining the capabilities to be measured.

3.5.3 Applicability layer and its components

This represents the components that are instantiated when the model is deployed in an organisation. The components of this layer are: 'Organisational inputs', 'Target BPM maturity', and 'Assessment framework'.

Organisational inputs: This embodies the relevant information and the decisions the organisation needs to make to implement the BPM-MM. It may include the target group (including external parties such as consultants applying the model), assessors, respondents, industry, size, organisational capabilities and processes, performance goals, the budget for improvements, etc. "The target group comprises the people who apply the maturity model and those to whom results are reported" (Ahlemann et al. as cited in Pöppelbuß and Röglinger (2011, p. 5) (GS05). Depending on these characteristics, some BPM-MMs may fit better than others in the organisation (Van Looy, 2013b; Van Looy et al., 2013) (GS: 12, 18). The number of inputs required and their details is determined by the 'Model's Attribute'. Some models like the BPMMOMG includes specific templates to include the 'Organisational inputs' while others are only subtly identified from descriptions of examples of applications. The 'Organisational inputs' includes the decisions that the organisation needs to make when implementing the BPM-MM, i.e., where the model will be applied (area, process, branch, etc.), how it will be applied (by selecting an 'Assessment framework'), and what is the 'Target BPM maturity' (by selecting it)

Target BPM maturity: It represents the desired (or TO-BE) level of maturity that the organisation wants to achieve when implementing a BPM-MM. The 'Target BPM maturity' is related to the 'Maturity framework' in a sense it is expressed (or framed) on the same scale. The criteria to determine the optimal level of maturity the organisation should aim for varies from model to model. Some BPM-MMs by default recommend striving for the greatest extent while some studies suggest considering other criteria such as the investment outflows estimated (Forstner et al., 2014) (GS03) or organisational goals (Van Looy et al., 2011a) (GS15). In general, there is "lack of guidance in the industry about which capabilities an organization should develop to what extent" (Forstner et al., 2014, p. 128) (GS03).

Assessment framework: This represents the instruments and methods utilised during the implementation of a BPM-MM to appraise the maturity of the unit of analysis determined in the 'Capability framework' (capabilities, process areas, processes, etc.), assessing the unit of observation defined in the 'Organisational inputs' component. It aims to determine the 'Maturity result' of the unit of observation. The 'Assessment framework' can be included within the documentation of the model or developed by a third party (such as consultancy firms) to apply the assessment based on the 'Capability framework' of the model. The GartnerMM by Melenovsky and Sinur (2006), for example, only describes the gradual improvements among levels, without presenting a method to assess the organisation's current level of maturity (Van Looy et al., 2011a). Tarhan, Turetken, et al. (2015) (GS08) suggest that BPM-MMs should include practical self-assessment to be performed by the organisations themselves with limited effort required, and not relying on external expertise. Such instruments can lower the initial resistance and barriers to BPM-MMs (Tarhan, Turetken, et al., 2015) (GS08). One example of a BPM-MM that includes a self-assessment instrument is the widely used PEMM by Hammer (2007). However, not having sufficient specification of the minimum requirements for applying a self-assessment tool such as the minimum sample size, can result in subjectivity and inaccuracy in the maturity result. Hence, Tarhan, Turetken, et al. (2015) (GS08) propose that the pre-requisites of the self-assessment should be considered.

Some other attributes that have been mentioned in the BPM-MM's literature when applying the assessment tools are the assessment duration and the procedures to convert the assessment results into the maturity scale of the 'Capability framework' (Van Looy et al., 2011b) (CS16).

3.5.4 The Outcome layer and its components

This layer is instantiated once the appraisal of maturity in the organisation is finalised, reporting the 'Maturity results' as output, which subsequently enables 'Prescriptions' and 'Comparisons'.

Maturity results: This component includes the actual (AS-IS) results from the applied 'Assessment framework' as a diagnosis. As the 'Maturity framework' describes the 'Capability framework' that determines the 'Assessment framework' to obtain 'Maturity results', it is expected that the results are aligned with the 'Maturity framework' levels (as an indirect link). It can be presented separately for different units of analysis (e.g., different capabilities of the same organisation), for different groups assessed (e.g., departments or branches of an organisation measured separately) or at an aggregated level as an organisational maturity result. Some models contain examples of their results from applications in real organisations. For example, the PMMA from Rohloff presents 'Maturity results' derived from its application in Siemens AG and the PEMM from Hammer presents the self-assessment of an anonymous U.S. company (Röglinger et al., 2012). 'Maturity results' enables 'Prescriptions' and 'Comparisons'.

Prescriptions: A set of improvements that lead the business to the desired maturity stage(s) over time (Tarhan et al., 2016). Described as roadmaps, some BPM-MMs claim to provide prescriptions towards higher levels of maturity. The 'Prescriptions' component aims to bridge the gap between the 'Maturity results' and the 'Target BPM maturity'. Some models, like the PEMM by Hammer, advises prioritising improvements towards less mature capabilities first (Pöppelbuß & Röglinger, 2011) (GS05). Other models such as the BPMOMG are highly prescriptive, giving a detailed guideline on escalating through Process Areas (Röglinger et al., 2012) (GS06). Pöppelbuß and Röglinger (2011) (GS05) propose that BPM-MMs should consider a 'Decision calculus' to determine specific prescriptions derived from the 'Maturity results' and 'Target BPM maturity' based on corporate performance, supporting the decision-making.

Comparisons: This component considers the analysis of the 'Maturity results' between different units of analysis (e.g., different capabilities of the same organisation), for different groups assessed (e.g., departments or branches of an organisation measured separately). "A low level of granularity provides a simple means for comparing and documenting maturity levels (e.g. a corporate level)" (Röglinger et al., 2012, p. 332) (GS06). Also, it is possible to compare the results obtained over a period of time as in longitudinal studies (Van Looy et al., 2011a) (GS15). "Cross-organisational processes are mostly studied from the perspective of one organisation. It is likely that this criterion will increase in importance, along with the emergence of cross-organisational processes and supply chains" (Van Looy et al., 2013, p. 473) (GS18).

The researcher claims that the meta-model descriptions encapsulate most of the functions of BPM-MMs. In the next sections, the researcher evaluates the model against completeness and generalisability, utility and theoretical soundness.

3.6 Phase 3: Evaluation of the meta-model

When designing an artefact, it is important to consider feedback loops to enhance the solution. Hevner et al. (2004) point out that the evaluations provide feedback and a better comprehension of the problem that can help to improve not only the quality of the product but also the design process. Guideline 3 in the DSR framework of Hevner et al. (2004) suggests that the evaluations need to rigorously demonstrate the quality and utility of the design artefact. The quality of the artefact can be assessed by setting criteria. For example, the completeness, generalisability, and utility of an artefact are a common criterion for evaluations in DSR. According to Gregor and Hevner (2013), there is the flexibility to determine to what extent evaluation of an artefact is needed, indicating that for novel artefacts (like this meta-model that is also conceptual instead of a practical IT artefact), a proof-of-concept (PoC) may be sufficient. They argue that when a researcher has expended significant effort in developing an artefact, often with much formative testing, the final evaluation does not need to be as in-depth and full as the evaluation for an artefact made by someone else. As the meta-model is a conceptual artefact, its theoretical foundation and contribution to knowledge need to be demonstrated. Gregor and Jones (2007) propose a framework to perform such an evaluation. Because this meta-model has been rigorously evidence-based derived and due to time constraints, the researcher has limited the scope of this project to three instances of artificial evaluation that includes: (i) evaluation for completeness/generalisability, (ii) evaluation for utility, and (iii) evaluation for the theoretical foundation. The aims, steps and results of these three evaluations are detailed in the next sub-sections.

3.6.1 Evaluation for completeness and generalisability

In this evaluation, the researcher aimed to test and compare the resulting list of components identified from the documents sampled in Phase 1 with a number of models. The coding scheme developed in Phase 1 (see Table 3) that identified the components of BPM-MMs was tested to confirm that these codes can be used to code and identify components in documented BPM-MMs. The quality properties to be checked were completeness and generalisability. Completeness implies that new generic components cannot be found in the models that are coded. This does not mean that every BPM-MM has all the components of the meta-model, but that the meta-model has all the components that maturity models could have to fulfil their purposes. Generalisability implies that maturity models in the BPM field are equally represented by these components and codes, regardless of their diverse nature, considering maturity structure (continuous or staged representation), origin (practice or academia), or maturity focus (organisational-wide capabilities, process capabilities). Passing this evaluation would indicate that the resulting meta-model is representative of the structure of BPM-MMs.

The sample of models for evaluating the completeness and generalisability of the meta-model involved two groups of models. Tarhan et al. (2016), in their study, paints a vivid picture of the landscape of BPM-MMs, comparing different BPM-MMs against their evidence of validity and also uptake. From this article, arguably the five most popular BPM-MMs were selected, by considering as criteria the number of publications referencing to the models as presented in Tarhan et al. (2016). The selected models are (i) BPMMM by de Bruin and Rosemann (2005), (ii) BPMMOMG by Object Management Group (2008), (iii) BPOMM by McCormack and Johnson (2001), (iv) PEMM by Hammer (2007) and (v) PMMA by Rohloff (2009c). This sample was selected for the evaluation for completeness and generalisability because: (a) they cover nearly 60% of the articles referring to BPM-MMs according to Tarhan et al. (2016, p. 127, Figure 4), (b) the feasible amount of information to code considering the diverse nature of the documents (For example, the BPMMM involves ten articles in total that range from peer-reviewed articles to a PhD thesis), (c) involves models with different characteristics, like using a continuous maturity representation (e.g., BPMMM, PMMA) and staged models (BPMMOMG, BPOMM); and origin of the models, being some developed by scholars (e.g., BPMMM, PMMA) and practitioners (e.g., BPMMOMG, PEMM).

However, there was a limitation with this sample. Using the most popular models for evaluating the meta-model might result in circular reasoning. This is because the sample of general studies (GS) during the development phase of the meta-model has mostly compared and analysed and studied the most popular models. As a result, the researcher considered expanding the sample to a second group of models, less popular in academia but widely popular in practice pondering the relevance in the BPM field of the organisations and practitioners behind the models (authors) and their references in BPM online communities. The next selected models were: (vi) BPMMFIS by Fisher (2004), (vii) Gartner by Melenovsky and Sinur (2006), (viii) APQC7T by Heller and Varney (2013), and the (ix) ISO/IEC 33000 family of standards by International Organization for Standardization (2015). The complete list of documents sampled for this evaluation for the completeness phase is available in Appendix D. These documents were labelled as SM Nx (Specific model), where 'N' is the number of the BPM-MM examined and 'x' the article with its content (a, b, c, etc.).

Step 10 was the first step of the evaluation phase. In this step, the researcher collected the primary and complementary studies regarding these models where the documentation (thesis or another research article) was written by at least the first or second author of the primary source of the model. Grey literature was included for models developed by practitioners since they are not published in scientific outlets.

In *Step 11*, the researcher content analysed and coded the sample of SMs with NVivo using the coding schema resulted from Step 4 and the descriptions from *Step 5*. This coding process was deductive because the text was analysed based on the codes and categories of the coding schema and descriptions from *Step 4* and *Step 5* in the development phase (see Section 3.4.1). In case a component did not match with the existing codes and did not fit the descriptions, that component would be coded as 'Unidentified'. Unlike in *Step 2* and *Step 3* in the Component identification stage, everything contained in the background or introductory sections was coded as part of the model because this time the actual BPM-MM documentation was being coded (unlike the phase 1 where General Studies were coded) and these sections were part of specific models.

In *Step 12,* the researcher compared and analysed the content of the coded components from both sources; general studies (GSs) and actual documentation of specific BPM-MMs (SMs). To obtain the qualitative data, the Matrix Coding from NVivo (a tabular table that presents the number of extracted references for each code and from which source) was extracted separately for both sources. Then, the researcher examined the percentages of references to each component from both samples. Feedback from this step was gathered to refine the descriptions of the components and, eventually, to redesign the meta-model if a new component found to make the descriptions more accurate. The results of this cross-reference process are presented in Table 5.

The rule the researcher set to pass the evaluation for completeness was that all the (generic) components of the sampled nine BPM-MMs for evaluation must exist in the resulting meta-model. Therefore, any unidentified component would trigger refinement of the meta-model to incorporate it, and the previous steps that enabled it, such as the coding schema and creation of descriptions. This rule did not apply for sub-components or attributes that could be incorporated as a code under an already identified component without altering the meta-model design.

The rule to pass the evaluation for generalisability was that each component of the meta-model must be referenced in by at least one the models for each of the three characteristics identified, i.e., maturity structure (continuous or staged representation), origin (practice or academia), or maturity focus (organisational-wide capabilities, process capabilities). It is important to note that for this evaluation it was irrelevant that the component actually existed in a specific BPM-MM because neither the quality nor the completeness of the models was evaluated, but the completeness of the meta-model. For example, some BPM-MMs may not have an 'Assessment framework' in their documentation, but they still could refer to it in a sentence which was coded as 'assessment framework'.

If the meta-model passed these two rules, then the meta-model is representative for most of BPM-MMs and confirmed by the five most popular ones and other four models relevant to practice.

From Table 5, it can be said that the components exhibited in the sampled SMs are consistent with the components identified in the general studies (GS). In fact, the majority of the components are referenced for at least one of the documents of the models.

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Model	Source	Maturity framework	Target BPM maturity	Capability framework	Assessment framework	Model's attributes	Maturity results	Prescriptions	Comparisons	Scientific methods	Underlying theories/ fact	BPM Domain	Organisational inputs	SM Coverage	
BPMMM	SM1a	X		X	X	X	X	X	X	X	X	X	X	11	92%
BPMMM	SM1b	X	X	X	X	X	X	X	X	X	X	X	X	12	100%
BPMMM	SM1c			X	X	X	X	X	X	X	X	X		9	75%
BPMMM	SM1d	X	X	X	X	X	X	X	X	X	X	X	X	12	100%
BPMMM	SM1e	X	X	X	X	X	X	X	X	X	X	X		11	92%
BPMMOMG	SM2	X	X	X	X	X	X	X	X	X	X	X	X	12	100%
BPOMM	SM3	X	X	X	X	X	X	X	X	X	X	X	X	12	100%
PEMM	SM4	X	X	X	X	X	X	X	X	X	X	X	X	12	100%
PMMA	SM5a	X	X	X	X	X	X	X	X	X	X	X	X	12	100%
PMMA	SM5b	X	X	X	X	X	X	X	X	X	X	X	X	12	100%
BPMMFIS	SM6	X	X	X	X	X	X	X	X		X	X	X	11	92%
Gartner	SM7	X	X	X	X	X	X	X	X		X	X	X	11	92%
APQC	SM8	X	X	X	X	X	X	X	X	X	X	X	X	12	100%
ISO33000	SM9*	X	X	X	X	X	X	X	X		X	X	X	11	92%
	Reference to components	13	12	14	14	14	14	14	14	11	14	14	12		
		93%	86%	100%	100%	100%	100%	100%	100%	79%	100%	100%	86%		
	Ref. type	Presented	Mentioned	Presented	Mentioned	Presented	Mentioned	Mentioned	Mentioned	Mentioned	Presented	Presented	Mentioned		

SM9*: Includes 23 standards, from ISO/IEC 33001 to ISO/IEC 33081

Table 5. Component identification from top five BPM-MMs documents for evaluation

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The researcher further classified the components according to whether they were mostly presented in the documents or mostly mentioned but not available. This classification is shown in the last row labelled as "Ref. type" (reference type) in Table 5 across the twelve components. By this evaluation process, the researcher could confirm the absence of many components in the models, highlighting the gap between what maturity models should have and what they do have. For example, the BPMMM does not present the 'Assessment framework' per se but includes some examples (as screenshots) of a "BPMM On-line Assessment" and a maturity survey (de Bruin, 2009, p. 657) (SM1a). The BPMMOMG describes its top maturity level (innovation – 5) as "wherein both proactive and opportunistic improvement actions seek innovations that can close gaps between the organization's current capability and the capability required to achieve its business objectives" (Object Management Group, 2008, p. 4) (SM2), but there is no guidance to determine the 'Target BPM maturity' of such capability to achieve the business objectives. The BPOMM acknowledges the importance of the 'Target BPM maturity' in a subsection where it is indicated that 'the first step in this [process orientation] journey is to clearly define the end goal or destination" (McCormack & Johnson, 2001, p. 106) (SM3). However, this subsection is limited to only contrast low and high maturity levels assuming the highest level as a target. To design the PEMM, Hammer (2007, p. 114) (SM4) "analysed the various factors that were necessary to sustain business processes [and] tested both lists over several years" but there is no evidence of the 'Scientific methods' nor the empirical evidence provided. The PMMA is another example of a BPM-MM that does not provide the 'Assessment framework', nor a 'Target BPM maturity' component but acknowledges both components indicating that "the well-defined approach and structured questionnaire with clearly defined requirements for the categories in combination with the trained assessors reduce the effort for conducting an assessment" and "an organization should aim for a particular maturity level in relation to its organizational strategies and objectives" (Rohloff, 2011, p. 393) (SM5b).

No evidence of a component different than the ones presented in the meta-model could be found. Therefore, the meta-model passed the evaluation for completeness.

When comparing groups of models between their availability in academic outlet against models from practitioners such as GartnerMM, APQC7T, ISO/IEC 33000, BPMMOMG, BPMMFIS, among others, there is a critical distinction. The references to the component 'Scientific methods' are significantly lower in the practitioner models than in the ones from scholars. These models poorly justify the set of capabilities they assess or prescribe to increase BPM maturity. Some of these models fail to mention the CMMi as a seminal model though they build on its staged maturity structure and scales (e.g., Object Management Group, 2008). Other models present some statistics of organisations achieving certain levels, but there is no reference given to access the data (e.g., Gardner, 2001). These findings suggest that the 'Scientific methods' component is the weaker component when examining the generalisability of the meta-model. However, overall, the meta-model passes the test because the majority of the models, including other models from practice, either present or mention all the components of the meta-model. Furthermore, no difference was identified for between the groups in terms of maturity structure (representation), being both, continuous of staged maturity identified as part of the maturity framework. With regard to the focus of the models in the maturity of organisational-wide capabilities or process capabilities, for both cases are part of the Capability framework since process capabilities are included here.

Although some difference in the composition of the models was found, the meta-model is generalisable for BPM-MMs because collectively, evidence from at least one model of different groups of BPM-MMs suggests the presence of each component. For instance, when the majority of the models from practice do not refer to the 'scientific methods' utilised to develop a model, the PEMM and the APQC7T mention a research process to determine the capabilities of the model. For example, "The Seven Tenets emerged after years of research that APQC7T conducted on process and process management. These principles take a horizontal and holistic view of how work is accomplished in an organization" (Heller & Varney, 2013, p. 7). Therefore, 'Evaluation for generalisability' also passed the test because the majority of the components of the meta-model are referenced by at least one SM after considering a variety of models with different characteristics, considering maturity structure (continuous or staged representation), origin (practice or academia), or maturity focus (organisational-wide capabilities, process capabilities).

Through this meta-model, the researcher confirmed that there is a gap between the components that an ideal/complete BPM-MM should have and what they really have. The gap becomes more critical at the 'Applicability layer' where both General Studies (GSs) and Specific Models (SMs) mostly presented short descriptions of components or allusions to the 'Assessment framework', 'Organisational inputs' and 'Target BPM maturity' in contrast to the 'Core model layer' components where it was possible to extract plenty of coding material because of sections in the models are dedicated to these, as in the case of the 'Capability-framework' which is the main focus for most of the models analysed.

3.6.2 Evaluation for utility: Proof-of-Concept

The goal of this evaluation was to demonstrate the potential of the meta-model to be used as an evaluation tool to assess the completeness and quality of BPM-MMs. According to Gregor and Hevner (2013), presenting a 'Proof-of-Concept' (PoC) is a viable option to demonstrate the potential contribution of the new artefact. Providing an instantiation as a working example can also support the credibility of the work (Gregor & Jones, 2007). A PoC is an early and simplistic version of the intended artefact as a draft with limited functionality and not rigorously designed, that aims to demonstrate that the solution is feasible. As a result, the PoC was scoped to demonstrate the utility of the meta-model by appraising the level of completeness and quality of a sample of BPM-MMs against the components of the meta-model.

In *Step 13*, the meta-model was simplified by converting it into a matrix (in MS-Excel) and added quality criteria to assess BPM-MMs through the lens of the components of the meta-model. It included the development of an 'Assessment criteria sheet' (see Appendix E) to evaluate the models as a complementary artefact. The criteria considered a four-level Likert scale: strong, sufficient, weak, and absent. Each scale described how each of the twelve components of the meta-model (considering as a baseline the descriptors

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obtained in *Step 5* from Section 3.4.1 and presented in Section 3.5) would be presented in a maturity model at each scale. Both the evaluation tool and its criteria sheet were only developed as a PoC to demonstrate the feasibility. Rigorous DSR principles were not applied for these complementary artefacts.

In *Step 14* it was considered the selection of two out of the five most-cited BPM-MMs sampled to run the test: The BPMMM by de Bruin and Rosemann (2005) and the PEMM by Hammer (2007). The researcher instantiated the tool with their information as an input. When instantiating a component from each of these two BPM-MM, it was assessed to what extent the component is presented and supported following the criteria sheet developed in *Step 13.*

To pass the test of utility, the researcher expected the meta-model evaluation tool to be able to be instantiated with the available information of the models, obtain indicators of completeness and quality, and draw conclusions with regard the quality of the models (as a PoC only).Figure 8 presents the results of an instantiation of the two selected models to evaluate them.

In *Step 15*, the researcher compared the results from both instantiations and made conclusions based on the tool indicators. Feedback from this step was gathered to enrich the descriptions of the components by providing examples from these models.

Comparing the overall ratings obtained for the models in Figure 8, it can be said that both models are similar regarding completeness and quality. The BPMMM presents a weak maturity framework based on CMM, which does not describe the capabilities at each level of maturity. Although the model presents evidence of maturity assessment in organisations using a case study approach, it does not include the tools to perform the assessment. The main strength of the model is its research rigour behind its design. On the other hand, the PEMM does not present evidence of the 'Scientific methods' to determine its capabilities and maturity scale. However, the structure of the PEMM connects the 'Maturity framework' with the 'Capability framework' through a maturity grid.

This PoC demonstrates that the meta-model can be used as an evaluation tool to compare different maturity models by spotting the strengths and their weaknesses for each component that BPM-MMs should have to achieve their purposes. In this PoC the components were weighted equally to determine a rating, which is not necessarily correct since some components may be more important than others. Further research could be performed to rigorously develop an evaluation tool based on the meta-model.

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	Model: BPMMM	Author: de Bruin et al., 2005	
Scientific Layer	BPM DOMAIN	UNDERLYING THEORIES/FACTS	SCIENTIFIC METHODS
Core Model Layer	MATURITY FRAMEWORK	MODEL'S ATTRIBUTES	CAPABILITY FRAMEWORK
Applicability Layer	TARGET BPM MATURITY	ORGANISATION AL INPUTS	ASSESSMENT FRAMEWORK
Outcome Layer	PRESCRIPTIONS	MATURITY RESULTS	COMPARISONS
Strengths:	Rigorous scientific methods, supported by theories. Includes empirical validation		
Weakness:	The maturity framework is disconnected from the capabilities (not described at different levels)		
Overall rating:	76.3	/100	

Model: PEMM	Author: Hammer, 2007	
BPM DOMAIN	UNDERLYING THEORIES/FACTS	SCIENTIFIC METHODS
MATURITY FRAMEWORK	MODEL'S ATTRIBUTES	CAPABILITY FRAMEWORK
TARGET BPM MATURITY	ORGANISATIONA L INPUTS	ASSESSMENT FRAMEWORK
PRESCRIPTIONS	MATURITY RESULTS	COMPARISONS
Strengths: Capability framework fully described by the Maturity framework		
Weakness: No design method nor scientific validation		
Overall rating: 74.0	/100	

	Scale	Rating
3	Strong	80-100
2	Sufficient	50-80
1	Weak	20-50
0	Absent	0-20

Figure 8. Evaluation of two BPM-MMs through the lens of the meta-model as a Proof-of-Concept

3.6.3 Evaluation for theoretical soundness

As the meta-model is theory itself, it is recommended to evaluate the method and the artefact for its theoretical foundation in the context of DSR. The meta-model was evaluated through the lens of "The skeleton of a design theory" proposed by Gregor and Jones (2007) which has eight components identified by the authors : (1) purpose and scope, (2) constructs, (3) principles of form and function, (4) artefact mutability, (5) testable propositions, (6) justificatory knowledge, (7) principles of implementation, and (8) an expository instantiation.

In *Step 16,* the researcher instantiated the skeleton of a design theory proposed by Gregor and Jones (2007) with the elements of the study. The criteria considered to pass the test of theoretical foundation was that the meta-model had to be instantiated with at least the first six of the eight components listed in the skeleton. The results of the instantiation of the theoretical skeleton are as follows.

Purpose and scope: There are three purposes for developing a meta-model of BPM-MMs. Firstly, the meta-model can bring conceptual clarity by summarising diverse terminology from existing literature, contextualising it and clustering the diverse concepts into distinctive components. Secondly, the meta-model will support BPM-MM developers to improve existing but incomplete BPM-MMs and underpin the development of future models. Thirdly, decision-makers in organisations and consultants will benefit from having available a conceptual map for understanding and evaluating BPM-MMs and the kind of decisions and requirements they will need to fulfil before implementing a maturity model. The motivation for this work considers the current issues of BPM-MMs such as ill-defined capabilities, lack of 'mutability', the absence of assessment instruments, and maturity levels not clearly defined nor guided. The development approach adopted was DSR and the outcome was a 'Concept map' and the list of descriptions for the components including the relationships between them. This item is included in Section 2.4.

Constructs: "A Maturity Model (MM) is a tool to systematically assess and improve capabilities, i.e., abilities or competences, to reach a goal" (Van Looy et al., 2011b, p. 52). 'Maturity', in the BPM context, refers to how developed are the organisation's capabilities or processes to foster optimal process performance and BPM initiatives. Meta-models are a "design framework, which describes the basic model elements and the relationships between the model elements as well as their semantics" (Rosemann & Green, 2002, p. 78). The researcher defined a 'Component' as the building blocks that make up a maturity model and play specific roles, supportive or pragmatic, towards the journey of determining maturity and further actions derived from it. This item is included in Chapter 1. Furthermore, each of the identified components for the meta-model was described in Section 3.5.

Principles of form and function: The meta-model was represented using the Concept maps modelling language from Cañas and Novak (2014). The 12 components were displayed within four layers that represent the instantiations of the BPM-MM components at different stages of their lifecycle. The components are linked with arrows that represent the direct relationship among them, and the flow indicates the order in which they are instantiated. The descriptions for each of the components are presented along with the meta-model and provide some examples. The meta-model can also be utilised as an evaluation tool to assess the completeness or quality of different BPM-MMs. It can also be used as a checklist for developing BPM-MMs. This item is included in Sections 3.4.2 and 3.6.2.

Artefact mutability: According to Gregor and Jones (2007) there are artefacts that are constantly evolving; thus, the mutability property of DSR artefacts is becoming more important. Simon, as cited in Gregor and Jones (2007), indicates that feedback loops to refine the design enables flexibility and adaptability of the artefact. The mutability property was considered during the design and evaluation of the meta-model. Indeed, the evaluations performed enabled the researcher to refine the descriptions for the components of the meta-model. On the other hand, the design and generic components of the meta-model did not change because, as intended, they are generic in nature. However, the researcher proposed that the simple Concept Map language of the meta-model can be converted into UML Class-diagrams for a more technical audience such as developers. In addition, the researcher utilised a compact version of the meta-model as a PoC tool for evaluation of completeness/quality of BPM-MMs as in the sub-section Evaluation for utility: Proof of Concept. This item is included in Sections 3.4.2 and 3.6.2.

Testable propositions: The testable propositions or hypotheses can be classified into two levels of granularity: at the study level and at the meta-model level. At the study level, the hypothesis was that if the researcher was able to identify the generic components of BPM-MMs and how they are arranged to reach maturity and subsequent prescriptions and benchmarking, then the researcher could spot their weaknesses and solve them by adding, replacing or enhancing the faulty components. In addition, knowing the generic components is paramount to advancing towards configurability of BPM-MMs, so they can mutate according to the context. Later, one of the propositions to test the model was that if the researcher could instantiate the components of the meta-model by using as input existing BPM-MMs, then the completeness, quality of the models can be assessed, which also demonstrate the functionality of the meta-model. This item is included in Sections 3.5.

Justificatory knowledge: An example of 'justificatory knowledge' for the meta-model is the previous work of meta-modelling for reducing diverse language, mapping system components and create new systems (e.g., Ahlemann et al., 2005; Beydoun et al., 2009; Ingalsbe et al., 2001; Othman et al., 2014). Another underlying theory utilised was that the meta-model could enable the analysis and comparison of models and detecting faulty/missing components that lead to issues. 'Concept maps' used as graphic tools with a strong theoretical foundation to represent knowledge that enables learning through comprehensive diagrams (Cañas & Novak, 2014) justified the selected modelling language. The researcher also identified the 'justificatory knowledge' as 'Underlying theories/facts' as a component of BPM-MMs. For example, "Business process maturity models (BPM-MMs) have become important assets for organisations to increase business (process) performance (Van Looy, 2013a, p. 2). This item is included in Chapter 1 and Chapter 3, Section 3.4.2.

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Principles of implementation: The meta-model itself is a guide to check the components of either existing BPM-MMs or to be developed BPM-MMs. The components are presented in a logical flow from the creation of the maturity models (Scientific layer) to the extraction of results (Outcome layer). The connection between components has been labelled and minimized to expedite the understanding of the meta-model. The Concept map is complemented with textual descriptions. This item is included in Sections 3.5. The meta-model is not an artefact to deploy in an organisation but to be available to practitioners and academics to support them analysing, improving or developing maturity models. Therefore, the principles of implementations are implicit in the handy (and well-justified) design of the artefact as a supportive tool rather than specific instructions for deploying it.

Expository instantiation: The researcher instantiated the meta-model as an evaluation tool (PoC) using two popular BPM-MMs: The BPMMM by de Bruin and Rosemann (2005) and the PEMM by Hammer (2007).

By covering each of the elements of the Skeleton of a Design Theory proposed by Gregor and Jones (2007) it has been demonstrated that this design artefact has a theoretical foundation.

3.7 Chapter summary

In this research, 12 generic components of BPM-MMs and their relationships have been identified to outline their structure in a meta-model. The components are instantiated at different stages of the lifecycle of BPM-MMs reflected in four layers in the meta-model; Scientific, Core Model, Applicability and Outcome layers. They are firstly developed by positioning the 'BPM domain' and exposing the 'underlying theories' that justify the 'scientific methods' to design the maturity model and validate it. The researcher called this background/supportive arrangement of components the 'scientific layer'. The resulting 'core model layer' exposes the 'model's Attributes' that establish the purpose of the models and determine the 'maturity framework' and the 'capability framework'. In the 'applicability layer', organisations implement the components available using instruments to measure the capabilities determining their maturity with an 'assessment framework'. This component requires certain 'organisational inputs' that involves decisions and characteristics from the organisation adopting the model such as the unit of observations (like the company as a whole, the branches or functional departments or processes, etc. to be appraised), participants (like firm respondents, the assessors, etc.) and the 'target BPM maturity' in order to guide the potential improvements. As a result, the as-is 'maturity results' are determined to enable subsequent analysis such as 'comparisons' and 'prescriptions' (improvements) when these outputs are stated in the purpose of the model. The meta-model for BPM-MMs is thus a graphic representation of the generic components of BPM-MMs that reflects their logical instantiations and most evident relationships. In addition, the meta-model is supported with descriptions for each of the components for better comprehension.

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Chapter 4: Assessment Framework for BPM Strategic Alignment

4.1 Chapter introduction

This chapter presents Artefact 2 that consists of the development of a maturity grid as an assessment framework to enable the application of maturity models in organisations. As stated in Chapter 1, Section 1.3, the leading research question for the development of this artefact is: *How can an 'assessment framework' to measure BPM maturity be developed with rigour? (RQ-2a).* Such a framework is meant to address the lack of assessments tools of BPM maturity models, as explained in Section 1.3, the lack of tools available for assessing the maturity of Strategic Alignment. After determining that the assessment framework to be developed was a maturity grid, the research question was then specified and scoped for one capability in the context of the BPMMM by de Bruin and Rosemann (2005). The scoped question is: *How can BPM Strategic Alignment capabilities be described at different levels of maturity? (RQ-2b).* This research question led the maturity grid to be populated with content about strategic alignment capabilities.

