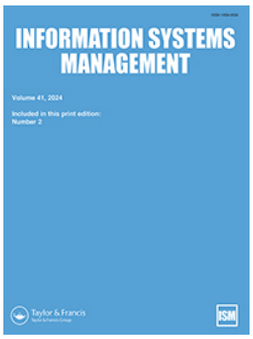

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Exploring the Limitations of Business Process Maturity Models: A Systematic Literature Review

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Abstract
Business Process Maturity Models (BPMM) offer organizations an approach to improving business processes. However, criticism of the usefulness of BPMMs in improving operational efficiency exists in the literature. Hence, a systematic literature review was conducted, thematically analyzing forty-seven studies about BPMMs. The paper provides an in-depth understanding of the limitations and the extent to which these problem areas have been addressed, aiming to provide a foundation for future research in improving the usefulness of BPMMs.

Keywords
business process; business process management; process maturity; business process maturity models; systematic literature review

Introduction

Managing business processes is essential in enabling organizations to meet customers' increasingly demanding requirements in a complex and competitive environment (Dumas et al., 2018; Nadarajah & Latifah Syed Abdul Kadir, 2014). Business processes are a collection of activities that transform one or more inputs into valuable outputs for the internal or external customer, utilizing organizational resources (De Boer et al., 2015). The process approach emphasizes optimizing activities following a horizontal approach spanning organizational boundaries with a customer-centered focus, enabling organizations to achieve stability and sustainability and reduce dependence on individuals (Brzychczy & Kostka, 2018). Viewing organizations as a "set of interrelated processes" implies that the understanding of current processes improves their management (Müller, 2014). Thus, organizations heavily rely on and shift their attention toward the expertise of Business Process Management (BPM) (American Productivity and Quality Center APQC, 2022). For instance, the business process trends (BPT) survey by Harmon and Garcia (2020) suggested that over 90% of participating organizations conducted at least one process improvement project to improve operational efficiency. However, managing business processes remains challenging, particularly in identifying processes for improvement and respective improvement measures (American Productivity and Quality Center (APQC), 2022; IBM, 2021). Also, executives face difficulties establishing a solid business case for process improvement and setting key performance indicators (KPIs) to measure improvement (BDO Digital, 2020). Furthermore, defining and mapping end-to-end processes present significant challenges in BPM (APQC, 2022). Thus, establishing a systematic approach toward identifying improvement opportunities emerged as the main issue (APQC, 2022).

In response to the challenges in BPM, the literature indicates the importance of process maturity as a "measure to indicate how excellent business processes can perform" (Van Looy, 2010). In this context, business process maturity models (BPMMs) serve as an approach to assess and improve business processes and BPM capabilities (Raschke & Ingraham, 2010). These models allow for a systematic approach to address uncertainty (Normann Andersen et al., 2020) and better understand the factors and relations that shape the operating domain that ultimately contribute to sustainable domain success (Britsch et al., 2012). BPMMs are defined as "models that assess and/or guide best practice improvements, expressed in lifecycle levels, through an evolutionary road map with regard to (i) process modeling, (ii) process deployment, (iii) process optimization (iv) process management often also including (v) organizational culture and (vi) structure" (Van Looy et al., 2011a). As such, organizations can use BPMMs to identify and define improvement opportunities through process maturity appraisals and develop best-practice guided improvement programs to address challenges

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in BPM (OMG Business Process Maturity Model BPMM, 2008).

Process maturity enables organizations to improve operational efficiency through reduced throughput times, resource efficiency, and increased quality to supplement their efforts to retain a competitive advantage (Dahlin, 2020). Raschke and Ingraham (2010) suggest a correlation between process maturity and performance, whereby firms with higher levels of process maturity have relatively better performance when compared to firms with lower levels of process maturity. Although Raschke and Ingraham's (2010) conclusions were drawn on cross-sectional datasets, the results are indicators of the potential of process maturity in organizations.

Despite the reported benefits of process maturity, the BPT survey suggests a decline in adopting BPMMs as these were not considered for improving BPM capabilities (Harmon & Garcia, 2020). This shows a shift in thinking in firms, as earlier BPT surveys indicated process maturity was consistently assessed, and organizations showed significant interest in adopting BPMMs (Harmon & Wolf, 2016). One reason for this shift could be the criticisms in the literature that maturity models are considered "step-by-step recipes," which oversimplify reality by disregarding factors that influence empirical improvement and instead relying on levels with predefined outcomes (Van Looy, 2015). This raises questions on the ability of these models to provide actions for improving process maturity, generally referred to as practical usefulness (Bandara et al., 2020; Szelagowski & Berniak-Woźny, 2020; Tarhan et al., 2016), which may consequently affect the adoption in organizations. Therefore, this paper focusses on understanding the reasons behind BPMMs' limited practical usefulness and identifying approaches that can potentially overcome these challenges.

The following section reviews the key theoretical concepts of BPMMs, complemented by similar work undertaken in the field. The paper continues with the research design section, outlining the methodological choices for conducting this review. In addition, the study's results are presented alongside the discussion of each topic. The paper concludes by suggesting directions for future research.