This chapter firstly introduces the concept of 'maturity grids' in Section 4.2. In Section 4.3, the approach for developing the maturity grid is outlined as a Design Science Research (DSR) project to build this artefact. The same section explains how the cells of the maturity grid were populated with content from the literature applying Content Analysis ton relevant documents about BPM-MMs. The results of the Content Analysis process, i.e., the maturity grid filled with descriptors, is presented in Section 4.4. Finally, Section 4.5 provides a summary of this chapter.

4.2 Maturity grids and scoring rubrics

In Chapter 1, Section 1.3, a background to maturity grids and their link with BPM maturity models was presented. The use of maturity grids has been in part eclipsed by the more robust structure of CMM staged maturity levels where different sets of capabilities are relevant at different levels of maturity (e.g., McCormack & Johnson, 2001; Object Management Group, 2008). However, maturity grids are still found in some of the most popular BPM models (e.g., Fisher, 2004; Hammer, 2007). One advantage of maturity grids is their simplicity in enabling self-assessments of maturity for businesses seeking fast and inexpensive alternatives (Maier et al., 2012). This study presents the development of a maturity grid to simplify the application of a BPM maturity model.

Maier et al. (2012) developed a procedure to design maturity grids. The procedure comprises four steps: (i) Planning, where the goals, audience, scope and success criteria are defined; (ii) Development, which considers selecting the process areas or capabilities, maturity levels, cell text and administration mechanism; (iii) Evaluation; where the validity and the reliability of the assessment are judged; and (iv) Maintenance, which

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includes benchmarking for checks, results database, documentation and development process. Although the procedure is broad, covering the scoping phase to the maintenance of the maturity assessment post-application, its development steps fall short in details, especially when determining the content of the cells of the grid. Given the lack of further references to bridge this gap, the researcher explored Assessment theory, where scoring rubrics have traditionally been developed for qualitative assessments.

The concept of a 'maturity grid' and its utility as an assessment enabler is similar to the use of scoring rubrics or marking sheets in a Criterion-referenced assessment (CRA) approach in education. The assessor uses the rubrics to measure the performance of the students against predefined criteria (Le Brun & Johnstone, 1994). Another approach is the use of norm-referenced assessments, where the assessor determines the results "according to a preconceived notion of how the distribution of grades will turn out" (Dunn, Morgan, O'Reilly & Parry, 2004, p. 22). However, the CRA approach is closer to maturity models because the level of maturity is idiosyncratic for each organisation, and there is no known norm that dictates the appropriate 'target maturity' an organisation should aim for taking into account its characteristics.

Scoring rubrics are made up of two main components: Criterion and Standard. 'Criterion' is defined as "a distinguishing property or characteristic of a unit of analysis, by which its quality can be judged or estimated, or by which a decision or classification may be made" (Sadler, 1987, p. 194). 'Standard' refers to "a definite level of excellence or attainment, or a definite degree of any quality viewed as a prescribed object of endeavour or as the recognised measure of what is adequate for some purpose, so established by authority, custom, or consensus" (Sadler, 1987, p. 194). In a scoring rubric, the standards are encapsulated in textual descriptions as requirements or descriptions to reach different scores in the scale of the assessment. The criterion is presented differently depending on the type of rubric. On the one hand, Holistic rubrics considers one criterion for assessing the unit of analysis (in this case, the Strategic Alignment factor) as a whole (Petkov & Petkova, 2006). On the other hand, Analytic rubrics break down the criterion to assess the unit of analysis in different parts and then combine the individual scores to determine the total score (Petkov & Petkova, 2006). This last type of rubric is adequate to measure the maturity of capabilities listed in BPM-MMs because they can be broken down. For example, in the BPMMM, each of the success factors is broken down into five capability areas. Therefore, the measurement of the maturity of a factor can be obtained by measuring the maturity of those capability areas.

Guidelines have been developed for designing analytic scoring rubrics. Across different frameworks, it is crucial that the development of the rubric is aligned with the learning outcomes (determining the strengths and weaknesses from progressing in BPM in the case of maturity grids to take actions) and required tasks to complete (Mertler, 2000; Moskal, 2000). The criterion to assess the assignment should be described, and the scoring scale labelled (Mertler, 2000; Moskal, 2000). When describing the standards for the items of the criterion through the scoring scale, it is recommended to complete the extremes of the scale first (minimum and the maximum score for each criterion) (Mertler, 2000; Moskal, 2000; Scriven, 2007). By contrasting the description of the extreme scores, it is possible to determine the descriptors for the middle score (Mertler, 2000; Moskal, 2000; Scriven, 2007). The contrast between the criteria for top-level performance and bottom level performance is likely to suggest appropriate criteria for the middle level of performance (Mertler, 2000; Moskal, 2000; Scriven, 2007). This comparison process can be followed to determine levels in between until the desired number of score levels is reached. Moskal (2000) states that it is preferable to have a few meaningful score levels than to have many that are difficult to distinguish. These guidelines can also be applied to the development of maturity grids because of the similarities they share with analytic scoring rubrics.

Although the development of a scoring rubric requires to be closely aligned with the activity to be assessed, including the learning outcomes of the specific tasks, and observing examples can support its development too. The Association of American Colleges and Universities (2009) has developed rubrics that have become a reference not only in the United States but internationally. Between 2009 and 2015, these rubrics were accessed by more than 70,000 individuals from more than 5,895 institutions (Association of American Colleges and Universities, 2009). The development process consisted of revising a number of rubrics and related documents for each learning outcome and incorporated additional feedback from faculty experts (Association of American Colleges and Universities, 2009). This approach that consists of examining related rubrics and synthesising them into improved rubrics can also be applicable for maturity grids, given their similarities.

When developing scoring rubrics, it is necessary to assure that the content of the grid is valid and reliable to perform the assessment. Validity can be defined as the degree to which the application of the assessment measures what the study intends to measure (Blair et al., 2013). In the case of a maturity grid, its content is valid if the descriptors are classified in the right capabilities at the right level for adequate measurement of the selected domain. In that sense, completeness of the content, defined as "the degree to which the artefact contains all necessary elements and relationships between elements" (Hevner et al., 2018, p. 14), is also part of the content validity. As a result, the grid should consider a sufficient number of items as criteria to measure the maturity of the intended unit of analysis.

'Reliability' is an essential property for qualitative assessment tools. It is required for both maturity grids and scoring rubrics (Maier et al., 2012; Petkov & Petkova, 2006; Sadler, 1987). 'Reliability' is defined as the property of an assessment that the subject is evaluated consistently by different assessors (Blair, 2015). As a mean to support the reliability in assessments, maturity grids and scoring rubrics use mutually exclusive cells which differentiated content enabling raters to select only one cell (standard) per criterion when judging the subject. For example, in the scoring rubrics developed by the Association of American Colleges and Universities (2009), some descriptors in a cell can be repeated in other cells; however, other descriptors that are different between the cells can help the assessor to compare the content and select one that matches better the observed variable. Therefore, the cells for the same criterion are mutually exclusive because the overall content has differentiators to facilitate the selection of a cell in the rubric. Breaking out the criteria into different components may increase interrater reliability because it provides more accurate explanations for each criterion for assessors (Wiggins, 1998). This principle can be applied to maturity grids.

4.3 Approach for developing and evaluating the maturity grid

The problem of measuring BPM maturity is 'wicked' by nature, meaning there are many alternative ways to address it. Still, it is difficult to draw generalisations due to the variety of solutions in idiosyncratic contexts. This type of research problems is suitable for the DSR approach where the solution to the wicked problem is sought by designing an artefact (Hevner et al., 2004; Kuechler & Vaishnavi, 2008; Pfeffer & Sutton, 1999). In this research, the DSR framework from Hevner et al. (2004) has been applied as the overarching method to develop the 'assessment framework' as an artefact. Hevner et al. (2004)'s guidelines have been often employed in designing maturity models or related frameworks and tools (e.g., Becker et al., 2009; Mettler, 2011; Pöppelbuß & Röglinger, 2011; Röglinger et al., 2012; Van Looy et al., 2012). The proposed 'assessment framework' will comprise a newly developed maturity grid that describes the capability areas of the BPM Strategic Alignment at different levels of maturity, complemented with heuristics guidelines for its application. The DSR framework is the overarching approach that guided the development of a maturity grid as an artefact that solves the problem of the lack of assessment frameworks in BPM maturity models. However, specific research methods such as content analysis and creative evaluation processes were incorporated into the research design for specific outcomes. Figure 9 displays this project arranged as a DSR artefact that involves these other methods, with inputs and outputs for each phase.

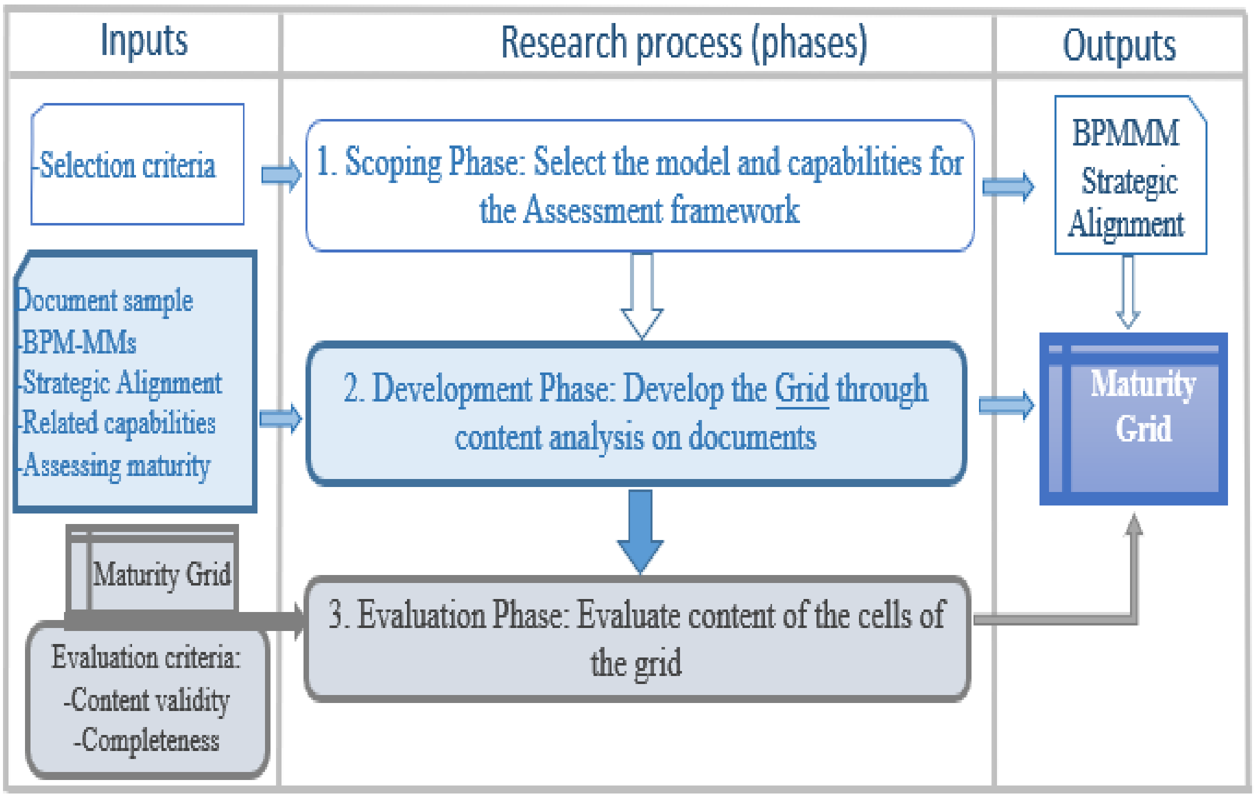

Figure 9. Research design for Artefact 2 framed in DSR

As depicted in Figure 9, three phases were considered to scope, develop, and evaluate the maturity grid. The inputs for completing the grid are initially extracted from available documentation presented in maturity models and applications (i.e., case studies, action research, DSR, or any naturalistic evaluation of the models).

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Then, the content of the grid, i.e., the summaries of the standards encapsulated in the grid, are evaluated in terms of supporting evidence and their placement in the grid to ensure progression through the maturity levels. The evaluation of the grid through empirical evaluation methods, such as in-depth interviews was beyond the scope of this research. However, the findings presented in this chapter are linked to an interview plan for further evaluation of the maturity grid.

The next sub-sections contain the details for each phase, from the selection of the maturity model to the evaluation of the grid for the particular maturity model.

4.3.1 Scoping phase: Selection of the model and capabilities for the assessment framework

This sub-section explains the selection of the model BPMMM by de Bruin and Rosemann (2005), in particular, the Strategic Alignment capabilities, as introduced in Chapter 1.

To design a suitable assessment framework for a BPM-MM, it is necessary to define which BPM maturity is to be assessed since the notion of maturity can vary from model to model, as well as the constructs that it involves; in particular, the items within the 'capability framework'. Therefore, it is necessary to scope the assessment in the context of one specific model.

The selection criteria for the model considered: (i) research impact (citations), (ii) being still in force, (iii) rigorous and transparent research methods for its development, (iv) empirical validation through application in organisations, (v) focus on business capabilities rather than process capabilities, (vi) availability of the content, (vii) lack of assessment instruments for its application.

The aforementioned criteria led the researcher to the selection of the BPMMM (Business Process Management Maturity Model) by de Bruin and Rosemann (2005) because it fully satisfies these criteria:

(i) This model has a high impact being the most cited one (Tarhan et al., 2016)
(ii) It is still in force, reflected in adoptions reported in recent and relevant publications (Dumas et al., 2018; Kerpedzhiev et al., 2017)
(iii) It has incorporated scientifically grounded capabilities following rigorous methods for determining them such as Delphi studies (de Bruin, 2009; de Bruin & Rosemann, 2007)
(iv) It has been empirically validated (de Bruin, 2007, 2009; de Bruin & Doebeli, 2015)
(v) It considers a holistic (enterprise-wide) viewpoint of BPM rather than a narrow process focus (aims for organisational maturity to support BPM initiatives instead of process maturity)
(vi) Its content is publicly available (key documents accessible to be reviewed)
(vii) Regardless of the greatly cited 'capability framework' that this model exhibits, its applicability is hindered by a lack of assessment instruments. Therefore, it is highly likely that this model would benefit from being complemented with a maturity grid as its missing assessment framework.

As a result, the design of the grid was conditioned to the constructs and characteristics of the selected model. Time constraints did not allow for the development of an assessment framework for the complete model and its six factors that each group five capability areas, so the next scoping step was to select one factor.

The selection criteria for the factor to be provided with a maturity grid were: (i) has been validated as a critical success factor (CSF) (ii) links with the business performance and relevance in organisations, (iii) a capability area included in other BPM-MMs, (iv) lack of assessment instruments, (v) availability of information for its capabilities.

Considering these criteria, 'BPM Strategic Alignment' was selected. This factor was introduced in Chapter 2, Section 2.3. and addresses the criteria as follows:

(i) It is supported as a CSF by Bandara et al. (2007); Hernaus et al. (2012); Neubauer (2009)
(ii) As mentioned by Trkman (2010, p. 128), "in order to reach long-term success and improved performance, BPM must be linked to the organisational strategy". Also, the involvement of the top management level to provide strategic direction is critical (Hernaus et al., 2016).
(iii) In Chapter 2, Section 2.3, it was mentioned the strategy is included explicitly in some models (e.g., de Bruin & Rosemann, 2005; Fisher, 2004; McCormack & Johnson, 2001; Rohloff, 2009a) and implicitly under other capabilities in others (E.g., Fisher, 2004; Hammer, 2007; Harmon, 2009; McCormack & Johnson, 2001; Object Management Group, 2008; Rohloff, 2009c).
(iv) As mentioned by de Bruin and Rosemann (2006, para. 1), "despite this wide-spread support, little is known about how the strategic alignment of BPM can be actually operationalised".
(v) Strategic Alignment is the only capability that is further described by the authors in a separate paper (i.e., de Bruin & Rosemann, 2006) which makes this research more feasible because it enables a better understanding of the context for this capability and its facets.

As a result, the BPM SA factor from the BPMMM and its six capabilities was selected as a capability framework to be combined with the maturity framework to produce a maturity matrix that enables the assessment of these capabilities.

4.3.2 Development phase: Building the maturity grid

This sub-section describes the document analysis process to discover evidence-based descriptors for BPM Strategic Alignment capabilities at different levels of maturity. Each step to derive the document analysis will be detailed in this section, including some preliminary results to provide the context to subsequent steps.

The goal of the document analysis is to provide the missing information in the selected model by information from other documents to describe how the capabilities look at different levels of maturity. Elo and Kyngäs (2008) propose a parsimonious qualitative approach for executing Content Analysis in a systematic manner to find structured knowledge. Such an approach contemplates the two major thinking approaches to follow it - deductive and inductive content analysis. In this case, the researcher looked for descriptions of maturity based on given information from the taken model (the BPMMM), which corresponds to the deductive approach. The earlier steps of the development grid followed a Systematic Literature Review (SLR) that enabled the researcher to obtain descriptions for the capabilities of the models and levels. The SLR framework selected was the one developed by Bandara et al. (2011) because of its detailed use of software utilised in the review

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process, which was also applicable for the content analysis. Figure 10 presents an overview of the five steps of the content analysis on documents that were performed.

The specific techniques for developing and evaluating the grid were derived from a range of methods and frameworks borrowed from maturity grids design (Maier et al., 2012) to guidelines to develop scoring rubrics such as the described ones in Section 4.2. In addition, the researcher observed maturity grids in the BPM domain (e.g., Fisher, 2004; Hammer, 2007; Leonardo consulting, 2019) and scoring rubrics as examples to consider in the design of the grid and narrative of standards. Section 4.2 explained how this approach allowed the Association of American Colleges and Universities (2009) to build a number of scoring rubrics for different types of assessments in education. This approach is suitable for developing the maturity grid considering the abundance of maturity models that considers eclectic capabilities but have overlaps in their content (models constantly building upon others) and similar maturity scales (CMM). The intended artefact, a maturity grid for BPM Strategic Alignment, synthesises standards for measuring the maturity of BPM Strategic Alignment capabilities by examining existing maturity models, combined with insights from experts in the BPM field with experience measuring or studying maturity. Figure 10 reflects this mixed approach aligned to different sections of the grid.

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Step	Activity	Outcome	Approach
Prep	Preparation before Literature Review and Content analysis	Documents collection, unit of analysis, data quality checks, NVivo Codes	Sampling
Development steps to build the BPM maturity grid			
1	Provide definitions for capability areas	-Descriptions of capability areas of Strategic Alignment -Key words for search -Re-labelling/re-arrangement of capability areas	SLR
2	Provide definitions for maturity levels	-Descriptions of maturity levels -Key words and criteria for classifying -Relabelling of levels	SLR
3	Identify descriptors of maturity for each capability at each maturity level	-Cells of the grid populated with mutually exclusive descriptors as standards for determine maturity per capability area	Content Analysis
3.1	Code descriptors found in the literature by precise mapping of the capabilities with the specific levels or using imprecise level codes for unclear levels	-Collection of fragments from the literature as potential descriptors	Content Analysis (deductive)
3.2	Analyse precise codes and arrange fragments into themes	-Fragments grouped in themes for each capability area at an specific level	Content Analysis (inductive)
3.3	Analyse imprecise codes and attempt to reassign the fragments into specific levels (Extreme levels first and then intermediate)	-Richer themes with more fragments as evidence for the capabilities at the specific levels -New themes at the specific levels	Content Analysis (deductive)
3.4	Synthesise themes coded into precise levels and their themes for each capability area	-Shorter, simplified and mutually exclusive themes	Content Analysis
4	Design the grid: In the layout, write up the synthesised themes into the cells of the maturity grid as descriptors (standards)	-Synthesised maturity grid with descriptors for each capability at each maturity level	Grids and scoring design)
Quality checks as pre-evaluation of the maturity grid			
5	Identify weaker descriptors in each cell based on evidence found (number of references)	-Indicators of evidence for each descriptor -Questions to be clarified with experts	Analysis
6	Inter-level analysis for each capability to ensure progression and mutual exclusivity of descriptors	-Identified incongruences with descriptors of the levels (progressive coverage and proficiency) -Identified cells that are not mutually exclusive	Analysis
Identification of heuristics for the application of the grid			
7	Identify processes and methods for determining BPM maturity from reported applications	-Heuristics for the application of the grid	SLR

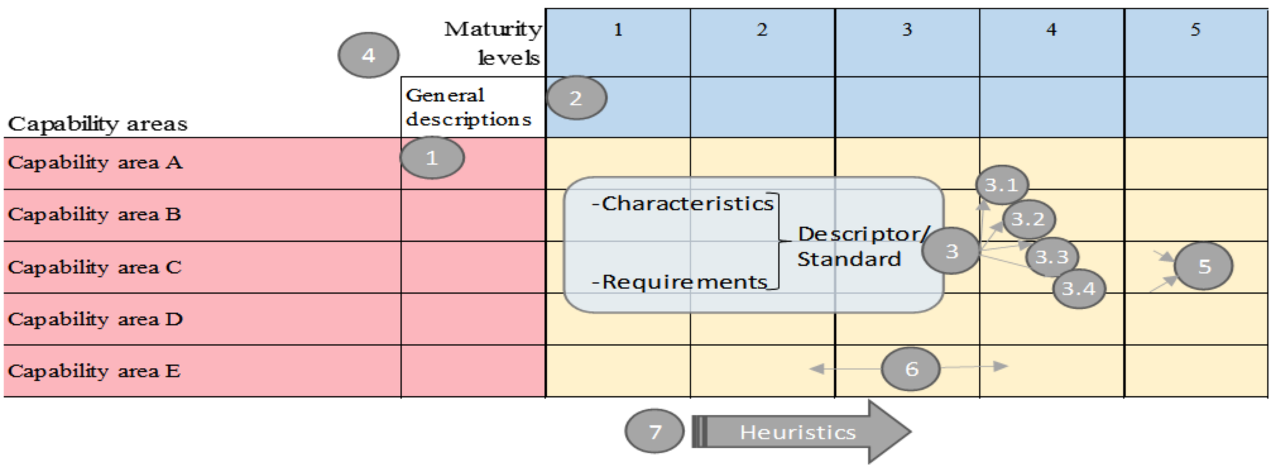

Figure 10. Overview of the steps for developing the document-based maturity grid and the areas of the grid that the steps address.

In the preparation step, the unit of analysis is defined as a 'fragment'. 'Fragments' are the sentences, paragraphs, tables, or figures found in the literature that contains information related to the capability at a certain maturity level (specific or broad). The fragments are analysed and synthesised into groups to create themes that will be the descriptors of a capability at a maturity level (the cell that intersects the capability and a specific maturity level).

The technique in use is manual coding of the papers using NVivo, complemented with keyword search to ensure that relevant facets of the capabilities contained in the sample have been covered. Once a keyword is identified, however, it is examined in its context to determine the relevance of potential fragments to be coded. The tool for coding and analysing is NVivo 12.

The steps described for the development process of the grid are designed to populate the three different areas of the grid: the capability areas as the criteria to assess BPM-Strategic Alignment (left column of the grid with the separated five capabilities), the maturity levels as the scoring scale to determine the level of BPM-Strategic Alignment in an organisation (top row of the grid with the separated five levels) and the descriptors of the capability areas at each of the maturity levels as the standards to assess the maturity of each capability area (cells that are at the intersection of each capability area and the maturity levels). Each of the areas of the grid was developed in different steps and followed different approaches, requiring different samples. However, as shown in Figure 11, some groups of documents are utilised for different areas of the grid.

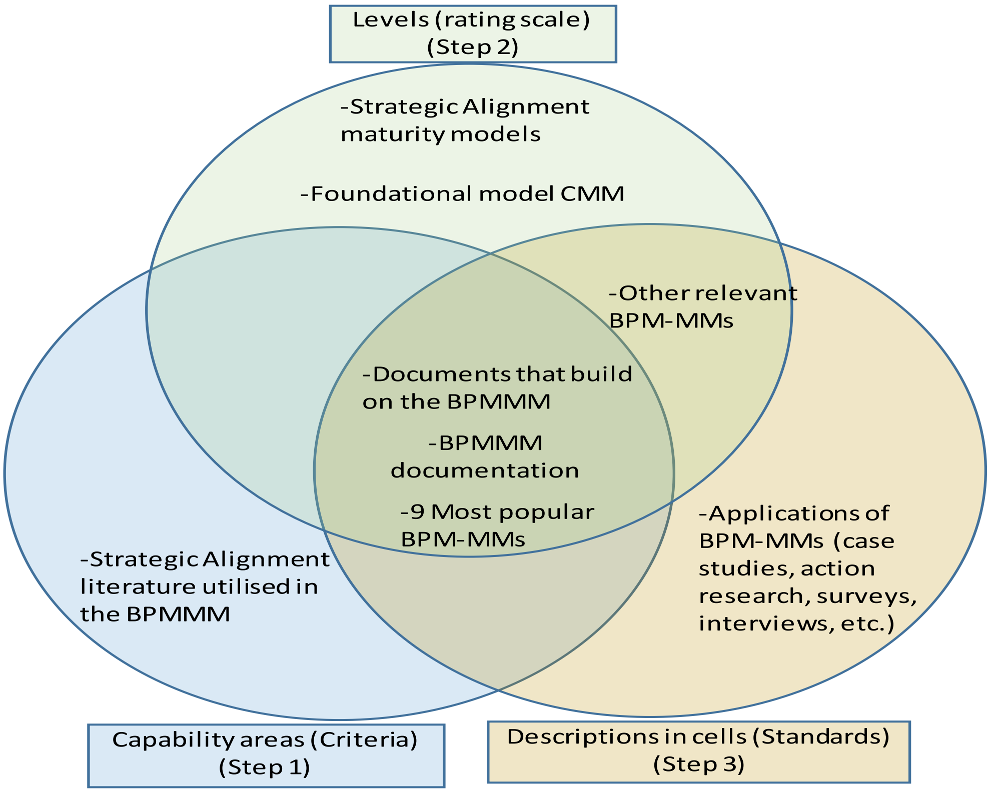

Figure 11. Document sample overlaps per maturity grid area

Table 6 provides a description for each sample group for developing the document analysis, including the related area of the grid and some reference examples.

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No	Sample group	Description	Maturity Grid area / Step	Example of references
1	BPMMM Documentation	Documents from the original model	-Capability areas (1) -Maturity levels (2) -Descriptors in cells (3)	de Bruin (2009); de Bruin and Doebeli (2015); de Bruin, Freeze, Kaulkarni, and Rosemann (2005); de Bruin and Rosemann (2005, 2006)
2	9 Most popular BPM-MMs	Most cited BPM-MMs according to Tarhan, Turetken, and Reijers (2016)	-Capability areas (1) -Maturity levels (2) -Descriptors in cells (3)	de Bruin and Rosemann (2005); McCormack and Johnson (2001); Object Management Group (2008); Rohloff (2009); Fisher (2004); Hammer (2007)
3	Strategic Alignment literature in BPM-MMs	Literature utilised by the authors of the BPMMM to build the theoretical constructs of SA	-Capability areas (1)	Elzinga, Horak, Lee, and Bruner (1995); Hung (2006); Pritchard and Armistead (1999); Zairi (1997)
4	Other documents that build on the BPMMM	Documentation that expand the theoretical constructs of the BPMMM	-Capability areas (1) -Maturity levels (2) -Descriptors in cells (3)	Dumas, La Rosa, Mendling, and Reijers (2018); Rosemann, de Bruin, and Power (2006); Rosemann and vom Brocke (2015)
5	Foundational model documents (CMM)	Documents related to the CMM as the base for the descriptors of the levels of the BPMMM	-Maturity levels (2)	Paulk, Curtis, Chrissis, and Weber (1993)
6	Strategic Alignment maturity models	-Documents that offer levels for Strategic Alignment maturity in general	-Maturity levels (2)	Luftman, Dorociak, Kempaiah, and Rigoni (2008); Sledgianowski and Luftman (2005)
7	Applications of BPM-MMs	Case studies, action research, surveys, interviews, etc. that apply BPM-MMs	-Descriptors in cells (3) -Heuristics (7)	Bandara and Opsahl (2017); de Bruin and Doebeli (2015); Niehaves, Plattfaut, and Becker (2013); Škrinjar, Bosilj-Vukšić, and Indihar-Štemberger (2008); Skrinjar and Trkman (2013); Thompson, Seymour, and O'Donovan (2009)
8	Other relevant BPM-MMs	BPM related maturity models from practitioners with documentation available	-Descriptors in cells (3)	Heller and Varney (2013); Leonardo consulting (2019); Melenovsky and Sinur (2006); Wilkins (2010)

Table 6 Sample groups for developing the document analysis

- **Step 1: Define the capability areas**

In *step 1*, the researcher seeks adequate definitions of the capability areas by performing an SLR. The dataset for finding the descriptions for the five capability areas of Strategic Alignment (rows) is shown as groups 1, 2, 3, and 4 in Table 6. The selection and review of the sources were executed according to their relevance to the BPMMM, in particular, to the Strategic Alignment capabilities. Hence, the review started with the thesis that hosted the model, followed by the related papers and the references that the authors utilised to develop the Strategic Alignment construct. Documents related to other BPM maturity models were also reviewed when containing capabilities related to BPM Strategic Alignment.

- **Step 2: Define the maturity levels**

After having found definitions for the capability areas, in *Step 2* the researcher continued using SLR with the definitions for the levels (columns), which were elaborated from data following content analysed in a dataset that includes specific maturity models. The inclusion of grey literature is justified by the fact that most of the maturity assessments are performed by practitioners (consultancy firms) rather than scholars. Grey literature is also a source to find up to date models and trends in their application. The sample of documents utilised for this step corresponds to groups 1, 2, 4, 5, 6 of Table 6.

The main purpose of *Step 2* was to observe the level of fit in the 'Maturity framework' component across a number of models. Considering that most of the models have a common foundation, the CMM, it was expected that descriptors for capabilities from one model to another could be transferable as much as the descriptors for the capability areas match. Strategic Alignment maturity models and other related models were also included to observe to what extent the maturity scales of the models are aligned.

- **Step 3: Describe the capabilities at different levels of maturity (standards in the cells of the grid)**

This is the most critical step for the development of the maturity grid and requires the most effort. In this step, the researcher executed a content analysis process following Elo and Kyngäs (2008) as explained in Chapter 1. The content analysis was executed as an iterative process where the information was systematically refined. Step 3 is broken down into four sub-steps to provide a detailed view of the process.

  - **Step 3.1: Codify fragments using 'precise' and 'imprecise' codes for the levels**

Step 3 is initiated once the labels for the grid and descriptions are completed, to identify descriptors for the maturity of the capabilities in the sampled documents to populate the cells of the grid that intersects the capability areas. The descriptors can be found in the literature in two distinct forms. On the one hand, they are presented as characteristics that describe the capabilities as found in maturity assessments. This descriptive approach is usually presented in case studies or action research projects that involve the application of a maturity assessment. On the other hand, the descriptors may appear in the literature as requirements or actions that should be done to reach a certain maturity level for a

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capability. This latter form of descriptors can be found in prescriptive/staged maturity models such as in the BPMMOMG. In either case, this study identified the fragments of the documents that can be related to a maturity level for a capability as 'Descriptors' and put them under the most representative code (nodes in NVivo) that reflects the cell, such as Process Improvement planning_2-Managed. The 25 codes (5 capabilities x 5 levels) were named 'precise codes'.

The name 'Imprecise codes' was utilised when the fragments of the document that describe the state of a capability could not be precisely assigned to a specific level of the maturity grid. The main reasons for such an impediment are: 1) The document does not assign a particular level of maturity in the description (typically presented in a vague manner like low, medium or high maturity, 2) The description of the maturity level of the document does not match with the description of the levels defined for the grid. These provisional fragments were mapped as imprecise codes with levels: undefined, low, medium, high, depending on the given information. They were kept analysing and clarifying them in a later stage once more data was collected to determine patterns that can enable the assignment of these fragments to a specific level in the grid. Finally, the fragments that could not be assigned at the end of the analysis were preserved to be clarified in the third cycle through interviews with experts. The level 'low' in the imprecise code was used to code fragments that could be between level 1 and 2. The level 'medium' served as an imprecise code for level 2 to 4, 'high' was used for levels 4 to 5 and 'undefined' was utilised when lack of further information impeded the classification of the fragment into any code.

Figure 12 illustrates how the fragments were identified in a manual approach complemented with a 'keyword search'. The researcher went through the paragraphs and images looking for links with the capabilities. He also utilised keywords detected from *Step 1* in the NVivo 12 search tool using the predefined codes that represent the capability areas, and the different levels where a fragment can be classified. The screenshot shows three panels: nodes, text search and visualisation of the documents. The nodes panel represents the code structure. In Figure 12-A presents a code for Strategic Alignment and under its general levels and the five capability areas. The last capability area, Process Improvement Planning, is opened to show the codes within it that the different levels where the fragments containing descriptors can be coded. Figure 12-B represent the levels of the maturity models (from 1-initial to 5-Optimising) whereas Figure 12-C shows alternatives when the fragment cannot be disseminated with the given information on the paper to code it accurately in a level of the model, therefore offering a less precise alternative to be clarified in a later step (classified from 0-undefined to 3-High). In the Text search panel, an example is given looking for the keyword "portfolio" (see Figure 12-B). NVivo supports the option to add stemmed words and synonyms to the search from the keyword entered. In this case, the researcher searched for stemmed words, as shown in Figure 12-F to find words closely related to the one used as input. The output of the search is presented in the Visualisation panel. The researcher has selected the option to visualise the words found in the query as Pdf in Nvivo 12 because that enables him to see the context of the word and also other Descriptors that can be potentially

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identified around the keyword found. In the example (see Figure 12-F), the word "portfolio" was found in the graph (among other places) in a document, and the researcher is coding it under the "2-defined" code of the Process Improvement Planning capability area.

Figure 13 displays an example when an imprecise code was utilised because the document did not present a descriptor for a specific maturity level. The fragment (yellow) is classified as evidence of 'weakness' in terms of maturity, reflecting a low maturity level. This fragment is coded as 'low' level because it could fit the descriptors for level 1 or level 2. The precise classification of this fragment into a specific maturity level was possible in a later stage after more information was accumulated and the fragments could be related and compared to others that were accurately classified based on the information given in the document.

A similar example is presented in Figure 14. The coded fragment extracted from Skrinjar and Trkman (2013) provides descriptors for specific levels of maturity while mentioning some relevant capability areas for Strategic Alignment, a precise coding to specific levels is not possible because the maturity scale utilised does not fit with the selected five-points maturity scale.

In Figure 14, an example from Škrinjar et al. (2008), presents a different maturity scale that hinders the mapping of fragments to the scale of the maturity grid. While the descriptions for the extreme levels (i.e., Ad-hoc and Integrated) match the initial and optimising levels adopted for the grid (Initial and Optimising), the two remaining levels (Defined and Linked) cannot be directly mapped onto the three levels of the grid.

One challenge of the coding process was the inclusion of fragments of BPM SA capabilities that are arranged under a different factor in the models. As expected, the capability areas for Strategic Alignment given in the BPMMM model are not always clustered into the same factor in other models. As the coding process performed was mostly manual and implied reading the relevant sections for the selected capabilities in the sample, some fragments included in other factors could be missed. For example, in the PEMM by Hammer (2007), traces of the Process View and Process Architecture can be found under the category 'Process Design' and 'Process documentation' in the 'Process Enablers' group. By using a complementary keyword approach over the sample of documents, the likelihood of missing fragments to code was minimised. The keywords were obtained iteratively when refining the descriptors for the capability areas and as the coding process for the cells progressed. In addition, some fragments can be relevant for BPM SA capabilities but are difficult to spot because they are presented in the literature with little context. For example, Rohloff (2009b) categorises the statement 'Schedule, quality and costs are not predictable' under level 1: Initial, but it is not specified to which capabilities this belongs. This requires a deep understanding of the capabilities intended for synthesis. For example, in this case, the aforementioned statement belongs to 'Process measures' because, in the model, the quality, cost, and delivery time can be indicators to evaluate a process ('Process measures') (de Bruin, 2009).

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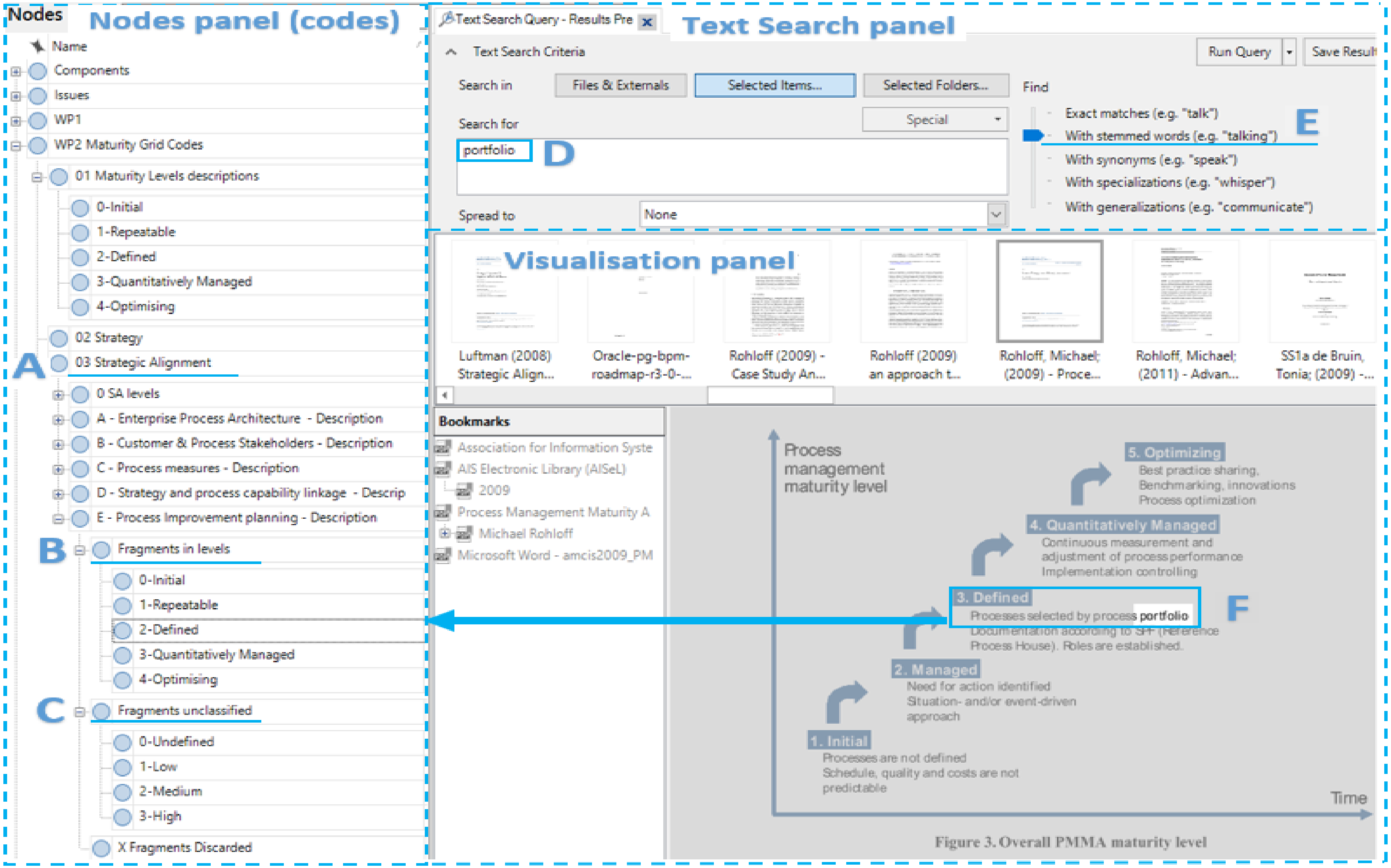

Figure 12. Screenshot of an example using keyword search with NVivo 12

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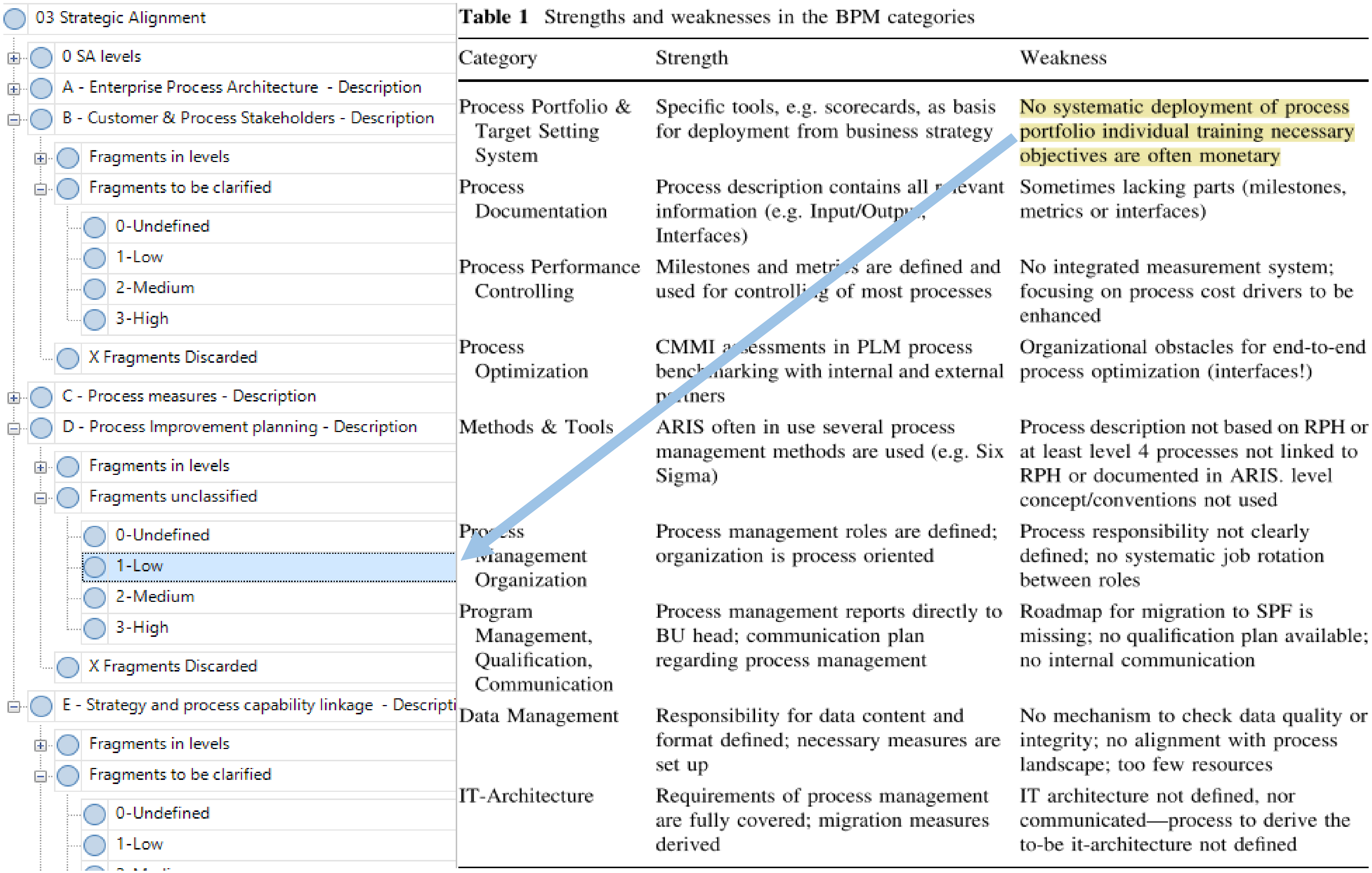

Table 1 Strengths and weaknesses in the BPM categories

Category	Strength	Weakness
Process Portfolio & Target Setting System	Specific tools, e.g. scorecards, as basis for deployment from business strategy	No systematic deployment of process portfolio individual training necessary objectives are often monetary
Process Documentation	Process description contains all relevant information (e.g. Input/Output, Interfaces)	Sometimes lacking parts (milestones, metrics or interfaces)
Process Performance Controlling	Milestones and metrics are defined and used for controlling of most processes	No integrated measurement system; focusing on process cost drivers to be enhanced
Process Optimization	CMMI assessments in PLM process benchmarking with internal and external partners	Organizational obstacles for end-to-end process optimization (interfaces!)
Methods & Tools	ARIS often in use several process management methods are used (e.g. Six Sigma)	Process description not based on RPH or at least level 4 processes not linked to RPH or documented in ARIS. level concept/conventions not used
Process Management Organization	Process management roles are defined; organization is process oriented	Process responsibility not clearly defined; no systematic job rotation between roles
Program Management, Qualification, Communication	Process management reports directly to BU head; communication plan regarding process management	Roadmap for migration to SPF is missing; no qualification plan available; no internal communication
Data Management	Responsibility for data content and format defined; necessary measures are set up	No mechanism to check data quality or integrity; no alignment with process landscape; too few resources
IT-Architecture	Requirements of process management are fully covered; migration measures derived	IT architecture not defined, nor communicated—process to derive the to-be it-architecture not defined

Figure 13. Screenshot of example using provisional mapping codes to later clarify.

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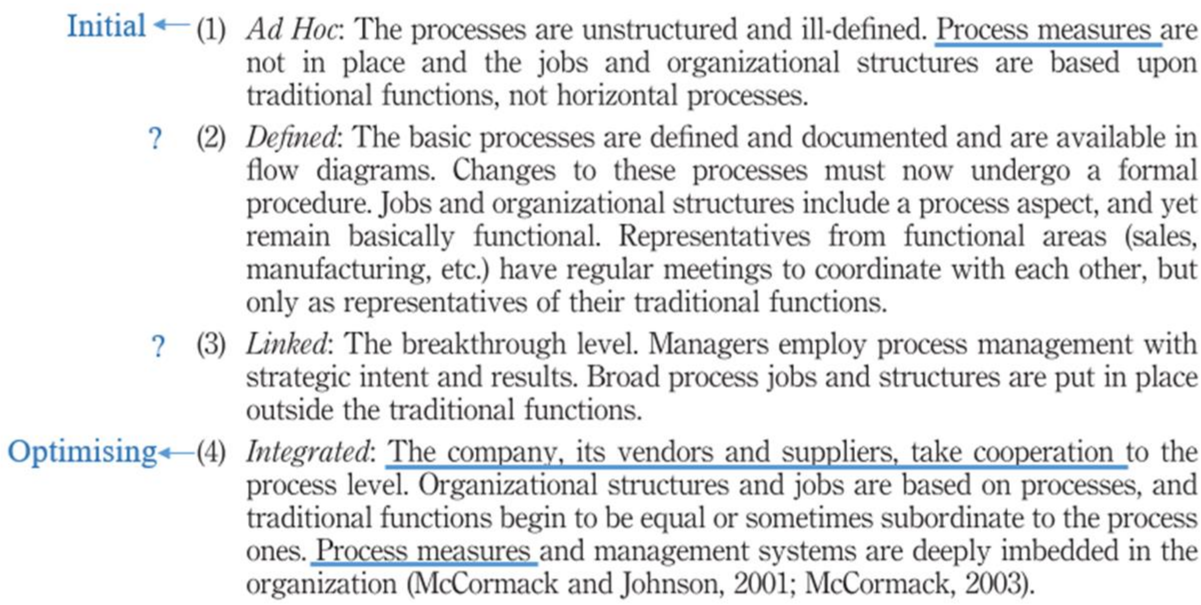
Initial ← (1) *Ad Hoc*: The processes are unstructured and ill-defined. Process measures are not in place and the jobs and organizational structures are based upon traditional functions, not horizontal processes.

? (2) *Defined*: The basic processes are defined and documented and are available in flow diagrams. Changes to these processes must now undergo a formal procedure. Jobs and organizational structures include a process aspect, and yet remain basically functional. Representatives from functional areas (sales, manufacturing, etc.) have regular meetings to coordinate with each other, but only as representatives of their traditional functions.

? (3) *Linked*: The breakthrough level. Managers employ process management with strategic intent and results. Broad process jobs and structures are put in place outside the traditional functions.

Optimising ← (4) *Integrated*: The company, its vendors and suppliers, take cooperation to the process level. Organizational structures and jobs are based on processes, and traditional functions begin to be equal or sometimes subordinate to the process ones. Process measures and management systems are deeply imbedded in the organization (McCormack and Johnson, 2001; McCormack, 2003).

Figure 14. Example of a document with a different maturity scale

It was also necessary to be able to discriminate fragments that refer to same capability areas but are outside the context of Strategic Alignment, belonging to other factors of the BPMMM like (IT, Governance, Methods, etc.). Given the multiple overlaps where the capability areas are repeated in different factors of the BPMMM, there were some difficulties in discriminating information that belonged to the capability but not in the context of BPM SA. For example, in the BPMMM, high deployment of process automation is a sign of high maturity for process view and architecture maturity. However, process automation is a tool to optimise the processes themselves rather than a strategic alignment component. Therefore, it should not be considered in the maturity grid. To bridge this gap, the researcher had not only to gain a deep understanding of the BPM SA capabilities but also to be very familiar with the other factors of the BPMMM to be able to identify them and filter out the content related to them. This implies having reviewed the sections of the other factors and respective capabilities of the BPMMM.

- **Step 3.2: Create themes with the fragments in the 'precise codes'**

In *Step 3.2*, after a thorough collection of descriptors at different levels for each capability, the researcher was able to identify the most salient facets within each capability area based on a number of models and documents referring to a fragment, making the descriptions more accurate and parsimonious by arranging them into themes inductively derived from the coded fragments. Following recommendations from assessment theory, in particular, scoring rubrics development as explained in Section 4.2, the researcher processed the extreme levels first and intermediate levels later (Mertler, 2000; Moskal, 2000; Scriven, 2007). As a result, the order in which the codes were processed was the following: Optimising, Initial, Defined, Managed, Quantitatively Managed.

- **Step 3.3: Create themes with the fragments coded in the 'imprecise codes' and reassign them into 'precise codes'**

After having identified key themes for each capability area in the specific levels, *Step 3.3* mimics the previous step by performing the same process on the imprecise codes with the aim of clarifying them considering the accumulation of knowledge gathered from the previous step. In this step, the fragments contained in imprecise codes were compared to the ones in precise codes in order to rearrange them into precise codes when possible.

Table 7 presents to which of the precise codes the imprecise codes were compared with.

Imprecise Codes	Precise Codes
Low	Initial (1) - Managed (2)
Medium	Managed (2) - Defined (3) - Quantitatively Managed (4)
High	Quantitatively Managed (4) - Optimising (5)

Table 7. Imprecise and precise codes to compare

- **Step 3.4: Synthesise fragments into themes**

Step 3.4 consists of synthesising all the fragments that were possible to code into specific levels and summarising the information within the themes for parsimony purpose. The reason for synthesising the data is to maintain the descriptors as simple to read, as advised in assessment theory (Moskal, 2000; Petkov & Petkova, 2006; Sadler, 1987). The themes considered verbal descriptors and combined multiple fragments. The following excluding criteria for descriptors were considered: Fragments with a focus in other capabilities, or fragments to be moved to another level different from the original in the model where they were presented. Meanwhile, fragments that do not have a shared view (low frequency) of a particular theme were still included in the grid as a separated theme or descriptor in a cell of the grid and would need to be clarified later with interviews. The synthesising process is conducted in MS-Excel where all the fragments from NVivo are deposited to build the grid. The rule is to minimise the number of descriptors by merging them into themes when they refer to the same facets of the capability area.

- **Step 4: Design of the maturity grid**

After having collected the potential information to be included in the maturity grid as outcomes from steps 1 to 3, the researcher had to decide on the layout of the maturity grid, including the sections with content and the manner it is delivered through the grid.

To design the maturity grid, the researcher observed both available maturity grids in the BPM domain such as Fisher (2004); Hammer (2007); Leonardo consulting (2019), and a random sample of five of the scoring rubrics developed by the (Association of American Colleges and Universities, 2009). Considering the outcomes from the previous steps that employed inductive and deductive reasoning, adding creativity to synthesise them in a logical structure using observed grids and rubrics as a reference, requires abductive reasoning (Fischer & Gregor, 2011). As a result, design principles were derived as criteria to guide the design of the artefact.

The design principles observed from the examples are the following:

- Parsimony and integration: Maturity grids and scoring rubrics tend to be self-contained artefacts, meaning that the necessary elements are presented in a succinct manner restricted to physical space (a paper sheet, for example). The heuristics to apply them can be displayed in the same layout in a few simple sentences. There is no need for users to search in other documents to make a decision. Therefore, there is a balance between parsimony and integration.
- Transparency: Maturity grids are normally developed by practitioners, which results in a lack of transparency of the research process to derive them; therefore, their validity cannot be confirmed because the rigour employed in the development is unknown.
- Mutually exclusive cells: The descriptors in the cells always differ and represents different levels of maturity. Therefore, an organisation cannot be represented for two horizontally adjacent cells at the same time.

There is a trade-off between parsimony, integration, and transparency. As a DSR project, rigour is essential and should be transparent. On the other hand, including several elements (integration) in the grid could endanger its parsimony, affecting its utility as a simple artefact that can be used by non-experts. The researcher constructed the grid in a multi-layer design to balance these principles. The essential components are integrated into the maturity grid per se (main layer) with summarised descriptors as standards. Some extra elements like the descriptors of the scale points and the descriptors of the capabilities, are normally not presented in the grids but were considered to be presented because they can have the same labels in other domains or capabilities. For example, in the BPMMM, the capability Process measures can refer to the Strategic Alignment factor and also to Methods. Therefore, their descriptor should be contextualised to that factor. Integrating these descriptors in the grid saves the user from having to explore additional documents. The details of the fragments that back up the standards are presented in separate sheets for those interested in the rigour behind the grid, mainly for academic purposes.

This principle of mutual exclusivity for the cells of the maturity grid is considered in this project. For example, the Process Architecture may be continuously updated for both, level 4 and level 5 of maturity, but an additional descriptor at level 5 including its institutionalised use in the decision-making process may allow the assessor to select the appropriate maturity level.

In the design of both maturity grids and scoring rubrics, it is fundamental to consider the target audience utilising them. In this case, the design considered that the grid could be used for BPM experts measuring maturity as assessors, BPM scholars who use the grid as a reference to build other maturity grids, and BPM novices who want to use the grid as a self-assessment tool in their organisation.

This step also included summarising the themes making textual descriptions to be placed in the maturity grid. In this step, the researcher elaborated the "verbal descriptions" consistently as advised by Sadler (1987) when creating standards, i.e., the descriptors of the capabilities at different maturity levels. To ensure consistency in the language employed to edit the descriptors, the underlying question for each of the cells is:

How is the [capability area X] at [maturity level Y] in an organisation?

As a result, verbal descriptors are presented in the present/past participle form. For example, the descriptor "the process improvements are implemented according to the strengths and weaknesses of the processes based on process metrics", synthesised from Ahlemann et al. (2005); McCormack and Johnson (2001); Melenovsky and Sinur (2006); Object Management Group (2008).

4.3.3 Evaluation phase: Preliminary evaluation of the maturity grid

The next steps (step 5 and step 6) describe the evaluation of the maturity grid. Evaluations of the design artefacts are necessary for ensuring the quality of the artefact (Hevner et al., 2004). The types of evaluations, the criteria and the methods were determined by the designer and researcher accordingly with the artefact.

The content of the grid was evaluated at two levels granularity. In step 4, the descriptors contained in the cells of the grid were individually measured in terms of evidence (references) to identify strengths and weaknesses of the grid. This is a comparative process of the number of references between the different cells. In Step 5, the textual descriptors of the cells were horizontally compared to ensure the progression of maturity for the same capabilities across different maturity levels. The details for each step are provided in the next sub-sections.

- **Step 5: Evaluation of descriptors of the grid**

Step 4 is a quality check for the descriptors of the grid in terms of support from the literature through references. The goal of Step 4 is to identify the weaker descriptors in the grid in order to clarify them in the subsequent phase with interviews with experts. The researcher established as criteria for weaker descriptors that the descriptor has a low number of references as evidence. The researcher incorporated an indicator system for weaker and strong descriptors based on the references (coded fragments). In the grid, the indicators for the references contain the number of references as coded fragments (F: Fragments) that are related to the descriptor, the number of sources (S: Sources), i.e., papers, articles, etc., that refer to the descriptor and the number of models (M: Models) that refer to the descriptor. The number of models that refer to the descriptor (M) is the most important indicator since one model can contain many papers that refer to it with high overlaps of references across many documents (e.g., de Bruin & Rosemann, 2005). For example, for the Customers and Stakeholders capability area, "the needs of customers and the positioning of the products and services in the market are considered to determine the process capabilities and features required" (F:2; S:2 M:2) is made up of two fragments from Object Management Group (2008) and Skrinjar and Trkman (2013) which refer to two different maturity models (BPMMOMG and BPOMM respectively).

In the grid, weaker descriptors were marked with "*" and "*", where "*" means that the descriptor has less than two precise references from documentation related to two different models (M<2) and "*" when the descriptor is only supported by imprecise references from documentation related to three different models (M<3). One example of a weak descriptor is: "The achievement of the business goals is predictable (using predictive models)" (F:3; S:1 M:1) (Object Management Group, 2008). Regardless of having three fragments that refer to this statement, this descriptor for the capability area of process measures at level 4 is weak because the three references come from the same document from the same model BPMMOMG). Figure 15 displays an example of descriptors in the grid with the indicators and marks.

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	4: Quantitatively Managed	5: Optimising
Process view and process architecture	The Enterprise Process Architecture is periodically updated and used extensively by executives and managers (F:1;S:1 M:1)* Processes has been designed to fit with other processes and the IT systems (F:1; S:1; M:1)* There is a systematic design and documentation of processes including attributes and descriptions for quantitative purposes (F:3; S:2; M:2)*	The Enterprise Process architecture is continuously updated and used as the rule in the decision-making process (F:1; S:1; M:1)* The processes has been designed to fit with customer and supplier processes in order to optimize interenterprise performance (F:1; S:1; M:1)* The process architecture integrates processes beyond the organisational boundaries, including suppliers and partners (F:4; S:1; M:1)*
Process Customers & Stakeholders	The processes of customers, suppliers and partners are taken into consideration for adjusting business processes (F:1; S:1; M:1)* The compliance with regulatory bodies is managed (F:2; S:1; M:1)	The strategic objectives are driven by the customer perspective (F:1; S:1; M:1)* Views of the customers and relevant stakeholders (internal and external) are integrated in process improvements and determining adequate process measures to achieve the business goals (F:4; S:2; M:2) (F:1; S:1; M:1) The processes are (re)designed to fit with customer and supplier processes in order to optimize interenterprise performance (F:3; S:3; M:3)* Competitive advantage is driven and shared by partners (F:1; S:1; M:1)*

Figure 15. Example of descriptors with indicators (F, S, M) and weaker descriptors marked

➢ **Step 6: Evaluation of the cells of the grid to ensure progression**

Finally, in *step 6,* the content of the cells for each capability is compared at different maturity levels (horizontal comparison of the cells). As advised in assessment theory, the verbal descriptors should be mutually exclusive and present a congruent progression across the scale as standard for the related learning outcome (Moskal, 2000; Petkov & Petkova, 2006; Sadler, 1987). In this case, the learning outcome is knowing the level of Strategic Alignment maturity of an organisation because the goal of the assessment is to assess it and take further actions for improvements according to the results. In step 6, the descriptor for the maturity levels is taken as a reference point, and the comparison between adjacent cells is performed. The criteria for this comparison are the extent the descriptor progresses in maturity across the scale. Such progression can be tracked in terms of coverage and proficiency according to the original BPMMM. Coverage refers to the extent the capability spreads through the organisation (from siloes areas to the extended value chain of the organisations), while proficiency refers to how often and sophisticated, the capability is presented (de Bruin & Rosemann, 2005).

Figure 16 presents an example of the comparison of descriptors across different levels of maturity for the Process Measures capabilities. While the first descriptor progresses consistently from level 1 towards level 5, fitting the descriptors of the capabilities, the second statement does not seem to be consistent (Figure 16-A). “Quality, cost and time are not predictable” at level 1 has only one reference and is not related to “The value that the process adds to the business is not measured” at level 2. Both descriptors are not progressive evidence for maturity but separated descriptors. Similarly, at level 3, “The value that BPM brings to the business is measured (BPM realisation)” is not clear that progress at level 4 with “The achievement of the business goals are predictable (using predictive models)” as seen in Figure 16-B. This misalignment may imply that:

(i) These statements are invalid, perhaps misplaced in the wrong capability

(ii) Some fragments in the literature were missed out in the coding process

This research was scoped to the evidence obtained in the content analysis process. As a result, the researcher was limited to verify the descriptors and revise the literature and the codes to enhance them if possible. Nevertheless, the researcher presents in Appendix G a detailed plan for in-depth interviews to resolve these issues in future research. Experts could help to clarify these statements and decide whether to keep, change or remove them from the grid.

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Capability Areas	Maturity levels	1: Initial	2: Managed	3: Defined	4: Quantitatively Managed	5: Optimising
	General organisational maturity reference	BPM is nonexciting or rarely used within the organization. BPM projects are carried out in an ad hoc fashion within individual IT or business divisions. The initiatives are uncoordinated and have limited coverage and the employee involvement is minimum. Coverage: Limited to sporadic projects Proficiency: reactive	The organization starts benefiting from on its BPM initiatives to build up BPM capabilities. Employees begin developing a process-thinking mindset. The awareness of BPM increases and the first processes are documented and analysed. There is more involvement in the management level, but knowledge of BPM methods and tools remains with external experts. Coverage: Limited coverage to business units/projects level Proficiency: Repeatable at business units level	The organization increases the benefits of the first BPM projects. The use of methods and tools becomes more sophisticated. Employees start getting trained in BPM to establish it and reduce the dependence upon external experts. The first process collaboration and communication attempt to disseminate BPM success experiences (e.g., using intranets to share process models). Coverage: End-to-end processes across functional areas. Considers strategic goals Proficiency: Standardised, aligned with strategy	Change management accompanies BPM projects to ensure the acceptance of the redesigned/improved processes; systematic performance monitoring guarantee that BPM projects deliver strategic benefits. BPM activities are coordinated by a BPM body. There is process orientation in every project (not only in BPM-specific ones) and the company relies on external expertise is reduced. Coverage: Enterprise-wide Proficiency: Predictable, continuous	BPM is fully settled, on the both operational and strategic level. At the strategic level, BPM has become an integral part of every management activities, accountabilities, and performance measurements. BPM methods and tools are widely accepted and a standardized, company-wide approach to BPM is in place. Coverage: Beyond enterprise (partners integrated) Proficiency: Predictable and adaptable in time
	BPM Strategic Alignment	BPM initiatives none or poorly aligned with the business strategy	Little or some initiatives strategically aligned at project or functional area strategy, not enterprise-wide	Some BPM initiatives strategically aligned with the business strategy	BPM initiatives aligned with the business strategy to a great extent and frequently revised	BPM initiatives continuously aligned with the business strategy and external integration (partners and other stakeholders) through world class
Process measures	The business ability to obtain process performance indicators (PPI) and link them with business objectives, typically measured through key performance indicators (KPIs). In addition to the measurement of process outcomes and outputs, this capability also considers the business ability to track measures through the process (in-process measures)	The measures or KPI are based on functions rather than process indicators with some exceptions for localised and ad hoc purposes (F:2; S:2; M:2) (F:4; S:3; M:2) Quality, cost and time are not predictable (F:1; S:1; M:1)* ? A	Some process measures taken at work unit level or projects (F:10; S:5; M:4) The value that the process add to the business is not measured (F:2; S:1; M:1)*	Key processes has metrics and are periodically monitored against the strategic business goals and KPIs (F:10; S:5; M:5) The value that BPM brings to the business is measured (BPM realisation) B ? (F:4; S:4; M:4)	Relevant process metrics are institutionalized as main performance measures (over functional KPIs) (F:2; S:2; M:2) The process performance is continuously measured in quantitative terms (F:15; S:6; M:4) The achievement of the business goals are predictable (using predictive models) (F:3; S:1 M:1)*	Measuring is systematic, efficient and continuous and proactive, enabling the business to detect opportunities for improvement and avoid errors before they occur (F:8; S:4; M:4) (F:1; S:1; M:1) The organization's improvement activities and results are monitored against the organization's improvement strategies and quantitative improvement goals. (F:5; S:2; M:2) (F:1; S:1; M:1) The measures consider the view of all relevant stakeholders and market dynamics (F:2; S:2; M:2) (F:1; S:1; M:1)

Figure 16. Example of comparative analysis of descriptors for Process Measures at different levels of maturity

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4.3.4 Outline heuristics to apply the maturity grid

Once the maturity grid is completed, Step 7 was carried out; - outlining a flexible process to apply the grid in an organisation as an assessment framework for BPM SA maturity. In this step, documents that report on applications of BPM-MMs that involve maturity assessments were sampled (item 7 in Table 6) to perform a SLR supported by NVivo as in Steps 1 and 2. The unit of analysis for this step was the fragments that were found in the sample of documents in sections that describe the application of maturity assessments in organisations. This included scoping steps, requirements for the assessment, units of analysis of the studies, research methods, data collection techniques utilised, analysis and reporting of results.