Theoretical background

Process maturity builds on the theoretical foundations of maturity, defined as "the state of being complete, perfect, or ready" (Crosby, 1979). However, in the context of BPMMs, maturity is interchangeably used and referred to as "process maturity" or "organizational maturity" (Albliwi et al., 2014; Kalinowski, 2018; Tarhan et al., 2016). Maturity is often used in the multidimensional nature of the concept, encompassing other elements of the organization apart from business processes (Sliż, 2018). For instance, Rosemann et al. (2004) explicitly note that their BPMM is not targeted only at business processes but rather at implementing BPM success factors in an organization. On the other hand, Hammer (2007) proposes two constructs as part of his BPMM for measuring maturity in organizations: (i) process maturity considering the enablers for ensuring capability and (ii) enterprise capabilities that consider the factors that can hinder or support mature processes in the organization.

To define maturity in the context of BPMMs, Van Looy et al. (2011a) initially established the theoretical components that BPMMs assess or improve, which simultaneously define the scope of these models. Van Looy et al. (2011a) found that BPMMs are used to measure or enhance components referring to either (i) Business Processes (BP), which includes process modeling and process deployment, and/or (ii) BPM, which includes process management and process optimization in addition to the former BP component; and/or (iii) BPO which consists of the organization's structure and culture in addition to the former BPM and BP components. Therefore, it can be suggested that a funnel structure is created, where BP is enclosed by BPM and further enclosed by BPO, implying that maturity can be defined in the context of BP, BPM, or BPO components. As such, Van Looy et al. (2011a) state that organizational maturity adopts a more holistic approach, given that any changes in the context of business processes would require the support of the whole organization. Hence, in its holistic nature, organizational maturity is defined as "the extent to which an organization has explicitly and consistently deployed processes," and it increases by simultaneously focusing on process modeling, deployment, optimization, and management, and the organization's culture and structure to facilitate this growth (Van Looy et al., 2014).

Nevertheless, BPMMs do not necessarily measure all six components. As such, measuring or improving one of the components is usually called measuring or improving "process capability." Process capability adopts a process-based approach and is defined as "the ability or competence of an organization to achieve the targeted results by following a particular process or process area" (Van Looy et al., 2011a). The concepts share a positive relationship, where an increase in maturity supports an increase in process capability or vice versa.

The improvement of maturity through BPMMs is outlined as an evolutionary pathway from an actual state to an anticipated state through predictable patterns of organizational evolution and change (Röglinger et al., 2012). Such models can be used to assess and improve the state of implementation of best practices for each level of maturity (Kohlegger et al., 2009). As such, processes are as mature as the extent to which the best practices for each level of maturity of the BPMM are implemented. In line with this, Van Looy et al. (2011a) imply that the usefulness of BPMMs in practice depends on the ability of the model to assess and improve maturity through detailed assessment or improvement methods, assessed by quality and performance indicators. Regarding practical application, BPMMs consist of three intended purposes of use (PoU), which represent the lifecycle of the model but also define its ability to assess or improve maturity in the implementing organization. The PoU of BPMMs is either descriptive, prescriptive, or comparative (De Bruin et al., 2005). For descriptive purposes, BPMMs are expected to assess the current state (As-Is) and inform the development of process improvement roadmaps. For prescriptive purposes, the model is expected to facilitate the provision of improvement measures to achieve the desired level of maturity (To-Be) and provide guidance on selecting and implementing such measures. Finally, for comparative purposes, BPMMs are expected to enable benchmarking best practices between organizations (Albliwi et al., 2014). The aim is to leverage the positive effects of increased process maturity on process and enterprise performance (Zemlyakova et al., 2021).

Another critical differentiation in the literature is highlighting the focus of BPMMs regarding process types, i.e., specific or generic. The literature recognizes models that address specific processes in specific industries, e.g., the success of Capability Maturity Model Integration (CMMI) in improving software development processes (CMMI Team, C.P., 2010). On the other hand, generic BPMMs aim for generalizability, thus ensuring the model's applicability for process improvement, regardless of the process type or industry (OMG, 2008).

This paper considers BPMMs focusing on generic processes, as reflected in the research design section's inclusion and exclusion criteria. Similar studies conducted previously in the BPM domain are discussed in the following section to support the need for this systematic review by determining the differences.

Related work

Pöppelbuß and Röglinger (2011) explored three viewpoints regarding maturity models: the development and validation of the model, the volume of publications that demonstrate an interest in maturity models, and the practitioner perspective that pertains to the use of the models in the industry. Research findings suggest a deficiency in the theoretical base for maturity models and difficulties for practitioners in maturity model selection due to the abundance of the models in the field, highlighting the pressing need for a standardized model.

In addition, Röglinger et al. (2012) evaluated a sample of BPMMs against the design principles framework. Findings suggest that these BPMMs address the basic design principles with reservations regarding fulfilling the descriptive and prescriptive PoU principles. These conclusions are further supported by Wendler (2012), confirming that research in the field mainly focuses on developing new models instead of evaluating and validating existing ones. Thus, suggesting the need for more empirical evidence on the usefulness of existing models in practice.

Tarhan et al. (2016) systematically reviewed the development, application, and validation of BPMMs and revealed limited empirical evidence of their usefulness and a continuance of limited prescriptive characteristics. Felch and Asdecker (2020b) extend the review of Tarhan et al. (2016) with data from 2015 to 2020 to identify potential developments toward the suggested gaps. The results indicated that most gaps remained valid, with minor contributions toward model documentation and empirical validation of the newly developed BPMMs.

Table 1 provides a chronological summary of the findings from comprehensive systematic reviews of the literature on BPMMs. Preliminary findings from related work suggest that the lack of empirical studies on the impact on performance, the lack of prescriptive features, and the lack of methodological foundation in existing BPMMs are likely to affect the usefulness of BPMMs in practice (Felch & Asdecker, 2020b; Tarhan et al., 2016).

While the studies provide significant contributions to establishing these gaps in the field, the reasons behind the limited usefulness of BPMMs in practice and the potential approaches to overcome these limitations are scarcely explored. Templier and Paré (2015) suggest that a systematic literature review (SLR) is commonly used to establish gaps in the body of knowledge that a study intends to address due to its ability to analyze and synthesize existing work (Xiao & Watson, 2019). Hence, a SLR was conducted to understand the limitations that hinder the use of BPMMs and explore the extent to which these problem areas have been addressed. The aim is to establish alternative research avenues that would assist researchers in pursuing

Table 1. Summary of key findings of influential reviews in the field.

Author(s)	Sample Size	Summary of Key Study Findings
Poeppelbuss et al. (2011)	76 articles	Lack of theoretical foundation for maturity models Lack of guidelines for selecting BPMMs for adoption Need for a standardized model in the BPM domain
Röglinger et al. (2012)	10 articles	Significant evidence of the models fulfilling the basic requirements. Partial fulfillment of descriptive characteristics. Lack of clarity on whether models address BP, BPM, or BPO maturity. Scarce evidence of prescriptive capabilities in the sampled models. Lack of empirical validity; impact on model standardization.
Wendler (2012)	237 articles	Focus on highlighting the importance of development guidelines for maturity models. Focus of research on maturity model development. Lack of evidence for model evaluation and empirical validation.
Tarhan et al. (2016)	61 articles	Focus on model development rather than enhancement of existing ones. Focus on the development of descriptive rather than prescriptive BPMMs. Lack of clarity between the reference model and assessment method concepts. Lack of evidence on the implications of model application toward business performance.
Felch and Asdecker (2020b)	69 articles	Neglect of previous authors' recommendations to refine the model's prescriptive features. Lack of evidence on the impact of the model on increased performance. Minor contributions to differentiating between the reference model and the assessment method concepts. Low rate of model publication in highly ranked journals due to methodological transparency. Lack of criteria to ensure methodological transparency for model development.

potential solutions to improve the usefulness of BPMMs in practical settings.

Research design

This SLR adopts the guidelines of Kitchenham et al. (2009) for systematically searching and documenting the review, supplemented by the guidelines of Clarke et al. (2015) for data analysis as illustrated in the research design (Figure 1).

Identification of research (steps 1–4)

Motivated by the decline of the adoption of BPMMs in practice and indications questioning their usefulness for improving process maturity, two research questions were established to achieve the aim of the SLR:

Research Question 1 (RQ1): Why are existing BPMMs considered to be not useful in practice?

Research Question 2 (RQ2): What has been done or proposed to improve the usefulness of these models?

The first research question is primarily concerned with systematically identifying the most frequently reported limitations in the literature that hinder the adoption of maturity models in industrial settings. Furthermore, it aims to clarify and better understand the relationship of such limitations with the negative impact on model usefulness, i.e., the rationale behind the importance of incorporating and addressing these challenges to fully leverage the capabilities of BPMMs to demonstrate business value in enterprise improvement initiatives. The second research question builds upon *RQ1*. It expands on BPMM usefulness by identifying and critiquing proposed approaches in the literature to address the limitations of better BPMMs. In addition, literature-proposed approaches for overcoming such limitations were collected and discussed to stimulate novel research directions.

The following information sources were used to identify the studies relevant to the research questions that form the foundation for the data analysis:

- *Scopus* – selected as it is the most extensive repository of bibliographic collection, and it allows for an advanced search where the string can be applied appropriately without breaking down or making additional alterations (Schotten et al., 2017).
- *Web of Science* – selected to supplement the sample of results with studies that may not be indexed by Scopus (Schotten et al., 2017).

In addition, based on preliminary research findings, a subset of influential primary studies on BPMMs was selected to extract the widely used keywords and ensure a robust search string was built that allows for a significantly inclusive scope of retrieved data. The subset of primary studies was selected based on the total number of citations. Finally, an initial search was conducted on the databases to understand the extent of inclusiveness by using the chosen keywords until the final search string was defined:

(("business process maturity" OR "business process capability" OR "business process orientation") OR