4.4 The resulting BPM maturity grid based on document analysis

This section presents the results obtained after having executed the steps described in Section 4.3.2 and 4.3.3, whose outputs represent the content to complete the maturity grid, displayed at the end of this section.

4.4.1 The capabilities of BPM Strategic Alignment and their descriptions

The outcome from Step 1 was a literature review performed to describe the selected factor of the BPMMM, Strategic alignment, and each of its five capability areas is summarised in Table 8.

The main documents that contributed to the definitions in Table 8 were the thesis that presents the maturity model (de Bruin, 2009) and the adaptations made by Dumas et al. (2018). The first one provided the more formal definition (first sentence of each capability and the definition for Strategic Alignment) because the intended artefact aims to measure the Strategic alignment in the context of this model. The second one complemented the definitions in a more explanatory manner. Nevertheless, other documents were useful to facilitate the understanding of these capabilities, their importance for BPM strategic alignment and their theoretical constructs. Most of these documents came from de Bruin and Rosemann (2006) entitled “Towards understanding the strategic alignment of Business Process Management”; the studies followed various research methods such as Delphi technique, literature review and exploratory case study to explain this factor. The references within this paper were also explored because they represent the theoretical source for the constructs.

Due to space constraints in the grid and for parsimony purposes, the definitions were complemented with a series of keywords for each capability that encapsulates some of the facets found in the review. Nevertheless, an extended description of the capability areas is exhibited in Appendix F.

Capabilities	Descriptions
BPM STRATEGIC ALIGNMENT	Continual tight linkage of organisational priorities and enterprise processes enabling achievement of business goals
a. Enterprise process architecture	The capacity of identifying the interrelationships between different type of processes (core value adding processes, support, and management process) and formalise them as an enterprise-wide process framework. It is also considered the decomposition of end-to-end business processes into lower level of abstraction processes and to what extent it captures relevant information (e.g., about process stakeholders) for the decision-making process.
b. Process customers & stakeholders	The capability of capturing the view of different process customers and business stakeholders (e.g., customers, process owners, executives, suppliers, government, legislation) into the processes to achieve business goals, communicate the strategy and comply with the often competing process customers and other stakeholders requirements.
c. Process measures	The business ability to obtain process performance indicators (PPI) and link them with measurable business objectives, typically measured through key performance indicators (KPIs). In addition to the measurement of process outcomes and outputs, this capability also considers the business ability to track measures through the process (in-process measures)
e. Process improvement planning	The business ability to prioritise BPM initiatives for process improvements. This capability considers the establishment of process strategies accordingly with the specific business goals the organisation pursues, which may change considering market dynamics. This capability area includes scheduling process management initiatives such as process reviews to assess the extent to which a particular process contributes to the achievement of the goals. This capability also considers the management of process initiatives as a group, i.e., a process improvement portfolio
d. Strategy & process capability linkage	The capability of stablishing bi-directional feedback loops between the strategy and the business processes. On the one hand, this capability ensure that the processes are able to meet the business goals. On the other hand, it identifies the limitations of the processes to plan the strategy, hence the strategy is adjusted accordingly with the process capacity. This capability area considers how the imbalances between the strategy and process capabilities are managed and solved (e.g., outsourcing, resourcing)

Table 8. Summary of process descriptions and keywords.

4.4.2 The maturity levels of the grid

The CMM model has greatly influenced the maturity scale of maturity models. Even though every maturity model presents its own maturity scale and descriptions, most of them replicate the labels from the CMM by Paulk et al. (1993) with adaptations in the description to contextualise their domain. Table 9 offers a comparison of the labels for the maturity levels/stages presented in different models. Firstly, it presents the levels/stages of the pioneers business maturity models, beginning with the QMMG by Crosby (1979), followed by CMM by Paulk et al. (1993) and the subsequent CMMi (CMMI Product Team, 2002). Then, the levels for the BPMMM are highlighted, followed by the eight most popular after BPMMM, according to Tarhan et al. (2016). Next, seven renowned maturity models offered in industry by reference groups or popular BPM vendors that the researcher has access were included, such as the model of APQC7T (Heller & Varney, 2013), ISO3020 (International Organization for Standardization, 2015), Gartner (Melenovsky & Sinur, 2006), Oracle (Wilkins, 2010), Aris (IDS Scheer, 2009), Appian (Appian corporation, 2010), and Leonardo (Leonardo consulting, 2019). Finally, the specific model for (IT) Strategic Alignment developed by Luftman (2000) and moving more specific to a capability, a model for Enterprise Architecture is presented (Behara & Palli, 2013). The rationale for considering such a mix of maturity models is to observe to what extent the levels/stages of the models are comparable given the broad influence of the CMM which adopted ideas from the maturity grid by Crosby (1979).

As shown in Table 9, the top BPM-MMs present a similar (when not identical) CMM scale that the authors of the BPMMM have adopted to the BPM domain. In the scale, the first level ("Initial" in most of the cases), represents the lowest level of maturity where the BPM efforts and processes are not measured and are isolated or ad hoc attempts.

Notwithstanding, Hammer (2015); McCormack and Johnson (2001) only present a 4 points maturity scale; the missed first level is the "default" where the organisation fails to reach the first level presented, which would match the description for the "initial" level in other models. The levels are comparable and complementary in most of the cases. For example, optimisation is related to integration. The level "Systematic" in Oracle is similar to "defined" or "standardised" ARIS. BPMMOMG also considers "standardised level" as the third one. This may suggest an equivalence between standardised and defined level. Whereas ISO 33000 calls this level 'stablished', indicating stability towards process management practices. Considering the similarities at this level, it is possible to argue that at this level it can be argued that the goal of the capability is "sufficiently" achieved, unlike the lower levels, such the 'initial' where there is no to little maturity and systemic in the initiatives and 'repeatable' level where the capability only supports BPM at business unit levels.

In most of the models, the initial level reflects almost non-existent maturity or no initiatives. In some cases, it is labelled as ad-hoc, meaning that the initiatives in the domain are spontaneously driven according to contingencies rather than by plans. Consequently, this level can be taken as the default level when the organisation assessed fails to reach level 2 (Managed) that reflects that the processes have been identified and there are some metrics to monitor.

Name	Reference	Maturity levels					
QMMG	Crosby (1979)		1: Uncertainty	2: Awakening	3: Enlightenment	4: Wisdom	5: Certainty
CMM	Paulk et al. (1993)		1: Initial	2: Repeatable	3: Defined	4: Managed	5: Optimising
CMMi	CMMI Product Team (2002)		1: Initial	2: Managed	3: Defined	4: Quantitatively Managed	5: Optimising
BPMMM	de Bruin and Rosemann (2005)		1: Initial	2: Repeatable	3: Defined	4: Managed	5: Optimising
BPMMOMG	Object Management Group (2008)		1: Initial	2: Managed	3: Standardised	4: Predictable	5: Innovating
BPOMM	McCormack and Johnson (2001)		-	1: Ad-hoc	3: Defined	4: Linked	5: Integrated
PEMM	Hammer (2007)		-	P-1 E-1	P-2 E-2	P-3 E-3	P-4 E-4
PMMA	Rohloff (2009)		1: Initial	2: Managed	3: Defined	4: Quantitatively Managed	5: Optimising
vPMM	Lee, Lee, and Kang (2009)		1: Initial	2: Managed	3: Defined	4: Quantitatively Managed	5: Optimising
BPOWI	Willaert et al. (2007)			1: Ad-hoc	3: Defined	4: Linked	5: Integrated
BPMMHR	Harmon (2009)		1: Initial	2: Managed	3: Defined	4: Managed	5: Optimising
BPMMFIS	Fisher (2004)		1: Siloed	2: Tactically integrated	3: Process driven	4: Optimised enterprise	5: Intel. operating networking
APQC	Heller and Varney (2013)		1: Initial	2: Managed	3: Defined	4: Quantitatively Managed	5: Optimising
ISO33020	ISO (2015)	0: Incomplete process	1: Performed process	2: Managed process	3: Stablished process	4: Predictable process	5: Innovating process
GARTNER	Melenovsky (2006)	0: Acknowledge Operational inefficiencies	1: Process aware	2: Intraprocess automation and control	3: Interprocess automation and control	4: Enterprise valuation control	5: Agile business structure
ORACLE	Oracle (2010)	0: No BPM	1: Ad-hoc	2: Opportunistic	3: Systematic	4: Managed	5: Optimised
ARIS	IDS Scheer (2009)		1: Initial	2: Managed	3: Standardised	4: Predictable	5: Optimised
APPIAN	Appian co (2009)			1: Enablement (individual)	2: Enablement (project)	3: Enhancement	4: Excellence
LEONARDO	Leonardo (2019)		1: No organised processes	2: Some organised p.	3: Most p. organised	4: P. Managed	5: P. Continuously improved
SAMM (SA)	Luftman et al. (2000)		1: Initial/ad-hoc process	2: Commited process	3: Stablished focused process	4: Improved/ managed process	5: Optimised process
EAMM (PA)	Behara et al. (2013)	0: No EA	1: Initial	2: Under development	3: Defined	4: Managed	5: Optimising

Table 9. Inheritance of the CMM scale across relevant BPM-MMs

Table 9 also includes an example of a specific model for enterprise architecture (EAMM), by Behara and Palli (2013) with a similar approach. However, its scale with six levels of maturity starts with level 0, that means that there is no architecture to be assessed. In BPM-MMs, however, previous measuring of a process architecture, identifying core and support processes is a step towards maturity.

Gartner, Oracle and ISO33020 (all from practice) propose six levels of maturity. However, having a close look into the extreme poles the labels matches the descriptions given by the BPMMM at the initial and optimised levels.

Despite the differences in the scale across models, most of the scales are inherited from CMM, making it feasible to transfer descriptions for one capability at a certain maturity level obtained from one model to another model. For example, BPMFIS by Fisher (2004) presents the labels as siloed, tactically integrated, process-driven, optimised enterprise and Intelligent operating networking. However, by a close examination of the descriptions of the capabilities for each level, the similarities with the other models, including the BPMMM, become apparent. For example, one description at the Tactically Integrated level in the BPMFIS for the process architecture is "limited process reengineering and cross-functional/process coordination (often manual, onetime efforts)" (Fisher, 2004, p. 6), which is line with the notion of BPM focused on the business unit as for the Managed level. Similarly, descriptions for the higher level in the BPMFIS, 'Intelligent Operating Networking', captures the idea of BPM spread beyond the organisational boundaries to integrate stakeholders, which matches the 'Optimising' level in the other models.

As a result of the literature review of the levels, the researcher considered adjustments to the maturity framework of the BPMMM. This modification should not impact the model due to the disconnection between the capability framework and the maturity framework that contains the scale in the model. Hence, the researcher considered using the scale of the CMMi instead of the CMM as given in the BPMMM because it is more up to date and widely known as demonstrated in the review. Moreover, Dumas et al. (2018) has used the CMMi scale to describe the capabilities extracted from the BPMMM model. The descriptions used for the maturity levels were contextualised to the BPM domain, making them more comprehensive for the capabilities accounted. Therefore, this maturity scale was adopted, and the descriptors of the levels were complemented with the notion of 'Coverage' and 'Proficiency' as dimensions of maturity in the BPM initiatives proposed in the BPMMM. In addition, keywords were added to complement the descriptions, as commonalities observed across different maturity scales that overlap in their descriptions. This enhancements to the maturity scale can help to better understand the model. Table 10 presents the maturity framework for the grid.

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Maturity Levels	Descriptions
0: Initial	BPM is nonexciting or rarely used within the organization. BPM projects are carried out in an ad hoc fashion within individual IT or business divisions. The initiatives are uncoordinated and have limited coverage and the employee involvement is minimum. Coverage: Limited to particular projects / Proficiency: reactive Key words: initial, add-hoc, chaotic, siloed, naive (unaware), uncoordinated, siloed, individual efforts, heroic efforts, specialist, low resources, reactive, manual, internal focus, misalignment
1: Managed	The organization starts benefiting from on its BPM initiatives to build up BPM capabilities. Employees begin developing a process-thinking mindset. The awareness of BPM increases, and the first processes are documented and analysed. There is more involvement in the management level, but knowledge of BPM methods and tools remains with external experts. Coverage: Limited coverage to business units level / Proficiency: Repeatable at business units level Key words: Managed/disciplined processes, individual standards
2: Defined	The organization increases the benefits of the first BPM projects. The use of methods and tools becomes more sophisticated. Employees start getting trained in BPM to establish it and reduce the dependence upon external experts. The first process collaboration and communication attempt to disseminate BPM success experiences (e.g., using intranets to share process models). The BPM initiatives start to align with the strategy. Coverage: End-to-end processes across functional areas. Considers strategic goals / Proficiency: Standardised Key words: Standardised, necessary practices for alignment
3: Quantitatively Managed	Change management accompanies BPM projects to ensure the acceptance of the redesigned/improved processes; systematic performance monitoring guarantee that BPM projects deliver strategic benefits. BPM activities are coordinated by a BPM body. There is process orientation in every project (not only in BPM-specific ones) and the company relies on external expertise is reduced. Coverage: Enterprise-wide / Proficiency: Predictable, continuous Key words: Predictable, Best practice/Best class
4: Optimising	BPM is fully settled on both operational and strategic level. At the strategic level, BPM has become an integral part of every management activity, accountabilities, and performance measurements. BPM methods and tools are widely accepted and a standardized, company-wide approach to BPM is in place. Coverage: Beyond enterprise (partners integrated) Proficiency: Predictable and adaptable in time Key words: coordinated, optimised, high expertise, organisational wide coverage, proactive, dynamic, highly automated, network as extended organisation, comprehensive resourcing, measuring BPM realisation, innovative, World class, Agile

Table 10. Descriptions and keywords for maturity levels from Dumas et al. (2018)

4.4.3 The capabilities described at different maturity levels

The results from the content analysis performed in Step 3 (see Section 4.3.2) provided a number of descriptors that were synthesised to be presented in a parsimonious maturity grid. Such descriptors are the standards that belong to the cells at the intersection of the capabilities (criterion) and the maturity levels (scale). Therefore, these standards were required to match both the definitions of the capability and the level where they belong. However, while the descriptors were required to match when a pattern in the document analysis was found, this also was used as feedback for the capabilities. As a result, the descriptors could enhance the definitions and/or keywords for the capabilities and also their labels (name of the capability).

The first capability, namely Process View and Process Architecture, is one example of the feedback that the discovered descriptors provided for the definition of the capability. In the BPMMM, the corresponding capability is named as Process architecture. However, it was found that the term 'process architecture' is restrictive. The content analysis showed that organisations formally developed a 'process architecture' from level 3 onwards. Indeed, such a BPM artefact is considered a requirement to reach the higher maturity levels. However, in lower levels of maturity, only separated processes are identified, and the organisation has a process view to determine its inclination towards a process structure. Considering that the maturity grid is meant to be used as an assessment framework, an assessor could struggle to obtain feedback from the business when the employees are not familiar with a 'process architecture'. As a result, the term Process View was added to the label of the capability because is broader and includes more facets existing in less mature organisations; for example, the extent to which the organisation focuses on functions or processes. The process view also allows the inclusion of facts that can be found at middle levels of maturity, such as the attention that the business pays to maintain and document its processes. At higher levels of maturity, the business has a process focus that goes beyond the boundaries of the company to integrate into the process architecture the processes of stakeholders such as customers, suppliers, and partners.

The 'Process customers and stakeholders' capability is one of the capabilities with fewer references from the document analysis. One of the challenges to discover descriptors for the maturity of this capability was the overlap with the 'People' factor and roles and responsibilities in the 'governance' factor. The use of keywords in the definition of the capability was useful to find more precise information about the type of customers and stakeholders. The term 'compliance' is also relevant to this capability because the organisation also needs to consider the view of regulatory bodies in order to align its strategy and processes. Overall, at lower levels of maturity, it is expected that the business limits the consideration of internal customers and stakeholders, either in isolated projects (initial level) or at functional areas (managed level). From the defined level onwards, the business integrates external stakeholders. Highly mature organisations constantly obtain feedback from the processes of customers and stakeholders, influencing the decision-making process.

The 'Process measures' capability was the most consistent across the sample of documents analysed, resulting in a high number of references synthesised in fewer descriptors in comparison to the other capability areas.

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The use of keywords was particularly helpful to identify fragments scattered in the literature that refers to this capability. For example, the use of KPIs could be linked to BPM methods and tools in other models, but in cases where a 'balanced scorecard' (another keyword) is presented, they are linked to strategic goals. For example, at the 'Defined' level of maturity, the process metrics are periodically monitored against the strategic business goals and KPIs (Fisher, 2004; Heller & Varney, 2013; Object Management Group, 2008). At higher maturity levels, the process measures are more generalised across the organisation that also measures the performance of external stakeholders and how these processes impact on the business performance.

The capability area of 'Process improvement planning' was also consistent across the literature. A noticeable facet within this capability was the process portfolio management, which is non-existent at the initial maturity level. The link with process portfolio and strategy becomes clearer at higher levels of maturity where the process improvement planning is more systematic, and each improvement project needs to be aligned with the business strategy.

The capability area of 'Strategy and process capability linkage' is also weak in terms of references resulting in an imbalanced number of descriptors in the cells of the grid with a little number of references for each. The link between strategy and process capability is non-existent at lower levels of maturity because it is unlikely that the business has developed a process management strategy, except for resourcing the necessary processes to perform the operations (2: managed level). The researcher incorporated the facet of process change as an adaptation to market dynamics proposed by Fisher (2004). In the grid, this capability was positioned after the process improvement planning because this capability area refers to the actual change, improvement or transformation of the process, that happens during the execution of the improvements plans set in the previous capability area.

The descriptors and all the relevant content for each capability and maturity level are presented in Section 4.4.5.

4.4.4 Heuristics to apply the maturity grid

The SLR review performed in Step 7 (see Section 4.3.4) enabled the researcher to determine basic steps based on maturity assessment using maturity models found in the literature. These heuristics include the research approach, data collection techniques, determination of assessment respondents, computation of results, possible documentation to assess and report the maturity.

There are several approaches to introducing a design artefact into an organisation. When performing BPM maturity assessments in organisations, the more dominant approaches are case studies (e.g., de Bruin, 2009; de Bruin & Rosemann, 2006; Rosemann & de Bruin, 2005), action research (e.g., McCormack et al., 2009), and surveys (e.g., Willaert et al., 2007). While surveys rely on questionnaires to collect data, since the BPM SA maturity grid is a qualitative artefact for assessment (like scoring rubrics), it is more suitable to be used in interviews or focus group, in case studies or action research approaches.

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Reports of case studies and action research studies typically start the process in a kick-off meeting, where the goals of the study are communicated, and the scope is set with the organisation, defining the unit of analysis that can be the entire organisation, a subsidiary, or a department (de Bruin, 2009). Also, the key informant needs to be defined and contact scheduled. The approach for determining the informants should depend on the capability to be assessed, but for Strategic alignment, a top-down approach is expected, where the researcher firstly approaches top senior management who decide on the knowledgeable respondents in the organisation (Harmon, 2004). The researcher must organise the appointment for further contacts (interviews, focus groups) in an agenda.

Once the planning phase is completed, data collection steps proceeds. For BPM strategic alignment capabilities, it is required to contact top management (interviews or focus group) to obtain information of the business/unit of analysis strategy (de Bruin, 2009; de Bruin & Doebeli, 2015). Next, the researcher proceeds with collecting data from knowledgeable professionals for the specific capability areas. Table 11 shows indicative roles per capability area that are appropriate for collecting relevant data based on the literature (e.g., de Bruin & Doebeli, 2015; de Bruin & Rosemann, 2006; Harmon, 2018; Rosemann & de Bruin, 2005; Willaert et al., 2007; Willaert et al., 2006).

BPM STRATEGIC ALIGNMENT	Define strategies with the top management and/or executive level
a. Enterprise process architecture	Process architect, process analyst
b. Process customers & stakeholders	Process architect, COO
c. Process measures	Process analyst, CFO, COO
d. Strategy & process capability linkage	Program Manager, CFO, Finance manager, COO, process analyst
d. Process improvement planning	Program Manager, COO, process analyst

Table 11. Capability areas of the model and indicative roles to collect data from

Van Looy (2013b) advises including archival analysis to provide insights, to avoid interrupting individuals or activities and at the same time minimise biased results from respondents. These triangulation methods are also advised in Case study research (Yin, 2017). "Although truly objective verification of conformance is impossible with a maturity model, an effective appraisal technique gathers multiple, overlapping forms of evidence to evaluate the performance of the practices contained in the BPMM" (Object Management Group, 2008, p. 5). Therefore, data triangulation needs to be included to ensure the validity of the data collected.

The assessment duration is also a variable to take into account. The more rigorous the assessment, the longer it will take to be performed, and this is translated in cost for both, the researcher(s) and the business (Van

Looy, 2013b). Harmon (2004) propose some steps for a quick maturity assessment that consists of interviews and visits to the organisations to collect evidence. Harmon (2004) claims that although the 'light' assessment to be conducted in a few weeks is not as rigorous as a formal assessment as the ones for obtaining CMMi certification that can take months; it is still a starting point for organisations to advance in maturity. The heuristics for the BPM SA maturity grid are 'light' assessment whose steps can be incorporated into a rigorous assessment such as a case study or action research.

Once the data is collected, it should be analysed, and the results computed. The most popular maturity grid in the BPM domain at this time is the PEMM by Hammer (2007). This grid is described as a self-assessment tool that is easy and quick to apply and yet can lead executives of organisations to plan process-based transformations, track their progress, and identify obstructions (Hammer, 2007). It is claimed that companies can use the grid across their organizations and perform benchmarking. The heuristics given by the author consist of one assessor (or a group of assessors) relevant to the organisation to go through the descriptors of the grid for each capability and colour the cells according to the extent that they match the organisation. Hammer reflects that the overall maturity level corresponds to one of the capabilities that obtained the lower result in its four-points maturity scale. This view is justified indicating that the low matured capabilities are roadblocks that will impede other capabilities to further increase their maturity as well as the overall BPM approach (Hammer, 2007).

For the BPM SA maturity grid, the selection of the maturity level for each capability must be the best match with the evidence collected; therefore, only one cell for each capability. This is because the grid was developed considering scoring rubrics design principles with mutually exclusive cells for the capabilities.

Finally, once the analysis and the BPM SA maturity has been calculated, the researcher proceeds with providing evidence-based feedback to the organisation. This is the last step for a diagnosis of maturity. Providing recommendations and prescriptions to decisions makers to enhance the capabilities towards an adequate maturity level of maturity is out of the scope in this research.

At the back of the maturity grid (Figure 17), the heuristics are presented as a procedure in Figure 18.

4.4.5 Design and presentation of the maturity grid

The structure of the maturity grid displayed in Figure 17 is a 9x7 matrix in which rows have been indicated with numbers and columns with letters for clear.

The first four rows of the grid are exclusively related to the maturity levels. The first row contains the labels of the maturity scale, ranging from C1 (1: Initial) to G1 (5: Optimising) inherited from the CMMi model as explained in Section 4.3.2, *Step 2*. In row 2, the descriptors for the level are general for BPM capabilities in an organisation. In row 3, the descriptors are narrowed down to BPM strategic alignment. Row 4 presents some keywords that characterise those maturity levels. The purpose of these four rows is to provide a general reference for assessors to classify the maturity of the capabilities considering how organisations and their BPM Strategic Alignment initiatives look at those levels of maturity.

The five next columns contain the descriptors related to the capabilities of the model. The five rows/capabilities in the grid are (5) Process view and process architecture, (6) Process customers and stakeholders, (7), Process measures, (8) Process improvement planning, (9) Strategy and process capability linkage. At the intersection with column A, the label of the capabilities is given, followed by column B with the description for each capability which determination was explained in Section 4.4.2, *Step 1*.

The core area of the grid contains the descriptors for the capabilities at a specific level of maturity. These cells are located at the intersections of rows 5 to 9 and columns C to G. For example, the cell C5 contains the descriptors for the Process View and process architecture capability at a maturity level of 1: Initial. These cells of the grid are populated with the themes synthesised and evaluated as described in Section 4.3.2, *Steps 3* to *5*. They contain indicators for the number of references which are labelled at the bottom of the grid as Fragments (F), Sources (S) and Models (M). The weak descriptors are also identifiable with a "*" sign.

The cells of the grid contain separated descriptors that are different themes with the aim of providing the assessor with distinctive information to use these descriptors to compare the maturity of a capability under examination in an organisation. Then, the assessor can select one cell with those descriptors that better matches the examined capability. Therefore, different capabilities of BPM Strategic Alignment can have different levels of maturity.

For integration and parsimony as design principles, the literature-based maturity grid is presented in two levels of abstraction. Appendix G is a sample of the content that supports one cell of the grid (C5). The complete grid with the supporting fragments for each cell is available at the following link: https://drive.google.com/file/d/1bAKTFMWUx3ylRPx2o_QTVs-NttRRSWMk/view?usp=sharing

4.5 Chapter summary

In this chapter, the concept of maturity grids as useful instruments to perform assessments was introduced. Then, a detailed description of the methods utilised for the development of the maturity grid for BPM Strategic Alignment was given. This research employed Design Science Research as the overarching methodology to develop and evaluate the intended artefact accompanied by Content Analysis for extracting the available knowledge in the literature as a means of content creation for the maturity grid. Some evaluations were performed to assess the quality of the content of the grid in terms of supporting references and continuous progression of the themes of the cells of the grid. The literature-based maturity grid was presented with the heuristics.

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BPM Strategic Alignment Maturity Grid