("process maturity" OR "capability maturity" OR "bpm maturity") OR

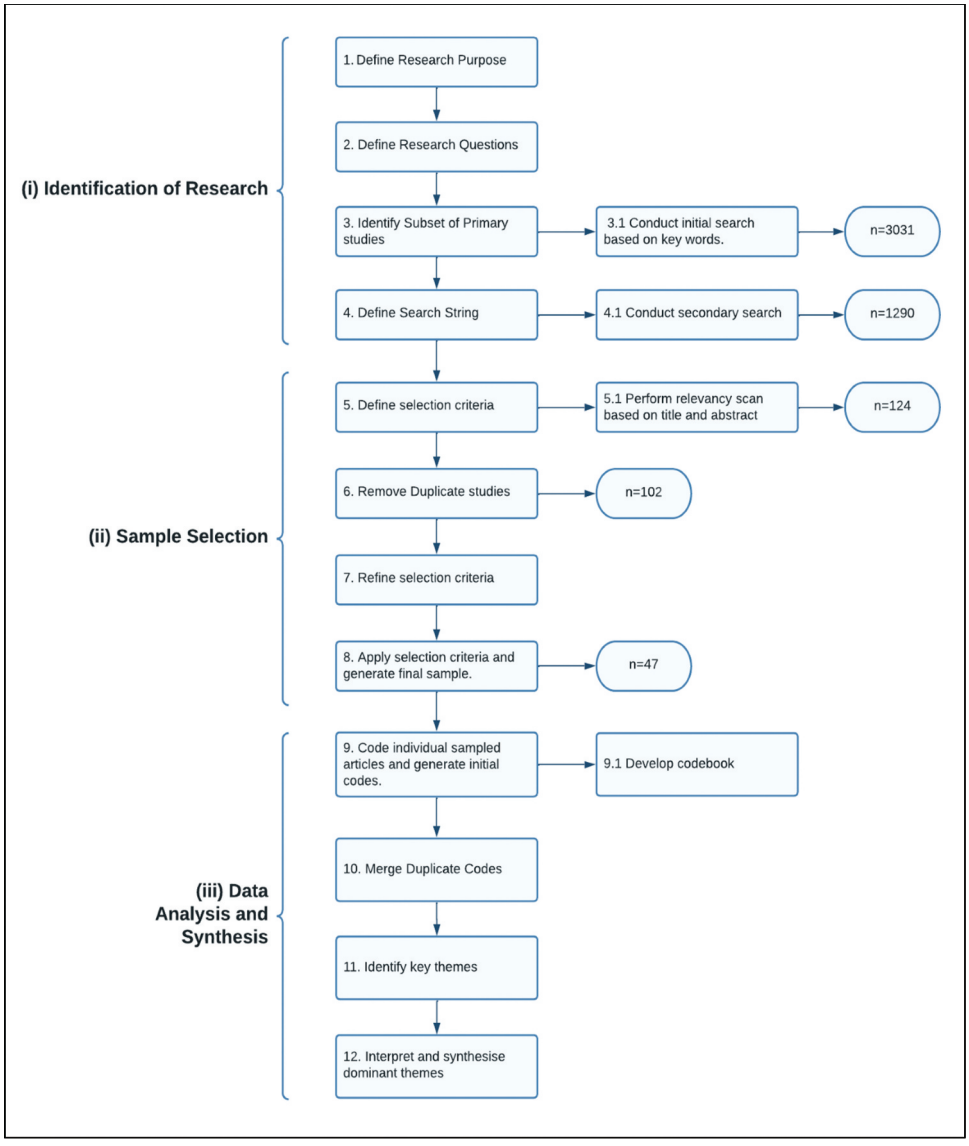

Figure 1. Research design of the SLR.

("process maturity assessment" OR "process maturity evaluation") AND

("business process management" AND "process maturity model"))

Sample selection process (steps 5–8)

The selection criteria focus on including primary studies that report the development, application, or evaluation of BPMMs to explore reported limitations. The literature search involved studies in the form of research articles published in academic journals and conference proceedings until 2022. In step 5, the initial selection criteria were applied to retrieve the candidate studies for the final sample. A relevance scan was performed based on the title and abstract of each article, resulting in 124 candidate studies. Further, a second round of exclusion criteria was applied after removing duplicate studies across both information sources, resulting in the final sample of 47 studies. The detailed selection criteria for the sample selection process are documented in Table 2.

Data analysis and synthesis (steps 9–12)

The SLR adopts a qualitative thematic analysis as a qualitative approach to analyze classifications and present themes that relate to the collected data, i.e., words, sentences, or paragraphs found in the sampled papers (Boyatzis, 1998). Thematic analysis is used as the data analysis approach as it is considered appropriate for studies that aim to discover different phenomena using interpretations in line with the collected data

Table 2. Literature search selection criteria.

Steps	Inclusion	Exclusion
5. Define Selection Criteria	Studies published in conferences and journals.	Concepts or ideas published in technical reports and white papers.
	Papers referring to maturity models in Business Process Management.	Concepts published in the form of abstracts, presentations, or posters.
	Studies published until 2022.	Studies that are not accessible or whose abstract is not available.
		Studies written in any other language but English.
7. Refine Selection Criteria	NA	Papers that represent or only focus on a process-specific maturity model, e.g., manufacturing, software development.
		Studies representing or only focusing on domain-specific maturity models other than BPM, e.g., business and IT alignment, industry 4.0.

(Alhojailan, 2012). Thus, factors or variables that affect specific issues reported in the literature were detected and identified, e.g., the limitations affecting the usefulness of the maturity models in the BPM domain and the reasoning behind that. Moreover, the thematic analysis allowed for a broad and holistic explanation of the issue and its associated factors through coding and categorizing data into themes (Marks & Yardley, 2004).

Each paper was considered as one unit of analysis. The analysis followed the stages of the thematic analysis adopted from Clarke et al. (2015), which are reflected in the last stages in Figure 1. The data management and analysis were facilitated through NVivo, which is recognized as a qualitative data analysis tool (Dhakal, 2022). The analysis followed an inductive approach: repeated rounds of reading, coding, and categorizing codes into themes. This resulted in a solid chain of evidence corresponding to the research questions instead of informing them through prior research (Boyatzis, 1998). The coding of data was conducted across all sampled papers rather than for each paper individually to identify commonalities running through a holistic dataset. In this instance, NVivo assisted in storing the papers in a portable document format (PDF), wherein sections of data in each paper were manually labeled in respective codes (Dhakal, 2022). After finishing the coding process, coded data were manually organized following a hierarchic approach, forming the final themes. In addition, the final themes were refined through repeated investigation of patterns of commonality and anomalous examples (Potter & Wetherell, 1987). The emerging limitations hindering the model's usefulness are classified as the key themes in the results section.