	A	B	C	D	E	F	G
1	**BPM STRATEGIC ALIGNMENT**	Maturity levels	1: Initial	2: Managed	3: Defined	4: Quantitatively Managed	5: Optimising
2		General Descriptions General organisational maturity reference	BPM is nonexciting or rarely used within the organization. BPM projects are carried out in an ad hoc fashion within individual IT or business divisions. The initiatives are uncoordinated and have limited coverage and the employee involvement is minimum. Coverage: Limited to sporadic projects Proficiency: reactive	The organization starts benefiting from on its BPM initiatives to build up BPM capabilities. Employees begin developing a process-thinking mindset. The awareness of BPM increases and the first processes are documented and analysed. There is more involvement in the management level, but knowledge of BPM methods and tools remains with external experts. Coverage: Limited coverage to business units/projects level Proficiency: Repeatable at business units level	The organization increases the benefits of the first BPM projects. The use of methods and tools becomes more sophisticated. Employees start getting trained in BPM to establish it and reduce the dependence upon external experts. The first process collaboration and communication attempt to disseminate BPM success experiences (e.g., using intranets to share process models). Coverage: End-to-end processes across functional areas. Considers strategic goals Proficiency: Standardised, aligned with strategy	Change management accompanies BPM projects to ensure the acceptance of the redesigned/improved processes; systematic performance monitoring guarantee that BPM projects deliver strategic benefits. BPM activities are coordinated by a BPM body. There is process orientation in every project (not only in BPM-specific ones) and the company relies on external expertise is reduced. Coverage: Enterprise-wide Proficiency: Predictable, continuous	BPM is fully settled, on the both operational and strategic level. At the strategic level, BPM has become an integral part of every management activities, accountabilities, and performance measurements. BPM methods and tools are widely accepted and a standardized, company-wide approach to BPM is in place. Coverage: Beyond enterprise (partners integrated) Proficiency: Predictable and adaptable in time
3		Alignment of initiatives	BPM initiatives none or poorly aligned with the business strategy	Little or some initiatives strategically aligned at project or functional area strategy, not enterprise-wide	Some BPM initiatives strategically aligned with the business strategy	BPM initiatives aligned with the business strategy to a great extent and frequently revised	BPM initiatives continuously aligned with the business strategy and external integration (partners and other stakeholders) through world class practices. Strategic alignment is the rule for every BPM initiative.
4	Capability Areas	Keywords:	Initial, add-hoc, chaotic, siloed, naive (unaware), uncoordinated, siloed, individual efforts, heroic efforts, specialist, low resources, reactive, manual, internal focus, misalignment	Managed/disciplined processes, individual standards, isolated	Standardised, necessary practices for alignment, emergent	Predictable, Best practice/Best class, consolidating	Coordinated, optimised, high expertise, organisational wide coverage, proactive, dynamic, highly automated, network as extended organisation, comprehensive resourcing, measuring BPM realisation, innovative, World class, agile, ubiquitous
5	Process view and process architecture	The capacity of identifying the interrelationships between different type of processes (core value adding processes, support, and management process) and formalise them as an enterprise-wide process framework. It is also considered the decomposition of end-to-end business processes into lower level of abstraction processes and to what extent they capture relevant information (e.g., about process stakeholders) for the decision-making process. Key words: process architecture/framework/landscape, reference process house, process structure, value chain, process catalogue, process models, processes automated, process portfolio	The organisation focuses on functions and there is none or little consideration of processes, therefore no process architecture has been designed (F:5; S:2; M:2) (F:1; S:1; M:1) There is none or few isolated processes modelled but not in use and without capturing their relationships (F:4; S:4; M:4) (F:1; S:1; M:1)	The core and support processes have been identified at business units or project level (F:2; S:2; M:2) Some end-to-end enterprise processes that may involve different functional areas are documented (modelled and described) (F:8; S:8; M:4) Some relationships between processes have been identified as starting point for building a process architecture (F:5; S:5; M:3)	Enterprise Process architecture (or process landscape) is in place as an Strategic Artefact that shows the main processes and their relationship while the business is still organised in functions (F:4; S: 3; M:3) (F:1; S:1; M:1) Value chains and major business processes, usually cross multiple functional units, are defined while the business is still organised around functions (F:3; S:3; M:3)* Process models are documented and maintained in a standard manner across the entire organisation (F:5; S:2; M:2) (F:4; S:3; M:3)	The Enterprise Process Architecture is periodically updated and used extensively by executives and managers (F:1;S:1 M:1)* Processes has been designed to fit with other processes and the IT systems (F:1; S:1; M:1)* There is a systematic design and documentation of processes including attributes and descriptions for quantitative purposes (F:3; S:2; M:2)*	The Enterprise Process architecture is continuously updated and used as the rule in the decision-making process (F:1; S:1; M:1)* The processes has been designed to fit with customer and supplier processes in order to optimize interenterprise performance (F:1; S:1; M:1)* The process architecture integrates processes beyond the organisational boundaries, including suppliers and partners (F:4; S:1; M:1)*
6	Process Customers & Stakeholders	The capability of capturing the view of different process customers and business stakeholders (e.g., customers, process owners, executives, suppliers, government, legislation) into the processes to achieve business goals, communicate the strategy and comply with the often competing process customers and other stakeholders requirements. Key words: stakeholders management, customer, supplier, supply chain, customer dependency, process owner, process participant, process sponsor, stakeholders reporting, extended value chain, compliance	There is none or little identification and consideration of customers and stakeholders of processes and BPM initiatives (F:1; S:1; M:1) (F:3; S:3; M:2) Some cross-functional/process team members are involved in the processes to solve pains (F:1; S:1; M:1)*	Some core processes are evaluated against the applicable laws, regulations, standards, organizational policies, and business rules (compliance) (F:1; S:1; M:1)* There is limited understanding of cross-departmental process needs and dependencies (F:2; S:2 M:2) The individuals and workgroups performing the work provide status of the work to the work unit manager and other relevant stakeholders on a regular basis (F:1; S:1; M:1)*	The organisation identifies relevant stakeholders of the processes and share information of the processes with them (F:1; S:1; M:1)* The needs of customers and the positioning of the products and services in the market are considered to determine the process capabilities and features required (F:2; S:2 M:2) The organisation starts to integrate the processes of suppliers for the resource management process (F:1; S:1; M:1)*	The processes of customers, suppliers and partners are taken into consideration for adjusting business processes (F:1; S:1; M:1)* The compliance with regulatory bodies is managed (F:2; S:1; M:1)	The strategic objectives are driven by the customer perspective (F:1; S:1; M:1)* Views of the customers and relevant stakeholders (internal and external) are integrated in process improvements and determining adequate process measures to achieve the business goals (F:4; S:2; M:2) (F:1; S:1; M:1) The processes are (re)designed to fit with customer and supplier processes in order to optimize interenterprise performance (F:3; S:3; M:3)* Competitive advantage is driven and shared by partners (F:1; S:1; M:1)*
7	Process measures	The business ability to obtain process performance indicators (PPI) and link them with business objectives, typically measured through key performance indicators (KPIs). In addition to the measurement of process outcomes and outputs, this capability also considers the business ability to track measures through the process (in-process measures) Key words: process measures/metrics/output/outcome, process performance indicator (PPI), throughput, defect, waiting time, process performance/realisation, process analytics, process intelligence, balance scorecard, Key Performance Indicator (KPI), process mining	The measures or KPI are based on functions rather than process indicators with some exceptions for localised and ad hoc purposes (F:2; S:2; M:2) (F:4; S:3; M:2) Process outputs such as quality, cost and delivery time are not predictable (F:1; S:1; M:1)*	Some process measures taken at functional level or projects (F:10; S:5; M:4) The value that the process add to the business is not measured (F:2; S:1; M:1)*	Organisational wide processes have metrics and are periodically monitored against the strategic business goals and KPIs (F:10; S:5; M:5) The value that BPM brings to the business is measured (BPM realisation) (F:4; S:4; M:4)	Relevant process metrics are institutionalized as main performance measures (over functional KPIs) (F:2; S:2; M:2) The process performance is continuously measured in quantitative terms (F:15; S:6; M:4) The achievement of the business goals are predictable (using predictive models) (F:3; S:1 M:1)*	Measuring is systematic, efficient, continuous and proactive, enabling the business to detect opportunities for improvement and avoid errors before they occur (F:8; S:4; M:4) (F:1; S:1; M:1) The organization's improvement activities and results are monitored against the organization's improvement strategies and quantitative improvement goals. (F:5; S:2; M:2) (F:1; S:1; M:1) The measures consider the view of all relevant stakeholders and market dynamics (F:2; S:2; M:2) (F:1; S:1; M:1)
8	Process Improvement Planning	The business ability to prioritise BPM initiatives for process improvements. This capability considers the establishment of process strategies accordingly with the specific business goals the organisation pursues, which may change considering market dynamics. This capability area includes scheduling process management initiatives such as process reviews to assess the extent to which a particular process contributes to the achievement of the goals. This capability also considers the management of process initiatives as a group, i.e., a process improvement portfolio. Key words: Process Portfolio Management (e.g., Kaplan), process improvement plan, process prioritisation, process review cycles, process solution	The improvement initiatives happen as a results of individual efforts in ad-hoc manner (F:6; S:4; M:3) Some process improvement initiatives may happen but are not linked to the business goals and the benefits are unclear (F:1; S:1; M:1) (F:1; S:1; M:1)*	There are Process improvement plans to address issues at a particular business unit or functional area (F:5; S:3; M:3) There is some attention to core processes (that add value to customer) when considering improvements (F:1; S:1; M:1)*	The Process improvement planning is systematic and the projects are managed individually or as a BPM portfolio to meet the business strategy (F:4; S:4; M:3) (F:1; S:1; M:1) The performance results are used in setting improvement targets and benefits communicated (F:2; S:2; M:2)	The improvement planning is not only derived from actual process performance measures, but also from quantitative predictions and simulations (F:6; S:2; M:2) The opportunities for improvement are identified from top-down (strategy influencing the processes) and bottom-up (processes influencing strategy) (F:1; S:1; M:1)* The process improvement efforts are supported by the top management levels (F:1; S:1; M:1)*	All process improvement projects are aligned with and monitored in terms of the organizational strategy (F:6; S:1; M:1) (F:4; S:3; M:3) Reviews and updates of improvement portfolio are standard and periodic (F:5; S:4; M:4) Candidate innovative improvements are rigorously evaluated to determine their costs, impacts, and contribution to achieving the quantitative improvement goals assigned to an improvement project (F:5; S:3; M:3) The process portfolio considers external stakeholders and market dynamics for the prioritisation of process improvements (F:2; S:2; M:2)*
9	Strategy and Process Capability Linkage	The capability of stablishing bi-directional feedback loops between the strategy and the business processes. On the one hand, this capability ensure that the processes are able to meet the business goals. On the other hand, it identifies the limitations of the processes to plan the strategy, hence the strategy is adjusted accordingly with the process capacity. This capability area considers how the imbalances between the strategy and process capabilities are managed and solved (e.g., outsourcing, resourcing) Key words: Capability mapping, strategy maps, process enablers, process inhibitors, resourcing, outsourcing	No process management strategy has been defined (F:2; S:2; M:1) (F:2; S:2; M:2) The process capability is a characteristic of the individuals, not of the organization (F:3; S:3; M:3) Process change is reactive to market conditions within 1-2 years, typically chasing a competitor (F:1; S:1; M:1)*	Business units manage the resources required to improve the process according to their needs (F:7; S:5; M:4) Process change adapts/reacts to market dynamics within 12 months (F:1; S:1; M:1)*	The process improvements are implemented according to the strengths and weaknesses of the processes based on process metrics (F:2; S:2; M:2) (F:2; S:1; M:1) The budgeted resources that are available and planned to support the organization's portfolio of products and services are reconciled with the capacity plans. (F:8; S:2; M:1) (F:3; S:3; M:2) Process change reactive to market conditions within 3-6 months, typically chasing a competitor (F:2; S:2; M:2)	The impact of the process improvements are predictable and connected to the business goals (F:3; S:1; M:1) Corrective actions are performed to achieve the goals (F:6; S:1; M:1) -Process change is reactive to market conditions within weeks (S:1; F:1; M:1)*	Proactive improvement actions devised to achieve the process capability required to meet changing business objectives (F:1; S:1; M:1) (F:2; S:2; M:2) The organization's improvement activities and results are kept consistent with the organization's improvement strategies and quantitative improvement goals. (F:2; S:1; M:1) Non-core business processes are outsourced to reduce cost and increase quality (F:1; S:1; M:1)* Corrective actions are performed continuously anticipating any deviation that could prevent the business to achieve the goals (F:3; S:1; M:1)* -The processes adapt to market dynamics in near real-time (S:1; F:1; M:1)*

Labels for reference indicators:

F: Number of coded FRAGMENTS that refers to the statement precisely in the specific level or equivalent	F: Number of FRAGMENTS that refers to the statement unprecisely in the maturity level (low, medium, high level of maturity) and were assigned to the specific level after comparing them with other statements (analytic process)
S: Number of SOURCES that refers to the statement precisely in the specific level or equivalent	S: Number of SOURCES that refers to the statement unprecisely in the maturity level (low, medium, high level of maturity) and were assigned to the specific level after comparing them with other statements (analytic process)
M: Number of BPM maturity MODELS that refers to the statement precisely in the specific level or equivalent	M: Number of BPM Maturity MODELS that that refers to the statement unprecisely in the maturity level (low, medium, high level of maturity) and were assigned to the specific level after comparing them with other statements (analytic process)
*Less than 2 direct references from documentation related to two different models (M<2) have been found	*Only indirect references from documentation related to three different models (M<3) have been found

Figure 17 The BPM Strategic Alignment Maturity Grid

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Heuristics to apply the maturity grid in organisations

Follow the steps below to perform an assessment using the BPM SA maturity grid. This procedure is flexible to perform a qualitative diagnosis in a business environment and can fit with rigorous research methods such as Case studies with interviews or focus groups. It is also recommended to triangulate the data gathered with documents and observation.

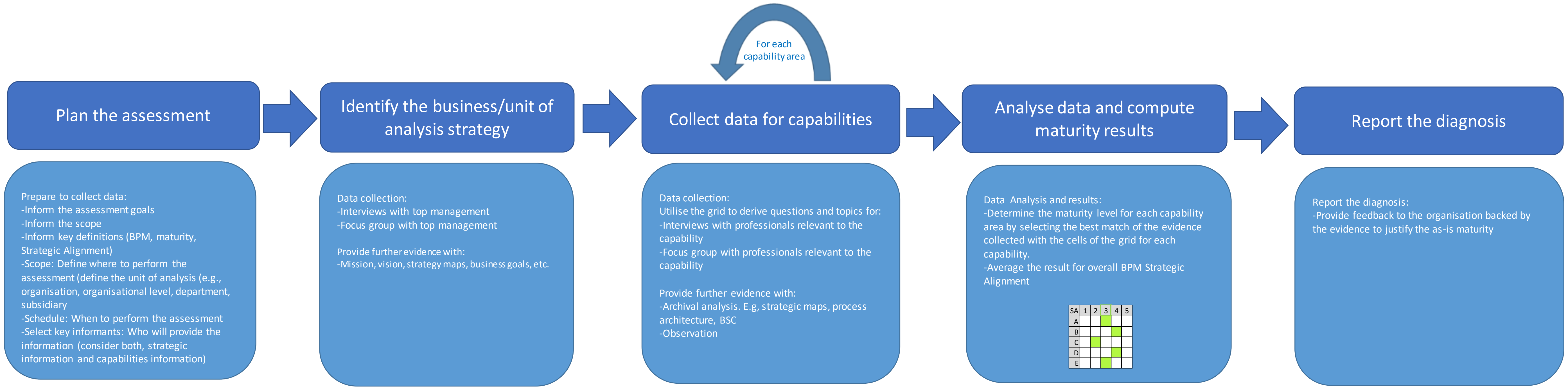

Figure 18. Heuristics for the application of the maturity grid in organisations

Chapter 5: Discussion and Conclusion

5.1 Overview of deliverables and study significance

As motivation for this study, four common challenges of BPM-MMs were identified in this research. The challenges are ill-defined Capabilities (C1), lack of mutability (C2), absence of assessment instruments (C3), and maturity levels not clearly defined nor guided (C4). This research employed a DSR approach to developing two artefacts separately to address the challenges: a meta-model of BPM-MMs (Artefact 1) and a maturity grid (Artefact 2). The meta-model was developed as an attempt to understand the structure of BPM maturity models guided by *RQ-1: What is the structure of BPM-MMs?* The assumption taken was that knowing the components of maturity models can help to address the highly explored, yet unsolved challenges of the models, by linking the issues with specific components and enhance the model from them. For example, one recurrent issue of BPM maturity models is the lack of tools included in the models to apply them (C3). The meta-model identified the component 'Assessment framework' as the target to address this issue. The development of a maturity grid, presented in this thesis as Artefact 2, partially solves this problem because it enables the self-assessment of one set of capabilities for one specific model. The development of a maturity grid was guided by *RQ-2a: How can an 'Assessment framework' to measure BPM maturity be developed with rigour?* After selecting the BPMMM by de Bruin and Rosemann (2005) to be enhanced with an assessment framework for BPM Strategic Alignment capabilities, this *RQ* was rescoped to *RQ-2b: How can BPM Strategic Alignment capabilities be described at different levels of maturity?* Each of the fields of the grid provides descriptors for the capabilities at different levels of maturity.

5.1.1 Summary of the results of Artefact 1, the meta-model

The meta-model identifies 12 generic components of BPM-MMs and their relationships, to outline the structure of the models. The components are instantiated at different stages of the lifecycle of BPM-MMs, reflected in four layers in the meta-model; Scientific, Core Model, Applicability and Outcome layers. They are firstly developed by positioning the 'BPM domain' and exposing the 'underlying theories' that justify the 'Scientific methods' to design the maturity model and validate it. The researcher called this background/supportive arrangement of components the 'scientific layer'. The resulting 'Core model layer' is released exposing the 'Model's Attributes' that establish the purpose of the models and determine the 'maturity framework' and the 'Capability framework'. In the 'Applicability layer', organisations implement the components available using instruments to measure the capabilities determining their maturity with an 'assessment framework'. This component requires certain 'Organisational inputs' that involve decisions and characteristics of the organisation adopting the model, such as the unit of observations (e.g., the company as a whole, the branches, functional departments or processes to be appraised), participants (e.g., respondents from the firm, process owners and assessors) and the 'Target BPM maturity', in order to guide the potential improvements needed to reach the desired level of maturity. Consequently, the as-is 'maturity

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results' are measured to enable subsequent analysis such as 'Comparisons' and 'Prescriptions' (improvements towards the target maturity) when these outputs are stated in the purpose of the model. The meta-model is thus a graphic representation of the generic components of BPM-MMs that reflects their logical instantiations and most evident relationships. The meta-model is also complemented with descriptions for each of the components to be better understood by the readers and users.

While developing the meta-model, it was possible to detect imbalances in the components of BPM-MMs, in that some components always presented while others are pointed to but not included, or simply omitted. The evidence gathered suggests that every maturity model has the components of the 'core model layer', i.e., 'Model's attributes', 'Capability framework', and 'Maturity framework'. For example, every model has attributes, such as a purpose and documentation to be presented in a platform such as a paper-based or an online platform. The 'Capability framework' explicitly addresses capabilities, whether enterprise-wide capabilities or process capabilities, arranges them into capability areas, or provides mechanisms to enhance the capabilities such as BPM practices or the formation of process. Furthermore, all of these need a maturity scale (part of the 'maturity framework' in the meta-model) to describe the range of possible maturity results.

On the other hand, the components in the 'Applicability layer' are often absent or poorly described for proper deployment of the models. This layer includes the 'Assessment framework', 'Organisational inputs' and the 'Target BPM maturity'. The 'Assessment framework' contains the details to perform a maturity assessment in an organisation, such as procedures, questionnaires, and rubrics or grids to describe the capabilities, among other facets. The 'Organisational inputs' explains the decisions to be made by the organisation implementing the models; for example, the goals of implementing the model in the business, what capabilities to assess, by whom, and in which area, and the budget and resources for the assessment and subsequent prescriptions to increase the maturity. This component is also required to customise the models and contextualise them for the organisational environment. The 'Target BPM maturity' is another component neglected in the design of BPM-MMs. In general, BPM-MMs with a prescriptive purpose aim to raise the organisational maturity to the desired state through capability improvements; however, none of the sampled models provides guidelines to determine what is the right maturity, which according to Van Looy et al. (2011a), should be influenced organisational goals.

This weakness at the 'Applicability layer' limits the results ('Outcome layer') of the models in different ways. For example, because of the lack of an objective/standard 'Assessment framework' for the application of the model, the maturity results may vary from organisation to organisation hindering the comparison of the results. Besides, the 'Prescriptions' derived from the maturity results cannot be prioritised when the organisation does not know the adequate maturity to strive for, undermining the prescriptive purpose of the models.

5.1.2 Summary of the results of the Artefact 2, the maturity grid

The maturity grid is a matrix that contains descriptors for each capability of the BPM Strategic alignment factor for each level of maturity. The grid has three main areas: the capabilities as headers for the rows, the maturity levels as headers for the columns and the cells that intersect them as descriptors for each capability at each different level of maturity.

The five maturity levels that represent the scoring scale for the grid are based on the CMMi scale as an updated version of the CMM scale that the BPMMM originally referred to. These levels were also defined from two perspectives to provide richer information for the user of the grid when determining a maturity level of a certain capability: (i) overall organisational perspective, (ii) BPM Strategic alignment (BPM SA) perspective. The organisational view describes how the business looks when the capabilities are at each level of maturity. This also includes the coverage of BPM (to what extent BPM is spread in the organisation, being at the lowest level of maturity when performed in siloes and generalised throughout the organisation at higher levels of maturity) and its proficiency (how often the BPM initiatives are performed and how sophisticated they are). The grid also presents descriptors for the levels considering the alignment of BPM initiatives with the business strategy; at the lowest level, the BPM initiatives disconnected or poorly aligned with the strategy, while at the highest level, continuously aligned with the strategy, going beyond the organisational boundaries by integrating the BPM initiatives and strategies of partners and stakeholders.

The five capabilities of BPM SA taken from the BPMMM by de Bruin et al. (2005) represent the criteria for the assessment of the overall BPM Strategic alignment maturity of an organisation. To facilitate the understanding of such criteria, the definitions for each capability are presented in the grid and complemented with keywords. The capabilities are then described at specific levels of maturity. These descriptors were obtained by examining a representative sample of BPM maturity models that included the most relevant ones in academia and grey literature from practitioners. Therefore, the grid captures the views of maturity for capabilities relevant to BPM Strategic alignment from a variety of models.

5.1.3 Theoretical contributions of Artefacts 1 and 2

Both artefacts developed in this research present a significant contribution to knowledge.

The ***meta-model*** conceptually addresses the four challenges mentioned: ill-defined Capabilities (C1), lack of mutability (C2), absence of assessment instruments (C3), and maturity levels not clearly defined nor guided (C4) (these challenges of BPM-MMs were described in Section 2.4). The meta-model addresses C1 by collecting the diverse terminology from the literature, analysing it and identifying the common denominator to cluster these concepts into a generic component that captures the main characteristics, the 'capability framework'. The researcher observed that regardless of the way the capabilities are labelled, classified, decomposed, or structured, the focus remains on either organisational or process capabilities. C2 was tackled by incorporating the role of contextual factors identified from previous work (such as the 'design principles' developed by Pöppelbuß and Röglinger (2011) and the several studies led by Van Looy

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(Van Looy, 2010, 2013a, 2013b; Van Looy et al., 2014; Van Looy et al., 2010, 2011a, 2011b, 2012) that were clustered into 'organisational inputs' whose function is to collect contextual factors including industry, organisational size, budget, and decisions to implement the model, fitting the model or customising it in the organisation. In the meta-model, the 'Organisational inputs' component interacts with other components. For example, the organisation needs to provide inputs to select the adequate 'assessment framework' for the capabilities they want to measure and mature, and to what extent they need to be matured ('Target BPM maturity'). This component and its interactions with other components like the two in the example given are gaps identified in this research that can be further explored in future research (see Section 5.3). This is one example that depicts that the meta-model can serve as a research gap spotting tool for BPM-MMs.

Table 12 summarises the main contributions of the meta-model to address four challenges of BPM-MM.

Ch	Related components	Contribution
C1	-Capability framework -Underlying theories/facts -Scientific methods	-Identifies 'Capabilities' as the common denominator for different terminology used. -Identifies components under the Scientific layer that are required to provide a foundation to the model that includes the rigorous selection of BPM capabilities through which the model describes maturity
C2	-All components and relationship between them -Capability framework -Assessment framework -Organisational inputs	-Identifies the generic components of BPM-MMs, their functions and relationships that enable the application of design principles to support configurability and reusability. -Identifies the boundaries between the Capabilities, described at different maturity levels by the 'Maturity framework', and the 'Assessment framework' to collect data and apply the model in accordance with the organisational context ('Organisational inputs')
C3	-Assessment framework	-Differentiates assessment instruments and requirements for the operationalisation of the model from the maturity scale (part of the maturity framework) and the 'Capability framework'. -Recognises the influence of 'Organisational inputs', that involves characteristics, decisions, and selection of capabilities to select an 'Assessment framework'
C4	-Maturity framework -Target BPM maturity	-Separates the 'Maturity framework' from the 'Capability framework'. The 'Maturity framework' describes the capabilities through different levels. -Distinguishes the 'Target BPM maturity' and the 'Maturity framework' indicating that the first one represents the criteria that helps organisations to determine the adequate maturity level to guide their 'Prescriptions', framed on the 'Maturity framework'

Table 12. Contribution of the meta-model by addressing current challenges of maturity models.

The researcher's approach to identifying the issues of BPM-MMs by seeing them as deficient systems with missing or weak components is novel and enables future research to focus on components to address the challenges.

The author believes that the meta-model can be generalised beyond the BPM domain to tackle similar problems in other models in the broader IS and Management domains based on capabilities. The challenges mentioned for BPM-MMs summarised in Table 12 also apply in other domains that include software development (CMM), Strategic Alignment, Knowledge management, quality management, project

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management, maturity models among others (Mettler et al., 2010; Pöppelbuß et al., 2011; Proença & Borbinha, 2016; Wendler, 2012). However, in this research scoped to the BPM domain, the generalisability was evaluated for that domain only at the moment. Nevertheless, potential work is listed in the research agenda in Section 5.3, Table 13.

The ***maturity grid*** developed in this research is a vivid example of how the components of the meta-model can be linked with common challenges of BPM-MMs. In this case, the selected model, the BPMMM by de Bruin et al. (2005) was found to lack assessment tools to measure maturity (C3), so a diagnosis cannot be performed in organisations. The maturity grid, as the assessment framework scoped to the BPM strategic alignment (BPM SA) capabilities, helped to connect each of its capability areas with the maturity framework (CMMi scale) by providing descriptions for each capability at each level of maturity, resulting in a matrix structure similar to a scoring rubric. The content of the grid that describes the capabilities of BPM SA at different levels of maturity is an important theoretical contribution to knowledge because the grid synthesises these descriptors otherwise scattered across several BPM-MMs.

A valuable contribution to knowledge from the methods employed to derive the grid is the number of lessons learnt. Far from being a straightforward process, the content analysis method to develop the grid was highly iterative, requiring multiple adaptations to solve emerging challenges during the coding process that could risk its objectivity. To perform the content analysis process of finding fragments from the literature and classifying them into BPM SA capabilities at different levels in a rigorous manner, the researcher needed to address four main challenges: the ambiguity in the description of the capabilities and their maturity, little context for some descriptors of capabilities, the variability in the arrangement of capabilities, the overlaps between capabilities. In the next paragraphs, these challenges and how they were sorted are described.

The first setback was ambiguity in a number of models in relation to the evidence they provide of maturity for specific capabilities (for example, low-poor maturity and high-advanced maturity), making them difficult to be classified in the five-point CMMi scale utilised in the grid. Those fragments were coded accordingly under imprecise levels codes (i.e., low, medium, and high level of maturity). In a later step in the process, they were analysed by comparing them with other statements coded under precise levels (CMMi levels). Matching the fragments from both type of codes it was possible to determine to which maturity level the imprecise descriptors belonged.

Another challenge when coding models was that some information provided little context. For example, Rohloff (2009b) categorises the statement 'Schedule, quality and costs are not predictable' under level 1: Initial, but does not specify to which capabilities it belongs. This requires a deep understanding of the capabilities intended for synthesis. Such knowledge was acquired progressively by moving further in the coding process and analysis. Eventually, the researcher was able to link those fragments with other ones more contextualised and cluster them in a descriptor. For example, the aforementioned statement belongs to 'Process measures' because, in the model, the quality, cost, and delivery time can be indicators to evaluate a process ('Process measures') (de Bruin, 2009).

A third setback encountered was that different models frame the included capabilities differently. This implies that findings regarding facets of a capability for one model could be considered in a different group of capabilities in another model. Consequently, the researcher might fail to spot those fragments of relevant information. The utilisation of keywords-search as a complementary method reduced the risk of missing information. Those keywords were observed processing the accumulated information in NVivo (word frequency) and also determined in a cognitive process based on the understanding of the information.

A fourth difficulty was that overlaps also occur between capabilities of the same model. For instance, process measures in the BPMMM are not exclusive to Strategic alignment, but also related to governance and methods factors. This implies that is necessary to be familiar with other factors (or another unit of grouping capabilities of the model) to judge the content of the fragments to decide whether they belong to the context of the assessment under development and to identify information that belongs to other factors.

Knowing those setbacks of the content analysis processes and the solutions to overcome them up-front is methodological knowledge that can further help researchers and practitioners who aim to develop maturity grids for other capabilities in a consistent and rigorous approach.

Both, the grid as an artefact that synthesised the maturity of BPM SA capabilities across several models and the methods behind its development and evaluation are novel. To date, this is the only BPM maturity grid that focuses deeply on one factor as opposed to grids for overall BPM initiatives that cover more factors superficially. Unlike other BPM maturity grids, the BPM SA grid considers principles and qualities for developing scoring rubrics that facilitate qualitative assessments. Furthermore, the design of the grid is transparent, meaning that the coded material is available in additional sheets of the presented grid to be tracked (see Appendix G as an example). This transparency can underpin the future evolution of the BPM SA grid by enriching the content with future maturity models.

5.1.4 Practical contributions of Artefacts 1 and 2

The researcher expects that this meta-model and the maturity grid will have a notable positive impact on practical work in academia and industry by addressing the needs of diverse stakeholders. Both artefacts have practical contributions for different activities in the lifecycle of a BPM-MM. In Section 3.4.2, a lifecycle of BPM-MM was presented to arrange the discovered components of BPM-MMs according to that cycle, which critical milestones are the scientific development of the model and its application in an organisation. The discovered components were linked with different challenges of BPM-MMs. As summarised in Section 5.1.3, the lack of 'Assessment Framework' was selected as a target for this research because of its negative impact in practice to apply BPM-MMs in organisations. This scope resulted in the maturity grid for BPM SA that represents not only an 'Assessment Framework' for one set of capabilities for a particular BPM-MM but also guidelines to develop maturity grids for other BPM capabilities. Such a

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maturity grid includes guidelines to perform the assessment in organisations based on maturity experiences as mentioned in Section 4.4.4.

Considering the lifecycle of BPM maturity models and the typical activities performed by researchers and practitioners in the exercise of developing, improving and applying BPM-MMs, Figure 19 depicts different usages of the meta-model and the grid. Both artefacts and their subsets underpin through a number of activities linked to BPM maturity models.

Following Figure 19, the ***meta-model*** of BPM-MMs can be used as a blueprint to develop new models or improve/complete existing ones. Instantiating the components of the Scientific Layer of the meta-model can guide the initial steps of scoping and designing a BPM-MM. As the models need to be arranged and communicated, the meta-model suggests instantiating the components at the Core Model Layer, which includes the 'Capability framework', 'Maturity Framework', and 'Model's Attributes' that includes the purpose and packages the model to publish it. Then, the author/improver of the model may need to determine the methods to assess maturity, the organisation's characteristics, requirements, and resources to deploy such assessment, and criteria to help organisations to determine the maturity they should strive for. These decisions are encapsulated in the components at the 'Applicability Layer'. These components directly support the application of the model in organisations that culminates with the analysis of maturity results, benchmarking and outlining of prescriptions, which are captured by the components of the 'Outcome Layer of the meta-model. In addition, as a preliminary step when the practitioner or researcher needs to select a model among various options, this choice can be made through the lens of the components of the meta-model as an evaluation tool (a Proof-of-concept of this application was presented in Section 3.6.2. using an evaluation criteria sheet included as Appendix E). For example, in the two instantiations of models performed using the BPMMM and PEMM (see Section 3.6), it was found that the BPMMM missed the 'Assessment framework' (C3) and the PEMM missed 'scientific methods', among other components. Developers of BPM-MMs (scholars or practitioners) can consider the 12 components, balancing the emphasis on all four layers instead of focusing mainly on the 'capability framework' component and neglecting components in other layers.

The ***maturity grid*** developed in this research contributes to practice by providing comprehensive guidelines to develop maturity grids that can be applied to other BPM capabilities in other models during the Development cycle of a BPM-MM. Typical users that may benefit from such guidelines are academics or practitioners developing new BPM-MMs or enhancing existing ones (like the BPMMM). The grid also presents heuristics that includes how to apply these grid-based assessments in organisations to determine the as-is maturity of business capabilities as a baseline.

The grid has been populated with BPM Strategic Alignment capabilities, which directly enables the assessment of these capabilities, supporting three maturity activities: a) determining the current level of SA capabilities of an organisation, analysing the maturity results as are summarised in the grid, comparing those results at different levels of abstraction or benchmark them at different business units or industries, and determining prescriptions based on the desired level of maturity (Target BPM maturity).

Overall, the users that can benefit from both artefacts are developers or improvers of BPM-MMs who can be researchers or practitioners, and users seeking for performing a BPM maturity assessment or developers of the model that wants to validate a model in a naturalistic environment.

5.2 Limitations of this research

The focus of this research is predominantly conceptual. Conceptual work is important to support the development and implementation of information systems and BPM related activities such as process improvement and process modelling (Wand & Weber, 2002). This also applies to BPM maturity models, highly deployed in industry but lacking common conceptualisation in their components, including the assessment frameworks. Therefore, the meta-model that outlines the structure of BPM-MMs and the maturity grid that is an example of an assessment framework are both conceptual contributions that will support more systematic applications in practice and further research in the field, as described in the previous section.

The specific limitations for each artefact are presented in the next sub-sections.

5.2.1 Limitations for Artefact 1, the meta-model

This research proposes that the challenges of BPM-MMs can be addressed by fixing their components. Hence, the development of the meta-model mainly focused on the overall structure of BPM-MMs by identifying those components. The 12 components and the layers of the meta-model are described in this thesis. Those descriptions, however, may not be sufficient to foresee a solution for the components. Enhancing the components requires deeper studies at the component level. This research, for example, was limited to focus on only one component, namely the 'Assessment framework' of the BPMMM, that was selected to be provided with a BPM maturity grid for BPM SA capabilities only. Nevertheless, having identified the components is paramount for further research at the component level, and the meta-model is useful for spotting research gaps in BPM-MMs. This idea is further explained in Section 5.3.

The data collection technique for identifying the components was a qualitative Content Analysis. And as per many content analysis efforts, the results are limited to the existent content in the sources utilised. Having said that, a well-formulated sample of papers were selected (as outlined in Sections 3.4 and 3.6).

Given that the author of this thesis was the only coder, no inter-coding reliability checks were conducted, which could result in a subjective interpretation of the fragments coded. However, given the volume of documents and the variety of codes, using multiple coders was unfeasible in the given timeframe. Nevertheless, the researcher iteratively enhanced the codes as the data was collected, constantly revising the codes to reduce subjectivity.