Results and discussion

The analysis resulted in 611 codes, documenting direct quotes from the studies involved in the sample. These codes were then categorized into sub-themes and themes in line with the research questions, as illustrated in Figure 2. The dominant themes form the reasoning to stimulate the research agenda in BPMM research are comprised of 1) the methodological foundation of BPMMs, 2) BPMM's purpose of use, and 3) the empirical evidence on the economic foundation.

The emerging themes were concluded in accordance with the frequency of occurrence across papers and the overall references through the coding process. While frequencies may not necessarily guarantee significance, they indicate the occurrence of the limitations highlighted in the sampled articles, thus establishing the extent to which these views are broadly shared, particularly in large qualitative samples (Greenland & Moore, 2022).

These themes involve limitations directly reported in BPMM's research that affect the usefulness of the models *(RQ1)* and approaches or practices implemented or proposed to overcome these limitations *(RQ2)* toward attempts to enhance model usefulness in the BPM domain. Table 3 provides the authors' interpretation of the themes and the respective sub-themes with the unique identifiers (ID).

The studies included in the sample associated with each thematic heading are provided in the analysis in Table 4, followed by a detailed interpretation of the themes based on the data categorized under each theme documented in the following sub-sections.

Methodological foundation of BPMMs

Methodological foundation is a critical element that affects the usefulness of BPMMs because it enables the replication of the model and improvement for future research. In addition, a well-documented model allows for transparency in identifying and understanding its limitations while facilitating the implementation of such models for maturity assessment and improvement purposes (Mettler, 2011). As such, multiple authors in Information Systems (IS) research suggest that maturity models are founded in the design science research (DSR) paradigm (Becker et al., 2009; Felch & Asdecker, 2020b; Mettler, 2011; Pöppelbuß & Röglinger, 2011; Wendler, 2012) due to the focus of DSR on problem-solving toward human and

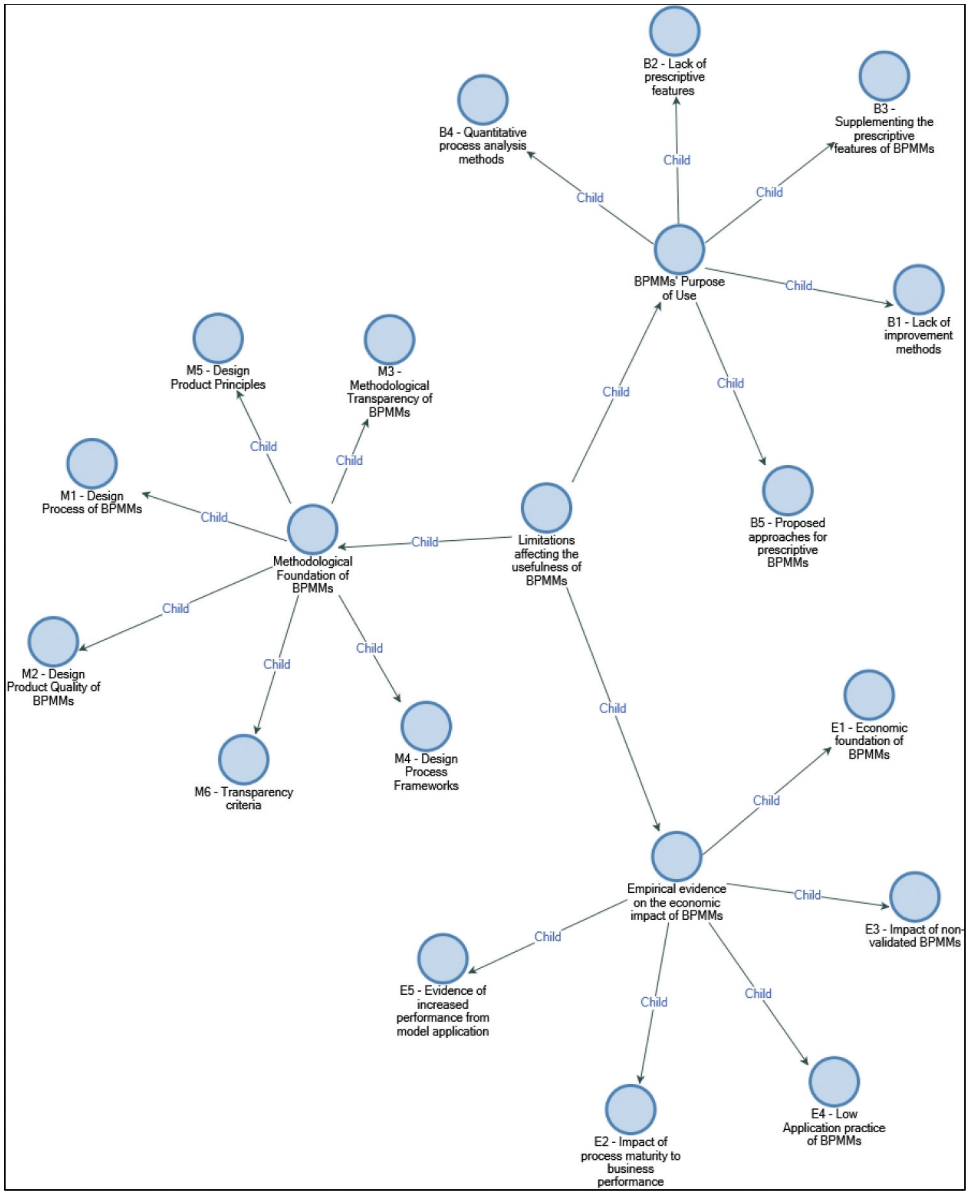

Figure 2. Thematic map of the emerging themes and sub-themes from the analysis.