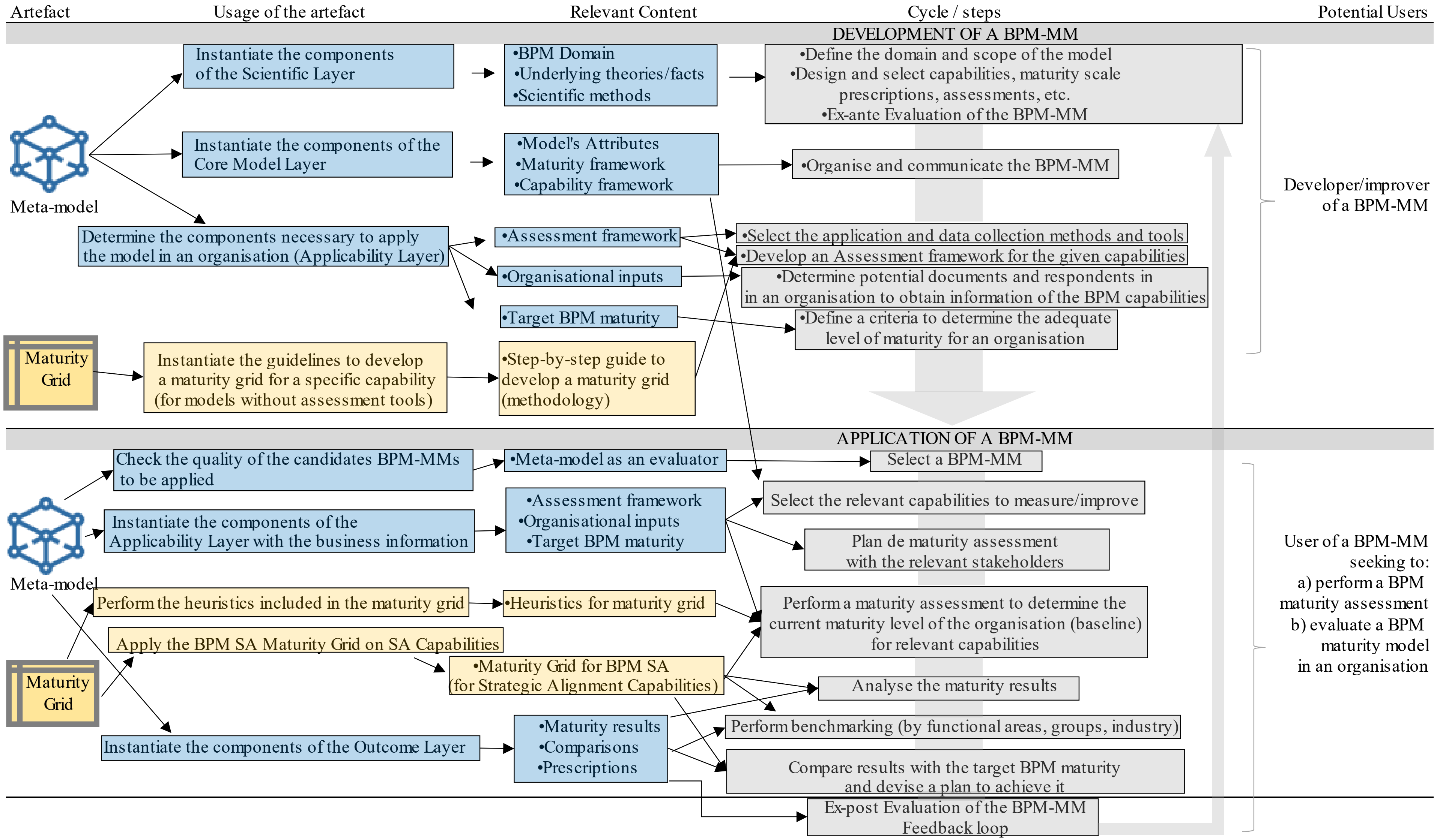

Figure 19. Contributions to practice of the meta-model (artefact 1) and the maturity grid (artefact 2)

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The researcher could witness a gap between what BPM-MMs promise through their documents and what the available information enables. Triangulation with other methods such as interviews or focus groups with practitioners and scholars could help to clarify why this gap exists. However, such triangulation was not possible in the time constraints of the study. In addition, the evaluation of this DSR artefact was limited to artificial/internal evaluation. Naturalistic evaluation with practitioners that deploy BPM-MMs and/or scholars that develop these models could be considered as future research to provide empirical evaluation via interviews or focus groups. Nevertheless, the four evaluations conducted (completeness, generalisability, utility, and theoretical foundation) position the meta-model as a quality artefact to represent the generic structure of BPM-MMs.

5.2.2 Limitations for Artefact 2, the maturity grid

As mentioned with the limitations of the meta-model, the evidence base for the content analysis of the maturity grid also was limited to the sources selected. And the development of the grid did not include inter-coding reliability checks because the process was performed by a single coder.

The resulting BPM SA maturity grid has some other specific limitations that are also acknowledged as per below:

- Descriptors are not up to date: Because most of the widespread BPM maturity model documentation was written between 2005 and 2012, there is a likelihood that the cell of the grid does not capture the most recent states of maturity regarding BPM Strategic Alignment. To minimise this limitation, the researcher included the most recent publications regarding BPM maturity assessments and grey literature from practitioners (e.g., Leonardo consulting, 2019). However, most of the content was extracted from older models.
- Circular referencing in the sample: The development of documentation of maturity models constantly builds on previous work generating repetitive information. This is often the case of multiple papers developed by the same authors of a model where the contribution to the grid of the first article processed is significant while analysing a related paper is minimal because of the overlaps in the descriptions, e.g., (e.g., de Bruin, 2009; de Bruin et al., 2005; de Bruin & Rosemann, 2005, 2006; Rohloff, 2009b, 2009c, 2011). This hinders the efficiency of the content analysis process.
- Imbalance in the number of references as support for the statements: Some descriptors are highly referenced while others are linked to a few citations, casting doubts on whether it is valid to include them in the grid or not. For example, the ‘Process customers and stakeholders’ and ‘Strategy and Process capability linkage’ contain weaker cells because less evidence for these capabilities was found, in contrast to ‘Process measures’ and ‘Process Improvement planning’ that were more supported by existing models.

- Lack of access to practitioners' documentation: Most of the consultants that assess maturity develop their own framework for profiting performing the assessment in organisations. Tacit knowledge is an important input for developing scoring rubrics like this maturity grid (Sadler, 1987)
- Human error in the coding process should also be considered. This can cause quality issues such as missing fragments that could be coded, or fragments coded incorrectly (invalid) that are difficult to detect without an expert opinion.

Although these four challenges could negatively affect the quality of the grid to assess SA maturity, the internal evaluations conducted enabled the researcher to assess the quality and take corrective actions based on reference indicators and comparisons of the content of the cells. Furthermore, the grid as it is, including the indicators in the cells, also provides inputs to address the limitations by interviewing experts with experience measuring BPM maturity. Due to time constraints, performing such interviews was out of scope for this research. A detailed plan to perform such interviews is included in Appendix H. The plan consists of a design for in-depth interviews with exemplary protocols, interview questions derived from the grid, identification, screening and prioritisation of potential participants to respond to the questions, and field forms. All these materials are available in the Ancillary materials which link is contained in Appendix H.

Having developed the conceptual grid is also necessary to conduct further naturalistic evaluations that require the application of the grid in a business environment. These activities could prove the utility, usability, and reliability of the grid as an assessment instrument. This can be achieved by performing a case study or an Action research project. The grid also included heuristics to introduce it in a business environment.

5.3 Research agenda

A research agenda is a desirable artefact in works with intensive literature analysis, as is this research. It provides a set of questions for further research, aiming to extend the review and keep the IS community up-to-date (vom Brocke et al., 2009). In this section, a research agenda is presented considering the development of the artefacts of this study to outline future research avenues for BPM-MMs.

The meta-model of BPM-MMs and the BPM SA maturity grid contribute towards finding solutions to the current challenges of BPM-MMs; however, both artefacts have their limitations, and none of them represents a definitive solution for the challenges presented in Chapter 2, Section 2.3. Nevertheless, the rigorous literature-based processes to develop them, including the Content analysis and Systematic literature reviews under a DSR paradigm enabled the researcher to spot further gaps in BPM-MMs. These gaps can constitute the basis for building a research agenda (Müller-Bloch & Kranz, 2015). As a result, a research agenda is proposed based on (i) gaps identified when analysing the literature/documents during the development of the artefacts, (ii) limitations of the artefacts developed.

This research identified imbalances in the evidence found for components of both the meta-model and the maturity grid. In the meta-model, these discrepancies were manifested when components were implicitly identified from references found in the descriptions, but the mechanisms of the expected components are not presented. For example, this research focussed on the 'Assessment framework' component because while the majority of BPM documents refer to maturity assessments to determine the baseline, i.e., the as-is maturity, and from there suggest improvements (prescriptions), the examination of the models showed that such instruments to measure the maturity were absent. In the maturity grid, the imbalances were revealed when populating the cells for the capabilities at different levels of maturity. Although the content analysis captured descriptors for all the cells of the grid, the quantities of evidence found to support the descriptors were unequal, which suggest that some capabilities of BPM SA are less explored and included across fewer maturity models. This approach to detecting gaps in this study was inspired by the utilisation of concepts matrix proposed by vom Brocke et al. (2009) where blank fields in the matrix were recognised as research gaps.

By developing the meta-model, the researcher detected that many of the components that maturity models should include in order to fulfil their descriptive, prescriptive, and benchmarking purposes, are absent or incomplete. The most critical missed components in the majority of the BPM-MMs are at the 'applicability layer', i.e., the 'Target BPM maturity', the 'Organisational inputs', and the 'Assessment framework', hindering their application in organisations and subsequent outcomes. The 'Assessment framework' component was tacked in this research by providing a maturity grid that connects the 'maturity framework' with the 'capability framework' components of the BPMMM, enabling the assessment for BPM SA capabilities. On the other hand, the relationship between the 'Target BPM maturity' and the 'Organisational inputs' has been unexplored. To the best of the knowledge of the author, there is no study that tells what level of BPM maturity for specific capabilities an organisation should strive for ('Target BPM maturity') given its characteristics (captured in the 'organisational inputs'). In the classification of research gaps proposed by Müller-Bloch and Kranz (2015), this is a 'knowledge void' in the domain and should be addressed.

Another gap that has been highlighted in this study is the generalised adoption and adaptation of the CMM and CMMi scales or similar, with little rationale in maturity models. Since this research is conceptual in nature, developing a new rating scale for the BPM SA grid was out of the scope. Perhaps, instead of using generic maturity scales, the development of the rating scale should consider the model aims and organisational characteristics. For example, the scale for measuring maturity in organisations that are novice in BPM, and that would normally be at level 1 in the typical CMM scale, should be different, so benchmarking can be more accurate for unmatured organisations. Consequently, the agenda considers guiding developers of BPM-MMs to define a maturity scale according to their model, aims, and business characteristics. This can be label as a 'methodological void' considering the classification by Müller-Bloch and Kranz (2015)'s framework.

The analysis of the results of the BPM SA maturity grid allowed the researcher to detect some knowledge gaps in the maturity of some of the capability areas of BPM Strategic Alignment. The capabilities with less evidence of maturity (less supported descriptors) were 'Process customers & stakeholders' and 'Strategy and process capability linkage'. Evidence of process customers (e.g., business clients and consumers and also internal customers like business departments) and stakeholders (e.g., process owners, operators, suppliers, regulatory bodies), can be often found in the BPM literature related to other capabilities such as people, and governance, but not often linked to the business strategy, which is the focus of this capability. Similarly, some models and BPM applications describe how the business allocates resources to reach the process goals, but the realisation of the business strategy through such improvements is not often mentioned. Similarly, examples of processes capacity influencing the business strategy are not common in BPM-MMs. Interviews with experts may help to clarify these gaps. Therefore, such knowledge voids need to be included in the research agenda. As conceptual artefacts, empirical evaluations for the meta-model and the maturity grid were out of scope in this research because of time constraints. This constitutes an evaluation void, according to Müller-Bloch and Kranz (2015)'s classification for research gaps. Ten research gaps that have been identified by this research are summarised in a research agenda in Table 13.

The researcher hopes that the meta-model as a blueprint and the maturity grid as a practical example of an assessment framework will encourage the development of complete maturity models ready to be used. Only then can BPM-MMs evolve based on the feedback they gather and feed the theories to make them more accurate in their results, analysis, and prescriptions. Ready to be implemented maturity models to obtain objective results could underpin research into the empirical validation of BPM-MMs. Moreover, applicable models can enable a feedback loop from cross-organisational results and learn from them, building theory about BPM organisational maturity and progression. Linking results from practice to theory development should inspire the development of BPM-MMs as data collection artefacts for cross-organisational maturity. BPM-MMs can highly benefit from using the technologies of the digital era, such as cloud computing and data mining, fostering innovation and turning more organisations worldwide into digital enterprises.

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Item	Gap/topic	Type of gap to be addressed	Goal	Potential RQ	Methods	Rationale
1	Evaluation of the meta-model: content validity	Evaluation void	Empirical validation of the content of the meta-model	What is the structure of BPM-MMs from the expert's perspective?	-Conduct a focus group or interviews and -Compare the findings with the current meta-model	Focus group is suitable to make or discard consensus about a conceptual model. Interviews can help to inductively determine components of the structure of BPM-MMs and compare them with the meta-model
2	Evaluation of the meta-model: generalisability	Evaluation void	Evaluation of the generalisability of the model beyond BPM. CMM, and others.	What is the structure of maturity models in the IS/management domain?	-Extent Content analysis to maturity models beyond BPM but related to IS/Management, such as CMM, Project Management, Knowledge Management -Focus groups to validate it	The meta-model for BPM-MMs has the potential to be valid for maturity models beyond the BPM domain. This needs to be evaluated
3	Target BPM maturity and Organisational inputs	Knowledge void	Recommend organisations a level of maturity for BPM capabilities to strive for according to their characteristics	What are the organisational characteristics that influence the maturity of capabilities?	-Multi-case study performing maturity assessments -Compare the results based on organisational characteristics	The results obtained from multiple organisations could help to determine patterns considering organisational variables such as to identify patterns on contextual variables (industry, business size, business strategy, etc.)
4	Maturity framework	Methodological void	Guide developers of BPM-MMs to define a maturity scale according to their model, aims, and business characteristics	What maturity scale should be used given the capabilities to measure and the characteristics of the organisations	-Multi-case study performing maturity assessment and comparing the results -Quantitative studies to create measuring scales	The majority of BPM-MMs utilises the CMMi scale or other similar, with little rationale. The CMMi scale was developed for a large organisation and its application in small businesses, for example, could be inappropriate
5	Evaluation of the content of the maturity grid	Evaluation void	Evaluate the content validity and completeness of the maturity grid	How do experts describe the maturity of strategic alignment capabilities?	-Perform interviews or focus group -Compare the results with the content of the maturity grid	Necessary to evaluate the maturity grid by triangulating methods
6	Evaluation of the utility of the grid as an assessment framework	Evaluation void	Naturalistic evaluation of the reliability and validity of the maturity grid	How reliable can be the results of the maturity grid in a maturity assessment? How valid are the results obtained in a maturity assessment?	-Apply the grid in an organisation via Case Study or Action research	Naturalistic evaluation is necessary to demonstrate the utility of the grid

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7	Strategic Alignment maturity and business performance	Knowledge void	Study the relationship of Strategic Alignment and business performance using the grid as an standard tool across different organisations	What is the effect of BPM Strategic Alignment on organisational performance?	-Apply the grid in an organisation via multiple Case Studies	Studies that link Strategic Alignment with performance use different instruments to determining maturity, therefore the results cannot be compared
8	Development of a maturity grid for another capability	Evaluation void	Evaluate the methodological contribution of this DSR to develop more 'assessment frameworks'	How can BPM [specific capability] be described at a different level of maturity?	-Instantiate the research methods (DSR and content analysis) to develop a new maturity grid	Assessment frameworks are scarce in BPM-MMs
9	Process customers & stakeholders and BPM strategy	Knowledge void	Obtain insights of maturity for this capability area	How the process customers & stakeholders influence the strategy at different levels of maturity (and vice versa)	Interviews with experts with experience assessing maturity	Little evidence is found in the literature that links process customers and stakeholders with the strategy at different levels of maturity and vice versa. Experts' insights are necessary
10	Strategy and process capability linkage	Knowledge void	Obtain insights of maturity for this capability area	How the process capability linkage is influenced by the strategy at different levels of maturity (and vice versa)	Interviews with experts with experience assessing maturity	Little evidence is found in the literature that links the process capability linkage with the strategy at different levels of maturity and vice versa. Experts' insights are necessary

Table 13. Research agenda

Reference List

Ahlemann, F., Schroeder, C., & Teuteberg, F. (2005). Kompetenz-und Reifegradmodelle für das Projektmanagement. *Grundlagen, Vergleich und Einsatz. Osnabrück: ISPRI (ISPRI-Arbeitsbericht, 01/2005)*.

Appian corporation. (2010). *BPM And ROI: Can Process Improvement Really Deliver a Return on Investment?* Retrieved 10-08-2019 from https://studylib.net/doc/9981341/appian-bpm-maturity-model

Argyris, C., & Schön, D. (1997). Organizational learning: A theory of action perspective. *Reis*(77/78), 345-348.

Association of American Colleges and Universities. (2009). *Team Work Value Rubric*. https://www.aacu.org/value/rubrics/teamwork

Bandara, W., Bailey, S., Mathiesen, P., McCarthy, J., & Jones, C. (2018). Enterprise Business Process Management in the public sector: the case of the Department of Human Services (DHS) Australia. *Journal of Information Technology Teaching Cases*, *8*(2), 217-231.

Bandara, W., Indulska, M., Chong, S., & Sadiq, S. (2007). *Major issues in business process management: an expert perspective* Proceedings of the 15th European Conference on Information Systems,

Bandara, W., Miskon, S., & Fielt, E. (2011). A systematic, tool-supported method for conducting literature reviews in information systems. Proceedings of the19th European Conference on Information Systems (ECIS 2011),

Becker, J., Knackstedt, R., & Pöppelbuß, J. (2009). Developing maturity models for IT management. *Business & Information Systems Engineering*, *1*(3), 213-222.

Behara, G. K., & Palli, P. (2013). Maturity Assessment for Enterprise Architecture.

Beydoun, G., Gonzalez-Perez, C., Henderson-Sellers, B., & Low, G. (2005). Developing and evaluating a generic metamodel for MAS work products. International Workshop on Software Engineering for Large-Scale Multi-agent Systems,

Beydoun, G., Low, G., Henderson-Sellers, B., Mouratidis, H., Gomez-Sanz, J. J., Pavon, J., & Gonzalez-Perez, C. (2009). FAML: a generic metamodel for MAS development. *IEEE Transactions on Software Engineering*, *35*(6), 841-863.

Blair, E. (2015). A reflexive exploration of two qualitative data coding techniques. *Journal of Methods and Measurement in the Social Sciences*, *6*(1), 14-29.

Blair, J., Czaja, R., & Blair, E. (2013). *Designing surveys: A guide to decisions and procedures*. Sage Publications.

Britsch, J., Bulander, R., & Morelli, F. (2012). *Evaluation of Maturity Models for Business Process Management - Maturity Models for Small and Medium-sized Enterprises* DCNET 2012, ICE-B 2012, OPTICS 2012, http://ub-madoc.bib.uni-mannheim.de/35864/

Cañas, A. J., & Novak, J. D. (2014). Concept mapping using CmapTools to enhance meaningful learning. In *Knowledge cartography* (pp. 23-45). Springer.

Chen, Y., & Cheng, B. H. (1997). Formalizing and automating component reuse. Proceedings Ninth IEEE International Conference on Tools with Artificial Intelligence,

CMMI Product Team. (2002). *Capability Maturity Model® Integration (CMMI), Version 1.1*. http://repository.cmu.edu/cgi/viewcontent.cgi?article=1622&context=sei

Conwell, C., Enright, R., & Stutzman, M. (2000). Capability maturity models support of modeling and simulation verification, validation, and accreditation. 819-828. (WSC '00)

Cronemyr, P., & Danielsson, M. (2013). Process Management 1-2-3–a maturity model and diagnostics tool. *Total Quality Management & Business Excellence*, *24*(7-8), 933-944.

Crosby, P. (1979). *Quality is free : the art of making quality certain*. McGraw-Hill.

Davenport, T. H. (1993). Need radical innovation and continuous improvement? Integrate process reengineering and TQM. *Planning review*, *21*(3), 6-12.

Davies, W. (2000). Understanding strategy. *Strategy and leadership*, *28*(5), 25-30.

de Bruin, T. (2007). Insights into the Evolution of BPM in Organisations. *ACIS 2007 Proceedings*, 43.

de Bruin, T. (2009). *Business process management: theory on progression and maturity* [PhD, Queensland University of Technology]. https://eprints.qut.edu.au/46726/

de Bruin, T., & Doebeli, G. (2015). An organizational approach to BPM: the experience of an Australian transport provider. In *Handbook on Business Process Management 2* (pp. 741-759). Springer.

de Bruin, T., Freeze, R., Kaulkarni, U., & Rosemann, M. (2005). Understanding the main phases of developing a maturity assessment model. Australasian Conference on Information Systems, Australia.

de Bruin, T., & Rosemann, M. (2005). Towards a business process management maturity model. Proceedings of the 30th European Conference on Information Systems, Regensburg, Germany.

de Bruin, T., & Rosemann, M. (2006). Towards understanding strategic alignment of business process management.

de Bruin, T., & Rosemann, M. (2007). Using the Delphi technique to identify BPM capability areas. Proceedings of the Australasian Conference on Information Systems,

Domingos, P. (1999). The role of Occam's razor in knowledge discovery. *Data mining and knowledge discovery*, *3*(4), 409-425.

Dumas, M., La Rosa, M., Mendling, J., & Reijers, H. A. (2018). BPM as an Enterprise Capability. In *Fundamentals of Business Process Management* (pp. 475-500). Springer.

Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing*, *62*(1), 107-115. https://doi.org/10.1111/j.1365-2648.2007.04569.x

Elzinga, D. J., Horak, T., Lee, C.-Y., & Bruner, C. J. I. t. o. e. m. (1995). Business process management: survey and methodology. *42*(2), 119-128.

Fettke, P., & Loos, P. J. B. P. M. J. (2007). Framework and meta-model for specifying business components. *13*(5), 628-643.

Fischer, C., & Gregor, S. (2011). Forms of Reasoning in the Design Science Research Process. In H. Jain, A. P. Sinha, & P. Vitharana, *Service-Oriented Perspectives in Design Science Research* Berlin, Heidelberg.

Fisher, D. M. (2004). The business process maturity model: a practical approach for identifying opportunities for optimization. *Business Process Trends*, *9*(4), 11-15.

Forstner, E., Kamprath, N., & Röglinger, M. (2014). Capability development with process maturity models–decision framework and economic analysis. *Journal of Decision Systems*, *23*(2), 127-150.

Gardner, R. A. J. Q. p. (2001). Resolving the process paradox. *34*(3), 51.

Gregor, S., & Hevner, A. (2013). Positioning and presenting design science research for maximum impact. *MIS Quarterly*, 337-355.

Gregor, S., & Jones, D. (2007). The anatomy of a design theory. *Journal of the Association for Information systems*, *8*(5).

Grisdale, W., & Seymour, L. F. (2011). Business process management adoption: a case study of a South African supermarket retailer. Proceedings of the South African Institute of Computer Scientists and Information Technologists conference on knowledge, innovation and leadership in a diverse, multidisciplinary environment,

Hammer, M. (2007). The Process Audit. *Harvard Business Review*, *85*(4), 111-123. https://doi.org/10.3354/dao074165

Hammer, M. (2015). What is Business Process Management? In J. vom Brocke & M. Rosemann (Eds.), *Handbook on Business Process Management 1: Introduction, Methods, and Information Systems* (pp. 3-16). Springer. https://doi.org/10.1007/978-3-642-45100-3_1

Harmon, P. (2004). *Evaluating an Organization's Business Process Maturity*. https://www.bptrends.com/publicationfiles/03-04%20NL%20Eval%20BP%20Maturity%20-%20Harmon.pdf

Harmon, P. (2009). *Process maturity models*. https://www.bptrends.com/process-maturity-models/

Harmon, P. (2018). *The state of business process management*. https://www.bptrends.com/2018-state-of-business-process-management-lp/

Hatten, K. J., & Rosenthal, S. R. (1999). Managing the process-centred enterprise. *Long Range Planning*, *32*(3), 293-310.

Heckl, D., & Moormann, J. (2010). Process performance management. In *Handbook on business process management 2* (pp. 115-135). Springer.

Heller, A., & Varney, J. (2013). *Using Process Management Maturity Models*. https://www.apqc.org/resource-library/resource-listing/using-process-management-maturity-models

Henderson, J. C., & Venkatraman, H. (1999). Strategic alignment: Leveraging information technology for transforming organizations. *IBM systems journal*, *38*(2.3), 472-484.

Hernaus, T., Bosilj Vuksic, V., & Indihar Štemberger, M. (2016). How to go from strategy to results? Institutionalising BPM governance within organisations. *Business Process Management Journal*, *22*(1), 173-195.

Hernaus, T., Pejić Bach, M., & Bosilj Vukšić, V. (2012). Influence of strategic approach to BPM on financial and non-financial performance. *Baltic Journal of Management*, *7*(4), 376-396.

Hevner, A. R., March, S. T., Park, J., & Ram, S. (2004). Design Science in Information Systems Research. *MIS Quarterly*, *28*(1), 75-105.

Hevner, A. R., Prat, N., Comyn-Wattiau, I., & Akoka, J. (2018). A Pragmatic Approach for Identifying and Managing Design Science Research Goals and Evaluation Criteria.

IDS Scheer. (2009). *Maturity level & ROI ; Enterprise BPM framework*. Retrieved 10-08-2019 from https://www.ariscommunity.com/users/frlu/2009-03-09-enterprise-bpm-framework-maturity-level-roi

Ingalsbe, J., Shoemaker, D., & Jovanovic, V. (2001). A metamodel for the capability maturity model for software. *AMCIS 2001 Proceedings*, 253.

International Organization for Standardization. (2015). *Information Technology - Process Assessment - Process measurement framework for assessment of process capability (ISO/IEC Standard No. 33020-2015)*. Retrieved 30-11-2018 from https://www.bsigroup.com/

Ittner, C. D., & Larcker, D. F. (1997). The performance effects of process management techniques. *Management science*, *43*(4), 522-534.

Kaplan, R. S., & Norton, D. P. (2004). The strategy map: guide to aligning intangible assets. *Strategy & leadership*, *32*(5), 10-17.

Kerpedzhiev, G., König, U., Röglinger, M., & Rosemann, M. (2017). *Business process management in the digital age*. https://www.bptrends.com/business-process-management-in-the-digital-age/

Krippendorff, K. (2013). *Content analysis : an introduction to its methodology* (3rd ed. ed.). SAGE.

Kuechler, B., & Vaishnavi, V. (2008). On theory development in design science research: anatomy of a research project. *European Journal of Information Systems*, *17*(5), 489-504.

Lee, J., Lee, D., & Kang, S. (2009). vPMM: a value based Process Maturity Model. In *Computer and information science 2009* (pp. 193-202). Springer.

Leonardo consulting. (2019). *BPM maturity assessment*. Retrieved 10-08-2019 from https://www.leonardo.com.au/bpm-maturity-assessment

Lockamy III, A., & McCormack, K. (2004). The development of a supply chain management process maturity model using the concepts of business process orientation. *Supply Chain Management: An International Journal*, *9*(4), 272-278. https://doi.org/10.1108/13598540410550019

Luftman, J. (2000). Assessing Business-IT Alignment Maturity. *Communications of the Association for Information Systems*, *4*. https://doi.org/10.17705/1CAIS.00414

Maier, A. M., Moultrie, J., & Clarkson, P. J. (2012). Assessing organizational capabilities: reviewing and guiding the development of maturity grids. *IEEE transactions on engineering management*, *59*(1), 138-159.

McCormack, K., & Johnson, W. C. (2001). *Business process orientation gaining the e-business competitive advantage*. St. Lucie Press.

McCormack, K., Willems, J., Van den Bergh, J., Deschoolmeester, D., Willaert, P., Indihar Štemberger, M., Škrinjar, R., Trkman, P., Bronzo Ladeira, M., & Paulo Valadares de Oliveira, M. J. B. P. M. J. (2009). A global investigation of key turning points in business process maturity. *15*(5), 792-815.

Melenovsky, M. J. (2005). Adopt BPM to realize business objectives. *Gartner Research*, *8*.

Melenovsky, M. J., & Sinur, J. (2006). BPM maturity model identifies six phases for successful BPM adoption. *Gartner research, stamford*.

Mertler, C. A. (2000). Designing scoring rubrics for your classroom. *Practical assessment, research, and evaluation*, *7*(1), 25.

Mettler, T. (2011). Maturity Assessment Models: A Design Science Research Approach. *International Journal of Society Systems Science*, *3*(1/2), 81-98. https://www.alexandria.unisg.ch/214426/

Mettler, T., & Rohner, P. (2009). Situational maturity models as instrumental artifacts for organizational design. Proceedings of the 4th International Conference on Design Science Research in Information Systems and Technology, Philadelphia, PA.

Mettler, T., Rohner, P., & Winter, R. (2010). Towards a classification of maturity models in information systems. In A. D'Atri, De Marco, M., Braccini, A.M., Cabiddu, F. (Ed.), *Management of the interconnected world* (1 ed., pp. 333-340). Springer.

Minonne, C., & Turner, G. (2012). Business Process Management—Are You Ready for the Future? *Knowledge and Process Management*, *19*. https://doi.org/10.1002/kpm.1388

Moskal, B. M. (2000). Scoring rubrics: What, when and how? *Practical assessment, research, and evaluation*, *7*(1), 3.

Motwani, J. (2003). A business process change framework for examining lean manufacturing: a case study. *Industrial Management & Data Systems*, *103*(5), 339-346.

Müller-Bloch, C., & Kranz, J. (2015). A framework for rigorously identifying research gaps in qualitative literature reviews.

Myers, M. D., & Newman, M. (2007). The qualitative interview in IS research: Examining the craft. *Information and organization*, *17*(1), 2-26.

Neubauer, T. (2009). An empirical study about the status of business process management. *Business Process Management Journal*, *15*(2), 166-183.

Niehaves, B., Plattfaut, R., & Becker, J. (2013). Business process management capabilities in local governments: A multi-method study. *Government Information Quarterly*, *30*(3), 217-225.

Niehaves, B., Pöppelbuß, J., Plattfaut, R., & Becker, J. (2014). BPM capability development – a matter of contingencies. *Business Process Management Journal*, *20*(1), 90-106. https://doi.org/10.1108/BPMJ-07-2012-0068

Nolan, R. L. (1973). Managing the computer resource: a stage hypothesis. *Communications of the ACM*, *16*(7), 399-405.

Novak, J. (1977). *A theory of education*. Cornell University Press. https://philpapers.org/rec/NOVATO

Object Management Group. (2008). *Business Process Maturity Model (BPMM) Version 1.0*. Object Management Group. https://www.omg.org/spec/BPMM/1.0

Othman, S. H., Beydoun, G., & Sugumaran, V. (2014). Development and validation of a Disaster Management Metamodel (DMM). *Information Processing and Management*, *50*(2), 235-271.

Paulk, M. C., Curtis, B., Chrissis, M. B., & Weber, C. V. (1993). Capability maturity model, version 1.1. *IEEE software*, *10*(4), 18-27.

Petkov, D., & Petkova, O. (2006). Development of scoring rubrics for IS projects as an assessment tool. *Issues in Informing Science & Information Technology*, *3*.

Pfeffer, J., & Sutton, R. I. (1999). Knowing "what" to do is not enough: Turning knowledge into action. *California management review*, *42*(1), 83-108. https://gateway.library.qut.edu.au/login?url=https://search.proquest.com/docview/216131354?accountid=13380

Pöppelbuß, J., Niehaves, B., Simons, A., & Becker, J. (2011). Maturity models in information systems research: Literature search and analysis. *Communication of the Association for Information Systems*, *29*(1), 1-15.

Pöppelbuß, J., & Röglinger, M. (2011). What makes a useful maturity model? a framework of general design principles for maturity models and its demonstration in business process management. Proceedings of the 19th European conference on Information System, Helsinki, Finland.

Porter, M. E. (1989). From competitive advantage to corporate strategy. In *Readings in strategic management* (pp. 234-255). Springer.

Porter, M. E. (1996, November, 1996). What is strategy. *Harvard Business Review*.

Proença, D., & Borbinha, J. (2016). Maturity Models for Information Systems - A State of the Art. *Procedia Computer Science*, *100*, 1042-1049. https://doi.org/10.1016/j.procs.2016.09.279

Rittel, H. W., & Webber, M. M. (1973). 2.3 planning problems are wicked. *Polity*, *4*(155), e169.

Röglinger, M., Pöppelbuß, J., & Becker, J. (2012). Maturity models in business process management. *Business Process Management Journal*, *18*(2), 328-346. https://doi.org/10.1108/14637151211225225

Rohloff, M. (2009a). An approach to assess the implementation of business process management in enterprises.

Rohloff, M. (2009b). Case study and maturity model for business process management implementation. International Conference on Business Process Management,

Rohloff, M. (2009c). Process management maturity assessment. Proceedings of the 17th Americas Conference on Information Systems, Detroit, MI.

Rohloff, M. (2011). Advances in business process management implementation based on a maturity assessment and best practice exchange. *Inf. Syst. E-bus. Manag.*, *9*(3), 383-403. https://doi.org/10.1007/s10257-010-0137-1

Rosemann, M., & de Bruin, T. (2005). Application of a holistic model for determining BPM maturity. *BP Trends*, 1-21.

Rosemann, M., De Bruin, T., & Hueffner, T. (2004). *A model for business process management maturity* Australasian Conference on Information Systems 2004 Proceedings, Hobart, TAS.

Rosemann, M., & Green, P. (2002). Developing a meta model for the Bunge–Wand–Weber ontological constructs. *Information systems*, *27*(2), 75-91. https://doi.org/10.1016/S0306-4379(01)00048-5

Rosemann, M., & vom Brocke, J. (2015). The Six Core Elements of Business Process Management. In J. vom Brocke & M. Rosemann (Eds.), *Handbook on Business Process Management 1: Introduction, Methods, and Information Systems* (pp. 105-122). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-45100-3_5

Sadler, D. R. (1987). Specifying and promulgating achievement standards. *Oxford review of education*, *13*(2), 191-209.

Scheuren, F. (2004). *What is a Survey?* American Statistical Association Alexandria. https://www.unh.edu/institutional-research/sites/default/files/pamphlet.pdf

Scriven, M. (2007). *The logic of evaluation*. University of Windsor. https://scholar.uwindsor.ca/cgi/viewcontent.cgi?article=1390&context=ossaarchive

Sein, M., Henfridsson, O., Purao, S., Rossi, M., & Lindgren, R. (2011). Action design research. *Management Information Systems Quarterly*, *35*(1), 37-56.

Škrinjar, R., Bosilj-Vukšić, V., & Indihar-Štemberger, M. J. B. P. M. J. (2008). The impact of business process orientation on financial and non-financial performance. *14*(5), 738-754.

Skrinjar, R., & Trkman, P. (2013). Increasing process orientation with business process management: Critical practices'. *International Journal of information management*, *33*(1), 48-60.

Spanyi, A. (2003). Business Process Management (BPM) is a Team Sport: Play it to Win. *Meghan Kiffer Pr*.

Tarhan, A., Turetken, O., & Ilisulu, F. (2015). Business Process Maturity Assessment: State of the Art and Key Characteristics. 41st Euromicro Conference on Software Engineering and Advanced Applications, Tarhan, A., Turetken, O., & Reijers, H. (2016). Business process maturity models: A systematic literature review. *Information and Software Technology*, *75*, 122-134. https://doi.org/10.1016/j.infsof.2016.01.010

Tarhan, A., Türetken, O., & Reijers, H. A. (2015). Do Mature Business Processes Lead to Improved Performance?-A Review of Literature for Empirical Evidence. ECIS,

Tenner, A., & DeToro, I. (2000). *Process redesign: The implementation guide for managers*. Prentice Hall.

Trkman, P. (2010). The critical success factors of business process management. *International Journal of information management*, *30*(2), 125-134.

Ulrich, D., & Smallwood, N. (2004). Capitalizing on capabilities. *Harvard Business Review*, 119-128.

van der Aalst, W. (2013). Business Process Management: A Comprehensive Survey. *ISRN Software Engineering*, *2013*. https://doi.org/10.1155/2013/507984

Van Looy, A. (2010). Does IT Matter for Business Process Maturity? A Comparative Study on Business Process Maturity Models. In R. Meersman, T. Dillon, & P. Herrero, *On the Move to Meaningful Internet Systems: OTM 2010 Workshops* Berlin, Heidelberg.

Van Looy, A. (2013a). Current Pitfalls Of Business Process Maturity Models: A Selection Perspective. European Conference on Information Systems,

Van Looy, A. (2013b). Looking for a Fit for Purpose: Business Process Maturity Models from a User's Perspective. In *Enterprise Information Systems of the Future* (pp. 182-189). Springer.

Van Looy, A. (2018). On the Synergies Between Business Process Management and Digital Innovation. International Conference on Business Process Management,

Van Looy, A., Backer, M. D., & Poels, G. (2014). A conceptual framework and classification of capability areas for business process maturity. *Enterprise Information Systems*, *8*(2), 188-224.

Van Looy, A., De Backer, M., & Poels, G. (2010). Which maturity is being measured? A classification of business process maturity models. 5th SIKS/BENAIS Conference on Enterprise Information Systems (EIS 2010),

Van Looy, A., De Backer, M., & Poels, G. (2011a). Defining business process maturity. A journey towards excellence. *Total Quality Management & Business Excellence*, *22*(11), 1119-1137. https://doi.org/10.1080/14783363.2011.624779

Van Looy, A., De Backer, M., & Poels, G. (2011b). Questioning the design of business process maturity models. The 6th SIKS Conference on Enterprise Information Systems 2011,

Van Looy, A., De Backer, M., & Poels, G. (2012). Towards a decision tool for choosing a business process maturity model. International Conference on Design Science Research in Information Systems,

Van Looy, A., De Backer, M., Poels, G., & Snoeck, M. (2013). Choosing the right business process maturity model. *Information & Management*, *50*(7), 466-488. https://doi.org/10.1016/j.im.2013.06.002

Venable, J. (2006). A framework for design science research activities.*Emerging Trends and Challenges in Information Technology Management* Proceedings of the 2006 Information Resource Management Association Conference, Washington, DC.

Venable, J., Pries-Heje, J., & Baskerville, R. (2016). FEDS: a framework for evaluation in design science research. *European Journal of Information Systems*, *25*(1), 77-89.

Vom Brocke, J., & Schmiedel, T. (2015). *BPM-driving innovation in a digital world*. Springer.

vom Brocke, J., Simons, A., Niehaves, B., Niehaves, B., Reimer, K., Plattfaut, R., & Cleven, A. (2009). Reconstructing the giant: On the importance of rigour in documenting the literature search process.

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von Scheel, H., von Rosing, G., Skurzak, K., & Hove, M. (2015). BPM and maturity models. In H. von Scheel & A.-W. Scheer (Eds.), *The complete business process handbook : body of knowledge from process modeling to BPM. Volume I* (pp. 399-430). Elsevier.

Wand, Y., & Weber, R. (2002). Research commentary: information systems and conceptual modeling—a research agenda. *Information Systems Research*, *13*(4), 363-376.

Wendler, R. (2012). The maturity of maturity model research: A systematic mapping study. *Information and Software Technology*, *54*(12), 1317-1339. https://doi.org/10.1016/j.infsof.2012.07.007

Wilkins, M. (2010). *Creating a BPM Roadmap, Release 3.0*.

Willaert, P., Van den Bergh, J., Willems, J., & Deschoolmeester, D. (2007). The Process-Oriented Organisation: A Holistic View Developing a Framework for Business Process Orientation Maturity. In G. Alonso, P. Dadam, & M. Rosemann, *Business Process Management* Berlin, Heidelberg.

Willaert, P., Willems, J., Deschoolmeester, D., & Viaene, S. (2006). Process performance measurement: Identifying KPIs that link process performance to company strategy. International Resources Management Association (IRMA) Conference,

Yin, R. K. (2017). *Case study research and applications: Design and methods*. Sage publications.

Zairi, M. (1997). Business process management: a boundaryless approach to modern competitiveness. *Business Process Management Journal*, *3*(1), 64-80. https://doi.org/10.1108/14637159710161585

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Appendices

Appendix A. An overview of the application of the DSR guidelines by Hevner et al. (2004) on the meta-model (artefact 1)

The meta-model for BPM Strategic Alignment was built following the 7 DSR guidelines of Hevner et al. (2004). These guidelines are instantiated below to reflect how they were followed for the meta-model.

GUIDELINES AND DESCRIPTIONS	INSTANTIATION OF THE GUIDELINES
Guideline 1 Design as an Artefact DSR must produce a viable artefact in the form of a construct, a model, a method, or an instantiation.	The meta-model of BPM-MMs synthetises and arranges the generic components of BPM-MMs, representing their generic structure.
Guideline 2 Problem Relevance The objective of DSR is to develop technology-based solutions to important business problems.	BPM-MMs are one of the most common BPM artefacts, embraced by process-oriented companies and BPM consultants (Tarhan, Turetken, & Reijers, 2016; Van Looy, De Backer, Poels, & Snoeck, 2013). However, these models have a number of challenges to overcome (see Section 2.4). Although the meta-model is a conceptual artefact, it underpins the understanding and development of BPM-MMs
Guideline 3 Design Evaluation The utility, quality, and efficacy of the design artefact must be rigorously demonstrated via well-executed evaluation methods.	An evaluation phase was integrated in the design of the meta-model to evaluate its completeness and generalisability as quality checks. A Proof of Concept to test the utility of the meta-model as a tool to compare and spot strengths and weaknesses of BPM-MMs was developed. Also, the meta-model was evaluated as a theory through the lens of “The skeleton of a design theory” proposed by Gregor and Jones (2007) (see Section 3.6.3)
Guideline 4 Research Contributions Effective DSR must provide clear and verifiable contributions in the areas of the design artefact, design foundations, and/or design methodologies.	The meta-model and the descriptions given is itself a data-driven theoretical contribution that provides a novel viewpoint that enables spotting issues of BPM-MMs at component level by identifying their boundaries and relationships. Contributions to knowledge and practice are presented in Sections 5.1.3 and 5.1.4 respectively.
Guideline 5 Research Rigor DSR relies upon the application of rigorous methods in both the construction and evaluation of the design artefact.	The methods to develop and evaluate the meta-model considered DSR and Content Analysis on documents as a data collection technique from a representative sample of documentation of BPM-MMs. As a DSR approach included three instances of evaluation as explained in Guideline 3 (see Section 3.4)
Guideline 6 Design as a Search Process The search for an effective artefact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.	Literature reviews were performed to understand the challenges of BPM-MMs and identify suitable methods for developing the meta-model and modelling techniques that better suit the target audience
Guideline 7 Communication of Research DSR must be presented effectively both to technology-oriented as well as management-oriented audiences.	This research potentially will be presented in the BPM Journal. Also, the student considers publications of the meta-model in other IS and management related journals.

Appendix B. An overview of the application of the DSR guidelines by Hevner et al. (2004) on the maturity grid (artefact 2)

The maturity grid for BPM Strategic Alignment was built following the 7 DSR guidelines of Hevner et al. (2004). These guidelines are instantiated below to reflect how they were followed for the maturity grid.

GUIDELINES AND DESCRIPTIONS	INSTANTIATION OF THE GUIDELINES
Guideline 1 Design as an Artefact DSR must produce a viable artefact in the form of a construct, a model, a method, or an instantiation.	The set of guidelines for developing BPM maturity grids is a methodological artefact. The maturity grid for BPM SA capabilities is an artefact that synthesises content about BPM Strategic Alignment capabilities by describing them at different levels of maturity. It is a tool to perform a maturity assessment.
Guideline 2 Problem Relevance The objective of DSR is to develop technology-based solutions to important business problems.	Assessment frameworks for determining the BPM maturity of organisations are often a missed component. In particular, there are not known assessments to determine the maturity of BPM SA capabilities. It is important to know to what extent the BPM initiatives are aligned to the business goals and strategy
Guideline 3 Design Evaluation The utility, quality, and efficacy of the design artefact must be rigorously demonstrated via well-executed evaluation methods.	The utility of the guidelines is evaluated by using it to develop a BPM maturity grid. The quality of the content of the maturity grid was evaluated at two levels. Firstly, each descriptor was linked to an indicator of the references that enabled us to point to the ones with more and less support in the literature. Secondly, the cells of the grid were horizontally compared to ensure progression in the maturity scale for each capability (See Section 4.3.3)
Guideline 4 Research Contributions Effective DSR must provide clear and verifiable contributions in the areas of the design artefact, design foundations, and/or design methodologies.	The guidelines for developing the grid represents a methodological contribution to address the scarcity of assessment frameworks to assess BPM maturity. The maturity grid synthesises descriptions for BPM SA capabilities at different levels of maturity enabling the assessment of these capabilities in organisations. Contributions to knowledge and practice are presented in Sections 5.1.3 and 5.1.4 respectively.
Guideline 5 Research Rigor DSR relies upon the application of rigorous methods in both the construction and evaluation of the design artefact.	Evaluation happened at different stages of this project. The guidelines were instantiated with a real BPM-MM. The methods to develop and evaluate the maturity grid considered DSR and Content Analysis on documents as a data collection technique from a representative sample of documentation of BPM-MMs. Also, SLR was employed for the overall descriptions of the capabilities of BPM SA and the maturity levels (See Section 4.3)
Guideline 6 Design as a Search Process The search for an effective artefact requires utilising available means to reach desired ends while satisfying laws in the problem environment.	Developing the guidelines involved exploring assessment theory to understand design principles of scoring rubrics that can apply to maturity grids. Also, this research considered comparing BPM maturity levels from different models
Guideline 7 Communication of Research DSR must be presented effectively both to technology-oriented as well as management-oriented audiences.	This research was submitted to the BPM Conference 2021 but unfortunately got rejected. The researcher is seeking for a new outlet to publish this work

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Appendix C. Document sample references for Developing meta-model

This list extracted from Tarhan et al. (2016) identifies the documents utilised from the present study for identifying BPM-MM components (from GS01 to GS22)

Id	Reference
GS01	Britsch, J., Bulander, R., & Morelli, F. (2012). *Evaluation of Maturity Models for Business Process Management - Maturity Models for Small and Medium-sized Enterprises*. Paper presented at the DCNET 2012, ICE-B 2012, OPTICS 2012. http://ub-madoc.bib.uni-mannheim.de/35864/
GS02	de Bruin, T., Freeze, R., Kaulkarni, U., & Rosemann, M. (2005). *Understanding the main phases of developing a maturity assessment model.* Paper presented at the Australasian Conference on Information Systems, Australia.
GS03	Forstner, E., Kamprath, N., & Röglinger, M. (2014). Capability development with process maturity models–decision framework and economic analysis. *Journal of Decision Systems, 23*(2), 127-150
GS04	Lee, J., Kang, S., Lee, D., Ahn, Y.-W., & Park, A. B. (2009). *Comparison of vPMM and BPMM.* Paper presented at the Software Engineering, Artificial Intelligences, Networking and Parallel/Distributed Computing, 2009. SNPD'09. 10th ACIS International Conference on
GS05	Pöppelbuß, J., & Röglinger, M. (2011). *What makes a useful maturity model? a framework of general design principles for maturity models and its demonstration in business process management.* Paper presented at the Proceedings of the 19th European conference on Information System, Helsinki, Finland
GS06	Röglinger, M., Pöppelbuß, J., & Becker, J. (2012). Maturity models in business process management. *Business Process Management Journal, 18*(2), 328-346. doi:10.1108/14637151211225225
GS07	Rosemann, M., & vom Brocke, J. (2015). The Six Core Elements of Business Process Management. In J. vom Brocke & M. Rosemann (Eds.), *Handbook on Business Process Management 1: Introduction, Methods, and Information Systems* (pp. 105-122). Berlin, Heidelberg: Springer Berlin Heidelberg
GS08	Tarhan, A., Turetken, O., & Ilisulu, F. (2015). *Business Process Maturity Assessment: State of the Art and Key Characteristics.* Paper presented at the 41st Euromicro Conference on Software Engineering and Advanced Applications.
GS09	Thompson, G., Seymour, L. F., & O'Donovan, B. (2009). *Towards a BPM Success Model: An Analysis in South African Financial Services Organisations*, Berlin, Heidelberg
GS10	Van Looy, A. (2010). *Does IT Matter for Business Process Maturity? A Comparative Study on Business Process Maturity Models*, Berlin, Heidelberg

GS11	Van Looy, A. (2013a). Current Pitfalls Of Business Process Maturity Models: A Selection Perspective. Paper presented at the European Conference on Information Systems
GS12	Van Looy, A. (2013b). Looking for a Fit for Purpose: Business Process Maturity Models from a User's Perspective *Enterprise Information Systems of the Future* (pp. 182-189): Springer.
GS13	Van Looy, A., Backer, M. D., & Poels, G. (2014). A conceptual framework and classification of capability areas for business process maturity. *Enterprise Information Systems, 8*(2), 188-224
GS14	Van Looy, A., De Backer, M., & Poels, G. (2010). *Which maturity is being measured? A classification of business process maturity models.* Paper presented at the 5th SIKS/BENAIS Conference on Enterprise Information Systems (EIS 2010)
GS15	Van Looy, A., De Backer, M., & Poels, G. (2011). Defining business process maturity. A journey towards excellence. *Total Quality Management & Business Excellence, 22*(11), 1119-1137. doi:10.1080/14783363.2011.624779
GS16	Van Looy, A., De Backer, M., & Poels, G. (2011b). *Questioning the design of business process maturity models.* Paper presented at the The 6th SIKS Conference on Enterprise Information Systems 2011.
GS17	Van Looy, A., De Backer, M., & Poels, G. (2012). *Towards a decision tool for choosing a business process maturity model.* Paper presented at the International Conference on Design Science Research in Information Systems
GS18	Van Looy, A., De Backer, M., Poels, G., & Snoeck, M. (2013). Choosing the right business process maturity model. *Information & Management, 50*(7), 466-488. doi:10.1016/j.im.2013.06.002
GS19	Vlahovic, N., Milanovic, L., & Skrinjar, R. (2010). Turning points in business process orientation maturity model: an east european survey. *WSEAS transactions on business and economics, 7*(1), 22-32
GS20	Vlahovic, N., Milanovic, L., & Škrinjar, R. (2010). *Using Datamining Methodology for Detecting Turning Points in Business Process Orientation Maturity Models*
GS21	Wendler, R. (2012). The maturity of maturity model research: A systematic mapping study. *Information and Software Technology, 54*(12), 1317-1339. doi:10.1016/j.infsof.2012.07.007
GS22	Willems, J., Bergh, J. V., & Deschoolmeester, D. (2012). Analyzing Employee Agreement on Maturity Assessment Tools for Organizations. *Knowledge and Process Management, 19*(3), 142-147. doi:10.1002/kpm.1389

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Appendix D. Document sample for the evaluation of the components of the meta-model

The following list contain the documentation of actual BPM-MMs (from SM1a to SM9), which were utilised to evaluate the components of the meta-model

Id	Reference
SM1a	de Bruin, T. (2009). *Business process management: theory on progression and maturity.* (PhD), Queensland University of Technology. Retrieved from https://eprints.qut.edu.au/46726/
SM1b	de Bruin, T., & Rosemann, M. (2005). Towards a business process management maturity model. Paper presented at the Proceedings of the 30th European Conference on Information Systems, Regensburg, Germany.
SM1c	de Bruin, T., & Rosemann, M. (2007). *Using the Delphi technique to identify BPM capability areas.* Paper presented at the Proceedings of the Australasian Conference on Information Systems
SM1d	Rosemann, M., & de Bruin, T. (2005). Application of a holistic model for determining BPM maturity. *BP Trends*, 1-21.
SM1e	Rosemann, M., De Bruin, T., & Hueffner, T. (2004). *A model for business process management maturity*. Paper presented at the Australasian Conference on Information Systems 2004 Proceedings, Hobart, TAS
SM2	Object Management Group. (2008). Business Process Maturity Model (BPMM) Version 1.0. https://www.omg.org/spec/BPMM/1.0: Object Management Group.
SM3	McCormack, K., & Johnson, W. C. (2001). *Business process orientation gaining the e-business competitive advantage*. Boca Raton, FL: St. Lucie Press
SM4	Hammer, M. (2007). The Process Audit. *Harvard Business Review, 85*(4), 111-123. doi:10.3354/dao074165
SM5a	Rohloff, M. (2009). *Process management maturity assessment.* Paper presented at the Proceedings of the 17th Americas Conference on Information Systems, Detroit, MI
SM6	Fisher, D. M. (2004). The business process maturity model: a practical approach for identifying opportunities for optimization. Business Process Trends, 9(4), 11-15.
SM7	Melenovsky, M. J., & Sinur, J. (2006). BPM maturity model identifies six phases for successful BPM adoption. Gartner research, stamford.

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SM8	Heller, A., & Varney, J. (2013). Using Process Management Maturity Models. Retrieved from https://www.apqc.org/resource-library/resource-listing/using-process-management-maturity-models
SM9	International Organization for Standardization. (2015). Information Technology - Process Assessment - Concepts and terminology (ISO/IEC Standard No. 33001-2015). Retrieved from https://www.bsigroup.com/

Appendix E. Assessment Criteria Sheet for Proof-of-Concept of the meta-model

COMPONENTS:	STRONG	SUFFICIENT	WEAK	ABSENT
BPM DOMAIN	The model describes the BPM domain and how it supports organisational or processes performance providing compelling evidence	The model describes the BPM domain and how it supports organisational or processes performance providing examples	The model limits to describe the BPM domain and how it supports organisational or processes performance without providing evidence or examples	The model does not explain the importance of the BPM domain
UNDERLYING THEORIES/FACTS	The model justifies its design and selection of components such as maturity levels and capabilities based on and evidencing theories, other models' success, or limitations of existing models.	The model justifies some aspects of its design such as maturity levels and capabilities based on theories, other models' success, or limitations of existing models.	The model provides limited justification about its design and component	The model does not justify its design and components
SCIENTIFIC METHODS	The model provides a rigorous research method for its development, components, and capabilities selection. It also includes empirical validation	The model provides evidence of its research methods for its development and some sort of validation	The model provides either its research method for its development or empirical validation	The model does not provide any scientific method
MODEL'S ATTRIBUTES	The model clearly states its purposes, defines its main constructs, has a clear structure, the scope is stated, its core documentation is presented in reliable sources	The model states its purposes and defines its main constructs, has a clear structure and its core documentation is available	The model presents some objectives but is not well organised and the documentation hard to gather	The model does not provide its purpose and the information is not accessible
MATURITY FRAMEWORK	The maturity framework is described, defines maturity, explains its scale, each level is described and each of them describe the capabilities at different levels	The model describes its maturity framework, defines maturity, and the maturity framework describes the capability framework without details per capability	The model limits to provide an overall maturity framework and levels but it does not describe the capabilities	The model does not provide a Maturity framework or is disconnected and irrelevant
TARGET BPM MATURITY	The model provides guideline to determine the target maturity based on information of the organisation (industry, size, goals, etc.) and maturity results	The model provides some guidance to determine target maturity	The model limits to encourage always higher maturity or indicates elements to consider but does not provide guidance to determine it	The model does not provide any indication to target a maturity level
CAPABILITY FRAMEWORK	The capability framework is explained in detail, presents a clear structure and the capabilities are broken down to be more measurable. It is linked with the maturity framework	The capability framework is described, structured and the capabilities explained. It is linked with the maturity framework	The capability framework is described, and the capabilities are broad. The link with the maturity framework is weak	The model does not provide a capability framework
ORGANISATIONAL INPUTS	Contains templates to be populated by the organisation such the target group, the assessors, the respondents, organisational treats (industry, size, goals, capabilities, processes)	The model specifies some requirements and decisions relevant for the organisation to apply the model	The model only indicates who apply the model in the organisation without further guidance	The model does not specify any input from the organisation
ASSESSMENT FRAMEWORK	Rigorous and validated methods such as questionaries are provided with the model to perform the assessment which is available (free or paid). Instructions are detailed including participants, sample size, data collection and duration	Methods such detailed questions are provided to perform the assessment (free or paid). Some guidance is given such as unit of analysis, unit of observation and data collection technique	Only a part of the assessment and instructions to apply is available	The model does not provide any applicable assessment instrument
MATURITY RESULTS	Maturity results are clear based on the capabilities described by the maturity framework. They can be analysed and interpreted to enable prescriptions and comparisons	Maturity results are clear based on the capabilities described by the maturity framework	Maturity results are unclear and not indirectly linked with the maturity framework	The model does not provide insights about how the results are
PRESCRIPTIONS	The model recommends specific prescriptions prioritising them according with the maturity results and the organisational inputs to reach the target maturity.	The model provides some guidance to prioritise the prescriptions according to the maturity results	The prescriptions are generic, implicit to maturity levels and there is no guidance to select them	The model does not provide prescriptions
COMPARISONS	The model results allow the organisation to perform insightful benchmarking considering areas, capabilities, branches, or other organisations	The model results allow the organisation to perform benchmarking for areas, branches, capabilities	The model only enables benchmarking of different areas or branches	The model does not provide comparisons

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Appendix F. Extended descriptors for the capability areas of the BPM SA (step 1)

This appendix presents a literature review derived from *Step 1* of the document analysis process described in Section 4.3.2.

Process improvement planning

This capability area refers to the extent selected BPM initiatives, such methods and tools, are aligned to specific business goals the organisation pursues (de Bruin & Rosemann, 2006; Dumas et al., 2018).

Process prioritisation through process portfolio management in one facet. The idea of process improvement planning is to outline how prioritised process improvement initiatives are meant to meet the hierarchised business goals (Rosemann & vom Brocke, 2015). The process improvement plan provides information related to how the BPM initiative relates to underlying projects such as the implementation of an Enterprise System and states how corporate benefits of BPM initiatives are to be realised (Rosemann & vom Brocke, 2015).

Strategy maps (e.g., Kaplan & Norton, 2004) can help the organisation to manage its process portfolio. Process improvement portfolios combined with strategy maps can be used to check to what extent the processes within an organisation relate to an overall strategy (Bandara et al., 2007). According to Rosemann and vom Brocke (2015), a strategy-driven process improvement plan captures the organisation's overall approach towards BPM. On the other direction, the entire management of an organisation that involves: strategy, goal setting, controlling and planning, should be based on its core processes (Bandara et al., 2007). An organisation performing process portfolio management framed by the business strategy and at the same time shaping it could be considered as an indicator of a high level of maturity with regards to the process improvement planning.

Not having a prioritised process portfolio for BPM initiatives can be problematic. For example, "proponents of TQM and lean manufacturing have frequently clashed over the alleged superiority of one ideology above the other, fighting over resources and conflicting cultural approaches to improvement" (Motwani, 2003, p. 340). Process improvement planning by assessing the initiatives against the strategies can not only elucidate the best project but also combine them. Pritchard and Armistead (1999) stressed on the need to have an integrated approach, in opposition to isolated and uncoordinated process improvement activities that will only provide short-term and unsustainable gains.

de Bruin and Rosemann (2006) presents an exemplary case study highlighting the importance of prioritisation. There was the perception in the case organisation that at high-level prioritisation was more conceptual with improvement activities only defined with little or no indication of how such initiatives might be achieved. At this level, the fact that something made it onto the list was seen to be an indication of prioritisation. At a lower level, prioritisation was more meticulous as optional results were developed in order to refine how to deliver the planned improvements. The strategic planning cycle was the time when more details were given with the process improvement plan being the driver for connecting process improvement metrics and priorities and ensuring fit with a strategic goal. Negotiation played an essential role during the prioritisation and coordination of improvement initiatives because it provided faster approval and superior commitment to the final plan. The process of informal negotiation complemented a formal process that oversees the overall strategic alignment process.

de Bruin and Rosemann (2006) discovered that the organisation ownership structure (e.g. parent-subsidiary relationship) may affect BPM initiatives. It may result, for example, in process improvement initiatives being mandated. As a result, they do not necessarily map to (local) organisational strategies. Moreover, there is a need for a shared understanding of process improvement initiatives across the top management to ensure they are in line with the requirements of internal stakeholders, supporting a holistic/integrated approach for process improvement planning (Al-Mashari and Edwards as cited in de Bruin & Rosemann, 2006). In the same vein, Hatten and Rosenthal (1999) suggest that decisions between processes need to be closely coordinated and sequenced.

Strategy and process capability linkage

This capability area encapsulates the bi-directional relation between strategy and business process (de Bruin & Rosemann, 2006; Dumas et al., 2018). It considers the extent to what the process capabilities are taken into account in the corporate strategy and the impact of the strategy on the processes, enabling informed decisions, and how strategic decisions affect processes (de Bruin, 2009; Dumas et al., 2018). It is crucial as well to consider the resources allocated to the key processes that are more tightly linked with the business strategy (Rosemann & vom Brocke, 2015). Hatten and Rosenthal (1999) argue that integrating functions and processes through business strategy supports a firm's operating decisions to be linked to the strategic focus towards the desired performance. Dumas et al. (2018) exemplify that if the main strategy of an organisation is that of "customer intimacy", then, it is necessary to identify the processes that influence more the customer experience. At the process modelling level, including the interactions with the customer in the process maps will be important, unlike in other processes where the customer is treated as black box. By analysing the models, the bottlenecks for the customer can be identified.

Another aspect to consider in this capability area is the extent of what process performance empowers or limits the execution of the strategy. For instance, Dumas et al. (2018) point out that when a company aims to simplify the operations through standardisation, some complex processes with many variants could post a bottleneck for the implementation of such strategy. For example, in the insurance industry, having several claims handling process (one per insurance service) will hinder this strategy (Dumas et al., 2018). Conversely, the process capabilities can influence the strategy (Dumas et al., 2018). For example, new process capabilities may influence the operationalisation of the marketing strategy of a business taking advantage of digital means like advertisements on websites and social media (Dumas et al., 2018). This direction from process capability to reshape the strategy is closely related to Argyris and Schön (1997)'s double loop theory.

Davenport (1993) argues that focusing on a coherent process-to-strategy approach BPM can add value to the customer. de Bruin and Rosemann (2006) explains that identifying an organisation's process capability enables informed decisions about how this capability maximise its contribution to strategic goals.

In a case study presented in de Bruin and Rosemann (2006), the researcher examined a BPM project were employees were transferred from functionally based work units to process improvement projects as mandated by the emergent process focus strategy over process capability. However, the employees had to deal with both functional activities and the required process improvement focus to maintain the performance standards for the day to day operations. The new strategy towards process improvement was perceived to provide the timeframe and direction for the long-term development of required process capabilities, but the human resource impact was seen as a short-term problem. Furthermore, evidence suggests that such an approach has the potential to create other issues as human resources are constantly stretched and challenged by on-going shortfalls in process capability. In short, a deficit in process capability can suggest potential areas for process improvement and underpins automatic alignment between new process improvement initiatives and strategy.

In the same case, at the structural level, it was reported that organisational ownership structure (e.g. parent-subsidiary relationship) might result in a dominant party within the bi-directional linkage between strategy and process capability. This implies that the parent strategy does not necessarily map to (local) organisational strategies (de Bruin & Rosemann, 2006).

Another facet within this capability area is that by knowing the relationship process-strategy, the business can decide if the process should be performed in-house or be outsourced or offshored (Dumas et al., 2018). Outsourcing strategies are mainly implemented to reduce operating costs that appeal cost leadership strategies and alike.

Enterprise Process architecture

The Enterprise Process Architecture (EPA) captures the interrelationships between the key business processes and the enabling support processes and their alignment with the strategies, goals and policies of an organisation (de Bruin & Rosemann, 2006). For service providers, a process architecture can be seen as a catalogue of all the processes underlying the services that a business delivers (Bandara et al., 2018).

An EAP is the highest-level abstraction of the actual hierarchy of value-driven and enabling business processes (Aitken et al. 2014; Spanyi 2014). Rosemann and vom Brocke (2015) describes a mature process architecture should highlight the major business processes, describe the industry/company-specific value chain, and include the enabling processes that support that value chain. Such artefact represents the main process landscape, and it is a starting point for more detailed process analyses and models. Reference models (vom Brocke, 2006) can guide the development of a process architecture that tailor the organisation.

Heckl and Moormann (2010) indicate that the control of processes also refers to strategic control aspects, in line with the 'Double Loop Learning' where the business considers adapting the strategy to solve the issue before rushing into immediate remediation (Argyris & Schön, 1997). Therefore, it may be necessary to reconsider and change the strategy with respect to the process architecture. If the target achievement appears to be out of reach, it would be necessary to develop an entirely new or an improved process structure – like in Business Process Reengineering (Hammer and Champy 1993) as well as in a more systematic approach like BPM through the number of methods and tools under its umbrella (e.g., Business Process Redesign, Kaizen, and Six Sigma).

The EPA can be presented at different levels of abstraction, from the holistic perspective of the organisation to be broken down into specific processes and vice versa. It is important to consider that the holistic EPA is presented by many studies as a maturity indicator for this facet (e.g., Dumas et al., 2018). However, less matured versions of this facet start by identifying the business process. Armistead (1996) argues that the identification of processes is a key enabler for changing the way in which managers set organisational direction and operationalise and support the provision of products and services. The scholar further emphasises that knowing the processes is as important as understanding their relationships. Otherwise, the initiative is under the risk of treating the process as silos, same as functional areas. Moreover, Kiraka and Manning (2005) (as cited in de Bruin & Rosemann, 2006) warns against the extensive use of individual low-level process models due to the speed with which they become dated.