organizational issues (A. Hevner & Chatterjee, 2010; Kuechler & Vaishnavi, 2008). DSR aims to develop solutions to real-life problems or needs through a structured approach (Vom Brocke et al., 2020). Typically, the solutions consist of either (i) conceptualizations that describe problems and solutions, (ii) models that illustrate problems and solutions in real life, (iii) methods that provide guidelines on how a particular process is conducted, and finally, (iv) instantiations, i.e., documents of an instance of reality (Van Looy, 2013). In this context, maturity models support the assessments and improvement of the organization's current situation; and are therefore considered a middle ground between models and methods (Felch & Asdecker, 2020a). In addition, DSR provides an iterative process based on two core activities: (i) developing the artifact and (ii) evaluating the extent to which the requirements are met with appropriate performance indicators (Vaishnavi et al., 2004). Thus, the paradigm's iterative process meets the need for maturity models to be evaluated through scientific research methods and the development of an overall sound and robust model (Mettler, 2011).

It is worth noting that the literature does not imply that DSR is the only suitable paradigm for the methodological foundation of maturity models (Becker et al., 2009). However, drawing on DSR, the literature proposed several methodological guidelines for maturity models addressing the design process, design product principles, and overall transparency perspective (Becker

Table 3. Overview of the dominant themes alongside respective sub-themes.

Themes	Theme Interpretation	Sub-Theme ID	Sub-Themes
Methodological Foundation of BPMMs	Investigates evidence from the literature about methodological concerns that affect model usefulness. Additionally, it documents approaches that have been published to tackle these limitations.	M1	Design process of BPMMs
		M2	Design product quality of BPMMs
		M3	Methodological transparency of BPMMs
		M4	Design process frameworks
		M5	Design product principles
		M6	Transparency criteria
BPMMs' Purpose of Use	Includes literature-based evidence on how the limited functionality of BPMMs, regarding the purpose of use, affects the usefulness of the model in practice. Moreover, approaches proposed by research to enhance these capabilities are documented.	B1	Lack of improvement methods
		B2	Lack of prescriptive features
		B3	Supplementing the prescriptive features of BPMMs
		B4	Quantitative process analysis methods
		B5	Proposed approaches for prescriptive BPMMs
Empirical Evidence on the Economic Foundation	Documents the lack of BPMMs' empirical economic foundation to evidence the impact of the artifacts in practical application and how this directly affects the usefulness and widespread acceptance in practice. Evidence on applying BPMMs in practice and its reporting of results are also documented.	E1	Economic foundation of BPMMs
		E2	Impact of process maturity on business performance
		E3	Impact of non-validated BPMMs
		E4	Low application practices
		E5	Evidence of increased performance from model application

et al., 2009; Felch & Asdecker, 2020b; Pöppelbuß & Röglinger, 2011). The following sub-sections thoroughly explain the relationship and implications of these methodological perspectives toward BPMM usefulness.

BPMMs from a design process perspective

The lack of methodological rigor and documentation of the design process are some of the major factors contributing to less useful BPMMs, as they hinder the generalizability of the model and the ability to make incremental improvements to adapt to technological and other environmental changes. It further compromises several essential elements of BPMMs, such as methodological transparency, model applicability, and standardization (Felch & Asdecker, 2020b; Röglinger et al., 2012). As such, inhibiting BPMMs from demonstrating value in industrial settings (Tarhan et al., 2016).

To address documentation issues, De Bruin et al. (2005) published a general framework to standardize the design process of descriptive maturity models while indicating that it provides a starting point for their evolution toward prescriptive and comparative purposes of use. The framework consists of six phases (i) starting with defining the model's scope and target domain; (ii) designing the model's architecture to meet the needs of the audience; (iii) identifying the domain components to be measured alongside the measurement method; (iv) testing the model's construct and instruments for validity, reliability, and generalizability; (v-vi) deploying the model in organizational settings and tracking its evolution over time. The framework has been widely accepted as a suitable approach to developing methodologically sound maturity models and has often been recommended as a prerequisite for their usefulness (Pöppelbuß & Röglinger, 2011). Although the framework contributes toward developing the architecture of the model, limitations are found regarding the theoretical foundation of the framework, questioning its generalizability.

Therefore, Becker et al. (2009) build on DSR as the underpinning methodological foundation, given that maturity models are considered DSR artifacts. Further, maturity models can become obsolete due to constantly changing technological conditions. As a result, BPMM development should be problem-driven to be able to report evaluation results and document a transparent methodological base. This enables researchers to incorporate necessary modifications over time to adapt to changing needs or discontinue BPMMs from the market if the evaluation results do not continuously demonstrate significance and validity.

The procedure model from Becker et al. (2009) predicts eight stages in developing maturity models aligned to the DSR requirements published by A. R. Hevner et al. (2004). The first stage of the model defines the

Table 4. Emerging themes and sub-themes across studies included in the analysis.