On the other hand, starting from a top-down approach, that is developing an EPA and then break it down into processes can be beneficial. According to de Bruin and Rosemann (2006), the decomposition of process architectures to lower levels is encouraged during major IT upgrade/implementations such as those involving ERP systems.

Dumas et al. (2018) emphasise on the importance of this artefact presented at enterprise-level to be complete and kept up to date with regular review cycles for the success of the overall BPM program. As a by-product of developing an EPA, de Bruin and Rosemann (2006) discovered that underpins a process thinking culture.

Process measurements

This capability area highlights the connection between process performance indicators (PPI) with business objectives, typically measured through key performance indicators (KPIs) (de Bruin & Rosemann, 2006; Dumas et al., 2018).

McCormack and Johnson (2001) consider that managing process improvement requires adequate measures to assess process effectiveness. According to Tenner and DeToro (2000), there are three ways in which to measure performance: process measures, which define activities, variables and operation of the work process itself; output measures, which define specific characteristics, features, values, and attributes of each product or service; and outcome measures, which measure the impact of the process on the customer and what the customer does with the product or service (customer satisfaction measures are often used here to evaluate outcome measures).

Rosemann and vom Brocke (2015) indicates that in order to evaluate actual process performance, it is important to have a clear and shared understanding of process outputs and related key performance indicators (KPIs). The strategic goals can be capitalised through process-oriented, and cost-effectively measured KPIs as process goals, facilitating process control (Rosemann & vom Brocke, 2015). The KPIs, different in nature across functional areas, should be standardised across different processes and process variants (Rosemann & vom Brocke, 2015). Such standardisation of process performance enables cross-process performance analysis against business KPIs that reflects the strategy; for instance, demonstrating which processes had a greater influence in the drop of customer satisfaction rate (Rosemann & vom Brocke, 2015). Furthermore, Rosemann and vom Brocke (2015) proposes that a more advanced (mature) analysis would result from observing to which extent the KPIs are linked to characteristics of the whole process, such as flexibility, reliability or compliance.

Dumas et al. (2018) suggest the use of 'process profiles' that states: the process vision aligned with the business strategy, the envisioned outcomes, and the success factors. The process success factors can contain a list of process measures over relevant performance dimensions (e.g., throughput time, cost) and related process performance objectives so that it explicitly shows the relationship between process measures and business goals reflected in KPIs (Dumas et al., 2018). In the same line, Rohloff (2009b) illustrates process descriptors that contain all relevant information (e.g. Input/Output, Interfaces). In addition, the performance measurements should be shared by relevant stakeholders and be standardised across processes and process variants to enable cross-process measurements aligned with shared KPIs (Dumas et al., 2018).

Key findings from de Bruin and Rosemann (2006, p. 7)'s case study include that the business should "focus on measuring the key enablers for delivering outcomes and not the outcomes themselves and consider both leading and lagging indicators when evaluating trends". Secondly, it is essential to recognise both situational and critical measures and widely communicate measurements through standardised reports.

One of the facets of this capability area is a financial achievement in terms of profits. Examples of financial achievements are represented by the return on Assets (ROA) and Return on sales (ROS). Ittner and Larcker (1997) attempted to measure maturity in the automotive and computer industries. Among the findings, they established that to reach a high ROA and ROS in the automotive sector, is required to foster a higher level of customer and supplier involvement in strategy and process design. On the other hand, in the computer industry, the ROA level is lower and requires less involvement of the customer and supplier in the strategy and process design, but a continuous process improvement focus to achieve the low ROS required because they follow an innovation focus strategy. Hernaus et al. (2012), indicates that performance models should clearly link strategic objectives and business processes on the one side with various performance measures on the other side.

Process customers and stakeholders

This capability area elaborates on the importance of considering different views, from the ones that influence the processes and those who are affected by the processes (de Bruin & Rosemann, 2006; Dumas et al., 2018). To mention some relevant stakeholders, it is listed: shareholders, executives, government bodies, and suppliers.

Being the customers another stakeholder, the model considers them separately in the same capability area because of their strategic importance. For example, Zairi (1997) argues that a clear alignment between process and customer requirement is exemplary in the practices of world-class BPM organisations such as Rank Xerox Corp, British Telecom and SmithKline Beecham. In the same line, Labovitz and Rosansky (as cited in de Bruin & Rosemann, 2006, para. 13) “suggest that the way an organisation thinks, works and is managed should be both guided and driven by the customer’s voice”. The process compliance may need to meet mandatory requirements like the ones from the legislation (de Bruin, 2009).

At the structural level, de Bruin and Rosemann (2006) extracted in their case study that organisational ownership structure (e.g. parent-subsidiary relationship) may lead to more inflexible relationships in the event of external but related customers and suppliers. Secondly, sometimes optimising process customer requirements in-line with strategy and process capability achieves greater benefits than maximising customer requirements by linking the strategy with process capability.

Ittner and Larcker (1997) encourage the involving of suppliers in a number of process activities, including process design and performance measurement.

As an example of the measurement of SA, Niehaves et al. (2013) assessed the strategic alignment factor (and others) through the lens of the BPMMM. The case organisation reflected low maturity level for each of the five capability areas. The company had not defined a BPM strategy at either overall or project/initiative level, having not process improvement plans defined, making the aligned with the business strategy on-existent. The organisation did not have a specific enterprise process architecture presented (no evidence of process identification checks presented in the study). The informants of the assessment stated that there were no process outputs or KPI defined at an organizational level. Although some units have defined some performance indicators, they are not linked to the processes. The employees commented during the appraisal that they do not align with the priorities of the stakeholders except for the legislative body (EU Service Directive). Although legal bodies should be considered stakeholders because the influence the adjustment and requirements for the process, ‘compliance’ as a capability is explicitly part of the Governance factor in the BPMMM, nevertheless, BPM factors are intertwined, and statutory bodies requirements can also be taken as part of the stakeholder's alignment and should be reflected under the facet: ‘role of process stakeholder in adjusting processes and resources. Evidence can be found in de Bruin and Rosemann (2006, para. 16) when explaining that “major IT upgrades/implementations and legislation such as Sarbanes Oxley contribute to the development of lower-level process maps and process improvement methods can improve visibility”.

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Appendix G: Example of coded fragments and emerging themes that derived the content of a cell in the grid (Capability area of Process View and Process Architecture, level 1 (C5)

Themes:
- Focus on functions and none or little consideration of processes, therefore no process architecture designed
- None or few isolated processes modelled but not in use and without capturing the relationships between processes
- According to Fragments from other documents this fragment fits in another level

Fragments (F) | Sources (S) | Models (M)

FRAGMENTS CODED AT 1: INITIAL LEVEL

BPMMFIS - Fisher (2004) The Business process maturity model - a practical approach for identifying opportunities for optimization

this is the organization that operates within the context of functional silos, geographic silos, product line silos, etc. In other words, these individual groups work to optimize their own piece of the organization (usually based on efficiency), but do little in terms of aligning strategy

Integration within functions • Driven by cost and efficiency
Some cross-functional integration to solve pains

Functional silos
• Geographic silos • Department focused
• Informal communications within departments

BPMMHR - Harmon (2004) Evaluating an Organization's business process maturity>

In essence, if we say that a manufacturing organization is at Level 1, we are saying that the functional group doesn't think in terms of processes, and hasn't made any serious effort to define their processes.
Instead, they rely on goals and measures associated with the manufacturing function, not with specific processes to which manufacturing might contribute.

Completely immature organizations usually think of themselves in terms of functional departments, and diagram themselves by means of a traditional organization chart

BPMMM - de Bruin, Tonia; (2009) - BPM Theory of progression>

Company U
 Nothing currently exists but there are plans to start working on this There are bits and pieces and pockets of process models but these are not related or are linked to discrete systems
 Existing process models are not used The top level processes have been identified and are felt to be okay however, these have not been devolved to lower levels
 A lot of high-level process modelling was done in ARIS for ISO manuals but these are not used
 Process models are not used for identifying improvement possibilities There has been no organisational decision about what an enterprise process architecture might look like including what levels would be reflected, what details would reside at each level, how such an architecture would be used and li

GARTNER - Melenovsky (2006) BPM Maturity Model Identifies Six Phases for Successful

Strategic alignment: The organization adds a new dimension of "process" to the established dimensions of function, product line and geography, (2: Management)

LEONARDO - Leonardo consulting. (2019). BPM maturity assessment>

No process architecture defined, documented, or in use. There may be some process models but there is no coherent architecture (even if there is a desire by someone to have)

vPMM - Lee (2007) An Overview of the Business Process Maturity Model BPMM

not planned and standardized processes.

Appendix H: Research design for potential interviews

Interviews have the potential to capture the tacit knowledge of experts. Based on the limitations of the literature-based maturity grid, this exhibit presents a detailed plan to triangulate the data gathered from the document analysis with interviews. The goal of conducting interviews is to evaluate the completeness and accuracy of the content of the maturity grid, which may lead to improving its content.

In qualitative research, interviews are the most common and among the most appropriate methods to collect primary data (Myers & Newman, 2007). In face-to-face interviews, the interviewer can increase cooperation rates and enables respondents to obtain immediate clarification (Scheuren, 2004). Myers and Newman (2007) propose a rigorous framework for conducting interviews in IS. The goal of the interviews is to complete the information that could not be extracted from document analysis and to perform evaluations on the artefacts. It is proposed the use of semi-structured interviews which predefined questions derived from the content analysis on the documentation. This flexible format is selected because allows the researcher to go deeper in the questions to maximise the participant expertise and where more information is required to describe a capability through the levels considering the strengths in the knowledge of the experts.

This appendix is supported with documents available as an Ancillary material. These materials cover a detailed plan for the interviews with some examples and justifications for the required activities proposed in the plan. It also includes field documents that can be used as a template to fulfil the plan. The Ancillary material is available on https://drive.google.com/file/d/1NwRO9eVxkBve5XcJLlLpXwVGAk2SMis5/view?usp=sharing

The process of conducting the interviews proposed in this plan considers eight steps and covers the preparation of the interviews (such as extracting tentative questions, determining the potential participants and arranging them), to the execution of the interview and further data analysis. Figure 20 summarises these eight steps, and they are each explained in detail below.

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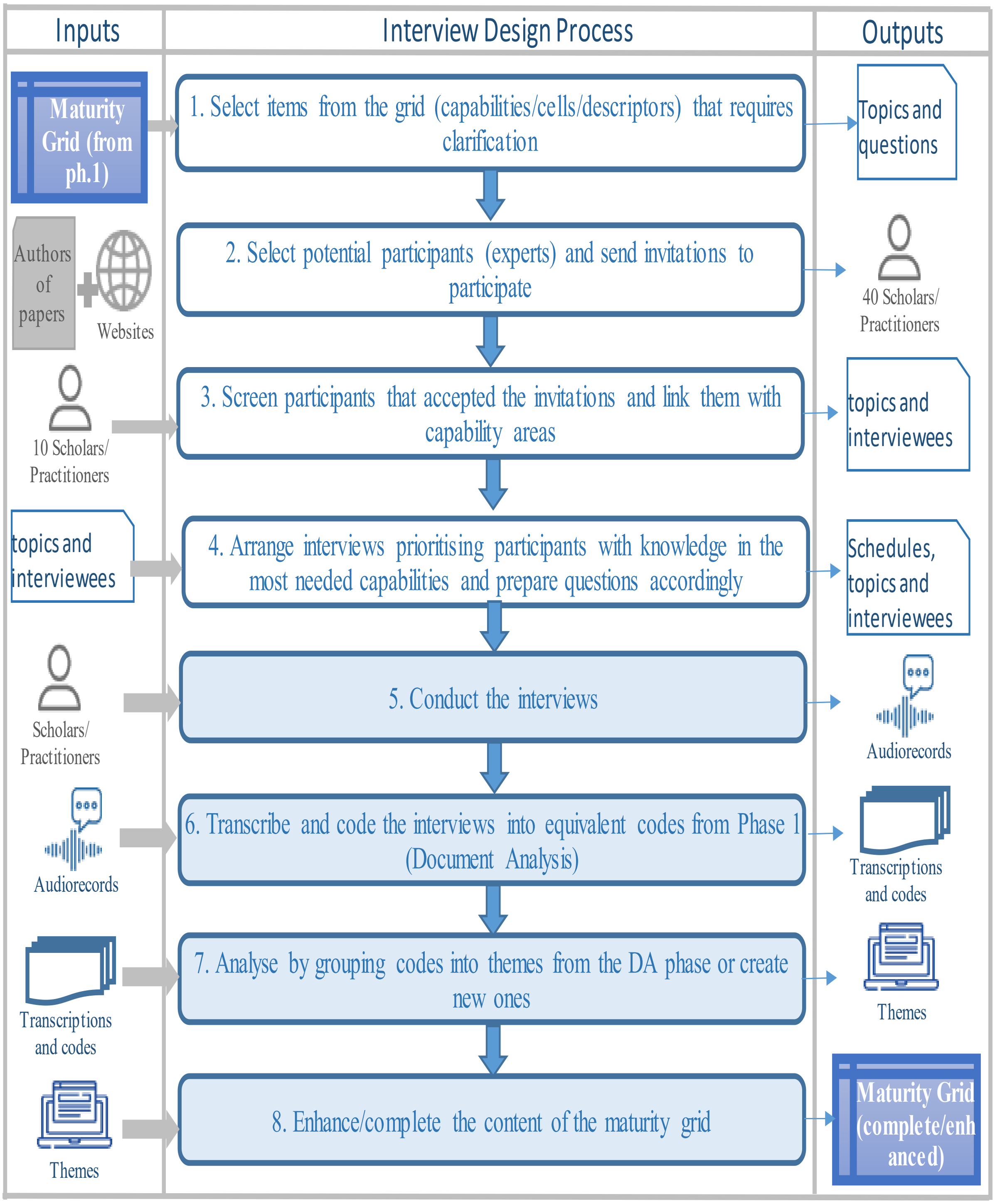

Figure 20. Interview design process for the completion and enhancement of the maturity grid

Each of the steps enumerated in Figure 20 is described in the following lines.

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- **Step 1: Identification of items that requires clarification and derive research questions**

The questions for the interviews are all related to the content on the cells, i.e., the descriptors. The grid exhibited in Section 4.4.5, Figure 17, is the main input for this step.

The questions can be classified according to their purpose to:

- Complete the grid, by considering themes for the capabilities under certain maturity levels that were not found in the document analysis
- Enhance the grid by either, confirming the consideration in the grid of weak descriptors (descriptors that obtained low citations in the content analysis over documents), removing them from the grid or moving the descriptors to other levels in the grid, according to the expert's opinions.
- Evaluate the completion of the grid: When reaching analytical saturation, i.e., no new themes are found when interviewing new experts, asking rather open questions about the capabilities rather than specific questions about descriptors will provide an opportunity for such evaluation.
- Evaluate the content validity of the grid: By presenting the content of a cell (a group of descriptors) to the expert and ask them where they would position in the grid. Then, the answer of multiple experts is contrasted with the position of the cell in the developed grid at that stage.

In Section 4.3.3 it was explained that the grid contains reference indicators (Fragments, Sources, Models) which purpose is to distinguish which descriptors are linked to more or less evidence from the literature where the descriptors with weaker evidence that back up them are indicated with the mark "*" (see example in Section 4.4.5, Figure 15). These weak descriptors are set as targets to be clarified with experts.

Taking as an example, the cell of the grid shown in Section 4.4.5, Figure 15, that refers to the Process view and process architecture capability, level 5, it contains two descriptors with low evidence (weak):

"The process architecture integrates processes beyond the organisational boundaries, including suppliers and partners" and *"The processes have been designed to fit with customer and supplier processes in order to optimize inter-enterprise performance"*.

A tentative question to ask an expert could be: *"At maturity level 5 for a process architecture, does the process architecture considers the processes of customers, suppliers, partners? Do they fit?* This question directly addresses the descriptors and depending on the answer of the expert; they will be either provided with more evidence from the interviews to keep them in that place, move them to a different maturity level (different cell in the grid) or remove them from the grid in case the opinion of the experts is different for this capability at that level of maturity.

Moreover, as explained in Section 4.3.3, it is important that descriptors in scoring rubrics such as this maturity grid reflect progression through the different levels of maturity. It was exemplified through Figure 16 that not all the descriptors obtained in the document analysis follow such a pattern. Those descriptors that are not

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related to other descriptors in adjacent cells of the grid (one lower or one higher level of maturity for the same capability) also requires clarification to experts and are inputs for questions.

Continuing with the example of Process Architecture, level 5 cell, it refers to a cell that is weak because it only provides two descriptors with little evidence from the literature. Therefore, it is necessary to assign a higher level of priority to weak cells.

Considering time constraints and a limited number of experts to interview, it is important to prioritise the questions based on the cells that require more attention in the grid. This prioritisation is established as follows:

- High priority: Questions related to cells of the grid where all the descriptors are marked with an "*" for low number of references.
- Medium priority: Related to some descriptors marked with "*". Also, descriptors that are not linked to descriptors in precedent or subsequent maturity levels, so they do not reflect progression in maturity, as described in Section 4.3.3 and exemplified in Figure 16.
- Low priority: The cells do not contain any descriptor marked with "*".

Ancillary material – Part B presents tables of questions for each capability area of the maturity grid. The questions are arranged from the general content of the capability to identify new themes that were not covered in the literature, encouraging the spontaneous/unbiased answer of the respondent. Then, the questions become more specific for the specific descriptors. The priority for each question is also assigned in the tables exhibited in Ancillary material – Part B.

As shown in Table 14, a total of 69 questions where extracted from the maturity grid.

Capability areas	High	Medium	Low	Total
Process view and process architecture	7	4	3	14
Process Customers & Stakeholders	7	5	3	15
Process measures	0	2	10	12
Process Improvement Planning	0	10	3	13
Strategy and Process Capability Linkage	8	4	3	15
Total	**22**	**25**	**22**	**69**

Table 14. Number of questions per capability and priority

In Table 14, the capabilities that require more attention are Process View and process architecture, Process Customers and Stakeholders, and Strategy and Capability Linkage. In contrast, Process Measures requires less attention because its descriptors were more cited in the document analysis. Therefore, interviewing experts with knowledge in the capabilities with more questions at a higher priority and medium priority should be arranged earlier than for less important capabilities such as Process measures which inputs obtained from the literature are satisfactory.

In Guideline 3, Hevner et al. (2004) indicate that the utility, quality, and efficacy of a design artefact is required to be rigorously demonstrated by performing evaluation methods which ultimately considers the deployment of the artefact within the business environment (i.e., the naturalistic evaluation according to Venable et al. (2016). The utility of the maturity grid is to position BPM Strategic Alignment within a basic framework of descriptors for the maturity of its capabilities. Such standardised evidence can be shared across multiple organisations and thrive the understanding of BPM Strategic Alignment maturity and its impact on organisations. The evaluation for the utility, usability and reliability requires a naturalistic evaluation of the assessment framework through its application on a business environment. This naturalistic evaluation is out of the scope for this research due to time constraints. However, the recommended evaluation criteria for the grid includes content validity and completeness through a series of in-depth interviews to experts with experience applying maturity models with capabilities related to BPM Strategic Alignment in organisations or studying or studying or the developers of such models.

Completeness is defined as "the degree to which the artefact contains all necessary elements and relationships between elements" (Hevner et al., 2018, p. 14). In this case, the statements in the grid are sufficient to measure the maturity of SA in an organisation.

Validity can be defined as the degree to which the data collected measures what the study intends to measure. According to Blair et al. (2013), validity requires that the instrument measures the dimension or construct of interest. For rigorous DSR deliverables, it is necessary that the artefacts obtain valid results. According to Elo and Kyngäs (2008) the content validation requires the involvement of experts to support concept production. This is the case for the maturity grid. For this assessment, the validity means that the descriptors are classified in the right capabilities at the right level for adequate measurement of Strategic Alignment maturity.

The questions for evaluation consist of a comparative process were the inputs provided by the interviewees are compared to the content already existing in the grid. The questions are more open than for addressing specific descriptors.

The questions for evaluation need to be derived after having iteratively enhanced the grid through a series of interviews, so it is evaluated in its close to final form. The interviews should systematically drift their focus from including more development questions to evaluation questions upon progress towards analytical saturation. If the experts add something new, it is asked to clarify it. New content is included in the grid only if another expert spontaneously refers to it in another interview. If no further content is needed to be included, then the maturity grid is considered complete.

For **content validity,** some descriptors of standards of a capability at certain maturity level (the content of a cell) after the document analysis and interviews for development, are given to the experts during the evaluation interviews. The researcher proceeds to ask the expert at which level they would classify. For example, a question can be formulated as In which level, from 1 to 5, would you classify a "Measures for processes spread across the organisation, process performance continuously measured in quantitative terms" (taken from the cell of the grid corresponding to capability: Process Measures, level 4). If the answer given matches the cell of the grid, then those descriptors are valid. However, if more than one expert has classified the descriptors

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into a different level, then the content for that cell needs to be revisited in the literature and more experts' insights.

For example, the following question can be used as an evaluation question for content validity:

"Every process has metrics and are periodically monitored against the strategic business goals and KPIs". Where would you place this statement in this maturity grid?

	1: Initial	2: Managed	3: Defined	4: Quantitatively Managed	5: Optimising
Process view and process architecture					
Process Customers & Stakeholders					
Process measures					
Process Improvement Planning					
Strategy and Process Capability Linkage					

Table 15. Maturity grid template as a proxy to classify a statement for evaluation purposes

If there is an agreement in the answers of the interviewees answering this question, then the descriptor is compared to its actual position at that moment and will be kept or moved considering the number of references from both, documents, and interviews

The detailed questions will be derived from the grid after completing the interviews for development.

As a by-product of this research, heuristics for the application of the maturity grid in organisations were derived from the interviews. Some questions to the interviewees were designed to address practical considerations when utilising the grid in a business environment. The guiding question designed to capture the heuristics during the interviews is:

How do you measure the maturity of ____X_____?

where "X" can be a capability area or a concept of a specific descriptor of the pilot grid, considering the instances of maturity assessments found in the sample of documents for the development of the grid (Section 4.3) such as: de Bruin (2009); Hammer (2007); Harmon (2004); Niehaves et al. (2013); Rohloff (2009b); Škrinjar et al. (2008).

The insights for the heuristics are obtained during the interviews for the development of the grid.

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- **Step 2: Identification of participants**

The profile of the interviewees required for *step 2* is either scholars or practitioners with experience developing and/or implementing assessments for Strategic Alignment or the capability areas of the model in the context of BPM-MMs, like the maturity of a process improvement plan, process architecture, strategy and process capability linkage, measurements, customers and stakeholders. The goal is to complete a pool of at least 14 scholars and 40 experts considering the possibility of rejection so that the research can ensure the participation of approximately 10 participants for the development of the grid (five scholars and five practitioners) and a similar number for evaluation.

Scholars have been identified from publications related to Strategic Alignment and maturity models. The publications have been identified already for performing the Content analysis previous to the interviews, and the scholars are identified from the references and ranked according to the proximity to the Strategic Alignment factor of the BPM maturity model from de Bruin and Rosemann (2005). For example, de Bruin, as the main author of the model, will be first on the list. At the lowest priority are located scholars with publications in only one capability area for Strategic Alignment of the five presented in the model. They can be approached by e-mail (see Ancillary material – Part E) that should contain attached the information about their participation in the project (see Ancillary material - Part F), including descriptors for capabilities given beforehand to provide the context of Strategic Alignment. A summary of the project must be given to maximise their time during the interview, so the experts will know what is needed from them. Ancillary material – Part G exhibits supplementary information to provide to the experts. The professionals interested in participating will have confirmed their recruitment once the Consent Form (Ancillary material – Part H) is signed and forwarded to the researcher.

For locating practitioners, firstly is necessary to find suitable organisations where they work. First criteria would be to identify consultancy firms that offer BPM services (e.g., Accenture, Procensol, Leonardo, KCG), which are the type of business that usually performs maturity assessments for organisations. Geographic location is relevant because of the contact net with QUT can foster a willingness to participate. However, geographic location is not a priority. The search strategy is using the google browser using the keywords "consultan*"[2] BPM, Business process improvement (BPI), Business process orientation (BPO) and all related acronyms. Despite the fact that the participation of consultants is desirable, it is also possible that they will not be willing to participate since the diagnosis of BPM maturity is part of their market. However, stimulating the diagnosis of BPM capabilities can lead organisations to seek support from BPM firms such as consultants to reach their desired level of maturity, which is attractive for consultants that offer prescriptions for process improvements.

Practitioners leading BPM efforts in organisations are also potential participants since they participate in the implementation of maturity models and are knowledgeable. One way to obtain access to them is by identifying

[2] The "*" represents a wildcard for search engines and it is given as an exemplary approach to search for the word consultant or consultancy

organisations that have implement BPM initiatives. One vital source to identify practitioners is through case studies about implementing BPM initiatives in organisations. For example, some case organisations where the BPMMM was applied can be found in de Bruin (2009). In the thesis of the BPMMM, a list of organisations that benefited from the development and application of the model is presented (de Bruin, 2009, p. 23). Another option considered is that the organisations can be found from websites of consultancy firms that offer BPM services or vendors of popular BPM systems and software such as Appian, Aris, SAP. Consultants and vendors typically have an "our clients/customers/partners" or "testimonials" section where they list the businesses for marketing purposes. The first step is to obtain a contact from the organisation that will eventually find the adequate person to talk with from the BPM field. Participating in BPM research from a prestigious and world-leading university in the BPM domain can be encouraging.

Other opportunities for identifying relevant practitioners, and also scholars are BPM online communities such as BPTrends, BPM online, BPM.com, IBM business process management forum, Camunda BPM forum, ARIS community, etc. Besides, local BPM round tables is an excellent opportunity for networking and identify potential participants. Furthermore, LinkedIn also offers an opportunity to contact potential experts by joining BPM communities and forums worldwide. Also, the BPM group at QUT has a world-wide reputation in the BPM domain with a considerable amount of research with industry partners. Such contact net can support the researcher to identify key contacts within organisations. Finally, QUT has undergoing process improvement projects, and there has been a collaboration with academics of the BPM group, making it an accessible organisation to ask experts to interview. Ancillary material – Part D provides a list of potential participants to be contacted in this research. The experts are separated into scholars and practitioners and prioritised, considering the suitability of their experience for this study. The first two potential participants are 1) Dr Tonia de Bruin, a practitioner who is the main author of the BPMMM that is used as a foundation for the SA maturity grid and has experience assessing BPM maturity using the same model. The second potential interviewee is the scholar Dr Michael Rohloff who has developed a maturity model building on the BPMMM and has implemented in organisations. Most of the participants contained in Ancillary material – Part D were identified from the sample of documents for the content analysis and mapped to specific capabilities as shown in Ancillary material – Part C.

Some organisations may have implemented different BPM tools, however not necessarily maturity models. Although maturity models are one of the most popular BPM tools (Tarhan et al., 2016; Van Looy et al., 2013) the researcher cannot ensure that the identified organisations that have performed BPM initiatives have assessed their BPM maturity. This research requires experts with experience performing maturity assessments. The first approach as a screening procedure to assess to what extent the participant can contribute to the study.

The only incentive for participating in this research is knowledge sharing by giving insights about the BPM Strategic Alignment capabilities. However, it will be highlighted that this research may underpin future capability and maturity assessment studies in the BPM field. Such knowledge could be an incentive for organisations to demand consultancy services for diagnosis and lead actions towards capability enhancements that can lead to process improvements, and subsequently, to performance improvements.

➢ **Step 3: Screening the participants**

Once the participation of the expert is confirmed (consented), in *step 3* it is recommended that the potential participants are contacted with the aim of gauging the knowledge and expertise for the assessment of the specific capabilities of BPM Strategic Alignment contained in the maturity grid. The goals for such a short interview is to screen to pre-assess the knowledge/familiarity of the interviewee with the BPM Strategic Alignment factor. Hence, the researcher will be able to maximize the next interviews by focusing in the capability areas of their expertise to ask about areas in the grid. The length of this interview is 15 minutes. The researcher then will rank the participants according to the proximity of their notion of maturity assessment and the given model (the BPMM).

Examples of questions for the preliminary conversation (screening) are:

- What BPM or process focus initiatives you have led or supervised?
- Which models have you used to assess maturity?
- Have you assessed the notion of Strategic alignment? What aspects or capabilities did you consider?
- Have you measured the maturity of a process architecture (or any other capability within SA)?

However, it can happen that the researcher or the experts may not have the time for such a small preliminary interview. Therefore, it is necessary to conduct the screening method with the information that has been already collected. In this case, as scholars and practitioners were identified from publications that were utilised for developing the grid, the experts can be mapped to the capabilities their publications contributed to, in the grid. NVivo 12 offers the Matrix Coding that can show the number of fragments from the literature coded for each capability and level (cells of the grid). Hence, the authors of the documents can be linked to the capabilities, as shown in Ancillary material – Part C, which is an adaptation of the Matrix Coding from NVivo 12.

➢ **Step 4: Arrange interviews prioritising participants**

Once the screening procedure concludes, in *Step 4* the participants are ordered according to their potential contribution in the capabilities that requires more attention considering the criteria described in *Step 1*. Each confirmed participant is linked to some capabilities to maximise the interview accordingly with the knowledge of the interviewer.

➢ **Step 5: Conduct the interviews**

The interview considers three parts: the opening and introduction, the main questions for the development/evaluation of the grid, and the closing step of the interview.

The purpose of the opening and introduction is to introduce the stakeholders (interviewer and interviewee) to each other to create the adequate atmosphere for the interview and restate the conditions of the interview (length, record). It also introduces the research project and scopes the interview with a few capabilities. This part is generic for every interview.

Then, the main questions derived in *Step 1* are posted with the purpose of completing, enhancing, or evaluating the content of the grid, as detailed in the description for such a step.

In the closing section, the interviewer will request additional comments, snowball to secure the number of interviewees to reach analytical saturation, obtain feedback to improve next interview, define the next steps and thanks the participation of the expert in the study. This part of the interview is generic for any type of interview.

The details for each section and exemplary comments and questions are presented in the Ancillary material – Part A, which is a generic protocol for these interviews.

The interviews can be conducted using a video call platform like Skype or Zoom in the English language (the same applies to the screening conversation).

- **Step 6: Transcription and coding of the interview**

In *step 6*, the transcription and coding of the interview happen once 2 to 4 interviews have been conducted. The transcriptions of the audio records are considered to be externalised, and the coding process matches the Document analysis approach, with a distinction in the codes to separate the fragments coded from the literature and the ones from the interviews.

- **Step 7: Data analysis of the interviews**

In *step 7***,** all the interviews considered in this research will be processed from their transcripts using NVivo and the coding schema from the document analysis. Same as in the document content analysis process, the relevant fragments will be coded as part of the node that aligns the facet of strategic alignment with one of the five maturity levels. Once analytic saturation is reached, i.e., there is sufficient information to make a description of for the specific cell in the grid, and it does not contradict or repeat the content with other cells, the researcher will synthesise the description based on the quality of the source, such as the experience of the participant and his/her familiarity with the model. In operational terms, analytical saturation is reached once no new themes can be made after adding new information (fragments encapsulated in the codes), and there is no fragment that needs to be grouped in a different theme.

- **Step 8: Enhance and complete the SA maturity grid**

The new information gathered from the interviews must be utilised for enhancing the descriptors of the grid derived from content analysis, adding new information that was not covered in the literature, or eliminate descriptors that are poorly supported. As DSR guidelines advice, the evolutionary artefact should keep track of the changes for continuous improvement. In this case, the reference from the coded interviews will be considered in the grid, adding the indicator "I: Interview" that will contain the number of interviews that support certain descriptor. Those coded fragments from the interviews will also be included in the Excel maturity grid under the sheets that contain the fragments for a specific cell and their grouping into themes.

- **Ethics consideration for human-centric data collection**

As this research considers in-depth-interviews for the enhancement/completion and evaluation of the maturity grid, it requires the submission of a low-risk ethical application for Human Centric data collection. The ethics application was submitted, and the committee acknowledged it as a low-risk application. However, it gave feedback to be addressed that is in revision. The new application considers the rescoped proposal for the Master of Philosophy course.

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~ END OF THESIS ~

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