N = 47	Themes and Sub-Themes															
	Methodological foundation of BPMMs						*BPMMs' purpose of use*					*Empirical evidence on the economic impact*				
Studies included in the sample	*M1*	*M2*	*M3*	*M4*	*M5*	*M6*	*B1*	*B2*	*B3*	*B4*	*B5*	*E1*	*E2*	*E3*	*E4*	*E5*
Akinpelu et al. (2021)								✓								
Albliwi et al. (2014)	✓		✓				✓	✓				✓				
Andriani et al. (2018)												✓			✓	✓
Bandara et al. (2020)							✓				✓					
Becker et al. (2009)	✓			✓												
Britsch et al. (2012)									✓	✓						
Brzychczy and Kostka (2018)										✓					✓	
Correia et al. (2021)													✓			✓
Dahlin (2020)					✓		✓	✓			✓		✓		✓	✓
De Boer et al. (2015)													✓			
De Bruin et al. (2005)	✓			✓	✓											
Dharmawan et al. (2019)			✓													
Felch and Asdecker (2020b)			✓	✓		✓	✓	✓								✓
Felch and Asdecker (2020a)			✓	✓	✓	✓									✓	
Feldbacher et al. (2011)													✓			
Hooda and Singla (2019)													✓		✓	✓
Kahrovic and Vignjevic Djordjevic (2019)															✓	
Kalina et al. (2013)								✓	✓		✓					
Kalinowski (2018)	✓							✓							✓	
Lee et al. (2007)								✓						✓		
Lima et al. (2017)												✓	✓			
Matkovic et al. (2017)															✓	
Mohammadi et al. (2021)													✓			✓
Moradi-Moghadam et al. (2013)													✓			
Novak and Janeš (2019)								✓				✓			✓	
Pöppelbuß and Röglinger (2011)	✓	✓		✓	✓			✓				✓				✓
Raschke and Ingraham (2010)													✓			✓
Röglinger et al. (2012)	✓	✓			✓			✓				✓				✓
Rosemann and De Bruin (2005)	✓												✓			
Singer (2015)													✓			
Sliż (2021)												✓	✓			✓
Söylemez and Tarhan (2016)															✓	
Szelagowski and Berniak-Woźny (2020)								✓	✓			✓				✓
Tarhan, Turetken, and Ilisulu (2015)												✓			✓	✓
Tarhan, Turetken, and Reijers (2015)								✓				✓	✓		✓	✓
Tarhan et al. (2016)					✓			✓	✓			✓				✓
Tarhan, Turetken, and van den Biggelaar (2015)															✓	
Van Looy (2010)													✓			
Van Looy (2013)	✓	✓						✓						✓		✓
Van Looy (2015)	✓												✓			
Van Looy (2020)											✓					✓
Van Looy et al. (2010)													✓			
Van Looy et al. (2011a)							✓						✓			
Van Looy et al. (2011b)													✓			
Van Looy et al. (2012)	✓	✓										✓				✓
Van Looy et al. (2017)	✓	✓						✓					✓			
Zemlyakova et al. (2021)										✓	✓		✓			

problem and demonstrates its relevance. Next, the second step of the process involves comparing existing models to determine if they can solve the defined problem. Depending on the comparison results, one can develop a new model, improve an existing one, or integrate multiple models. The central phase of the project is the iterative development of the model, which involves creating the model architecture and adding attributes over several stages. If the model passes the comprehensiveness, consistency, and problem adequacy tests, artifact communication channels are selected. Finally, a final evaluation is conducted to decide whether to discard or improve the artifact based on the anticipated benefits (Becker et al., 2009). However, the frameworks from De Bruin et al. (2005) and Becker et al. (2009) only focus on the development process of maturity models, thus disregarding the functions of BPMMs to achieve the intended problem.

BPMMs from a design product perspective

In addition to BPMMs meeting process requirements, it is equally important to consider BPMMs from a design product perspective, given that BPMMs are a product of the DSR paradigm. A critical factor behind the need to

deal with the criticisms of maturity models is the importance of evaluating DSR artifacts according to their effectiveness in addressing the aimed problem (A. R. Hevner et al., 2004). Maturity models as DSR products are assessed according to their quality and components (Pöppelbuß & Röglinger, 2011). Quality represents the desirable properties or dimensions of value, whereas components shape the structure of the maturity model. Thus, the more BPMMs adhere to the quality criteria aligned with the DSR requirements, the more effective the artifacts are toward achieving the defined problem, hence, the better the usefulness of the model. In return, this supports avoiding the above mentioned shortcomings, which holistically affect these artifacts' theoretical and practical usefulness in the operating domain (Röglinger et al., 2012). Overall, the literature defines multiple quality taxonomies that apply to models in general and specific quality measures tailored to capability and assessment methods, e.g., relevance, applicability, validity, reliability, cost efficiency, etc (Röglinger et al., 2012).

However, only Pöppelbuß and Röglinger (2011) address the principles of form and function that BPMMs must adhere to as DSR products by establishing a framework of general design principles (DPs), encouraging model usefulness within the application domain and intended purpose of use. The framework contains principles that are categorized into (i) basic principles that contain essential domain knowledge, while (ii) descriptive and (iii) prescriptive principles refer to requisites that the maturity model must fulfill to serve the functionalities of the respective purpose of use. The contribution of this framework is valuable not only regarding the development of new maturity models in the domain of BPM but also in leveraging the improvement of existing models by using the framework as an evaluation basis for highlighting artifact shortcomings (Felch & Asdecker, 2020a; Röglinger et al., 2012).

BPMMs from the methodological transparency perspective

Felch and Asdecker (2020b) reflect on the quality and usefulness of existing BPMMs by examining the publication outlets of these artifacts. The lack of theoretical and methodological foundation, alongside the lack of design and artifact documentation, hinders the model's ability to be reproduced or replicated. Following this line of thought, the authors hypothesize that the quality and reputation of BPMM outlets should reflect these issues. Results indicated that BPMMs are published in less recognized journals that do not provide scientific significance to the scientific community, confirming that the key reasons behind that are the insufficient theoretical foundation and methodology and model documentation. This directly affects the usefulness of maturity models in practice and further research because of the additional challenges it raises with the model's credibility, applicability, and dissemination rate.

To address this issue, Felch and Asdecker (2020a) extend the above studies and provide a framework of several criteria researchers can use to develop methodologically transparent BPMMs. The criteria draw on DSR in line with the requirements from high-quality journals, especially model development, evaluation, use and contribution to the knowledge base. The authors synthesize the criteria from the literature and categorize them according to the segments of DSR: (i) Environment, (ii) IS Research, and (iii) Knowledge Base. The first segment of DSR justifies the need to develop a maturity model by defining problem and solution requirements. However, to ensure relevance to theory and practice, it is equally important to validate the extent to which the developed artifact meets the requirements set in the first stage. This further provides insights into whether the artifact reflects the reality it describes and the implications on the environment, i.e., people, processes, etc. Secondly, the IS research segment proposes using the frameworks by Becker et al. (2009) and De Bruin et al. (2005) to develop the model, followed by criteria for its evaluation. Finally, the knowledge base represents the theoretical foundation that maturity models should be underpinned by, i.e., existing theories and popular literature on BPMMs. It also includes the contribution to knowledge that the development of the new artifact would bring. As a result, the artifact should have well-documented basic, descriptive, or prescriptive components depending on the model's functionality (Pöppelbuß & Röglinger, 2011). The study offers literature-based criteria that can be measured for each stage, i.e., application and evaluation of the model. Moreover, it provides recommendations on the methods that can be used to assess these criteria or achieve the requirements at each stage, i.e., establishing the need, methods for development, etc.

Increasing awareness for methodological foundation

Despite the contribution toward standardizing the development process of BPMMs and providing a starting point for exploring their methodological flaws, the frameworks differ in some respects, mainly regarding the theoretical underpinning of the artifact. The artifacts published by De Bruin et al. (2005) and Becker et al. (2009) contribute to the previously mentioned shortcomings of the maturity models. De Bruin

et al. (2005) generalize the maturity model development process. The practical expertise of the stakeholders involved in developing the maturity models is simultaneously an advantage and weakness of the framework, as it is limited to the field experiences of researchers and practitioners from the development journey of only two maturity models in their respective domains. On the other hand, the procedure model of Becker et al. (2009) is underpinned by the requirements of the DSR paradigm, providing more methodological rigor and solid ground for relevance to the theory. However, Becker et al. (2009) only give a generic overview of the design process with details about model architecture or potential research method choices for data collection at different stages of the design process, which are predicted in the framework by De Bruin et al. (2005). In contrast, both frameworks do not consider the requirements from a model function point of view to assess model usefulness with regard to what the model is expected to achieve, which is supplemented by Pöppelbuß and Röglinger (2011) through the design principles. Moreover, Felch and Asdecker (2020a) similarly draw on the DSR paradigm and argue the importance of BPMMs' methodological transparency. DSR-oriented criteria are extracted by expanding on the previously mentioned artifacts to enhance BPMMs' methodological transparency.

Multiple perspectives were explored concerning BPMMs' methodological foundation, with significant contributions emerging to address the associated methodological issues. However, literature findings indicate that the authors' recommendations are barely implemented to address methodological challenges and improve the usefulness of BPMMs in practice (Felch & Asdecker, 2020a; Röglinger et al., 2012; Tarhan et al., 2016). Despite exploring and justifying the reasons behind hindering model usefulness from a methodological perspective, the reasons for not implementing the guidelines remain unclear. Although this may not be the only reason, BPMM authors may neglect the importance of the above artifacts and concentrate primarily on the model's content, e.g., domain knowledge and issues. Perhaps this is because the above artifacts operate independently. It may, therefore, be possible to raise awareness and improve the applicability of methodological recommendations for future BPMM developers by employing an integrated framework that holistically addresses methodological issues. In this regard, exploring the motivation for not adopting these recommendations may help convey the essence of methodologically sound BPMMs, building on the criteria gathered from the literature. Table 5 summarizes all the literature-based criteria drawn from the artifacts discussed in the methodological foundation theme. These criteria were aggregated from the review, and this study suggests using them to evaluate existing models and as the starting point for developing methodologically sound BPMMs.

BPMMs' purpose of use

Ensuring that BPMMs adhere to a solid methodological foundation and empirical evidence that supports the development, application, and impact of such models in their application domain is critical in the context of model usefulness. However, so is the ability of the model to enable practitioners to prescribe improvement measures to transition toward upper levels of maturity and eventually leverage the benefits toward overall business performance. In other words, a methodologically solid and empirically validated maturity model is not a guarantee of a capably functional model with regard to maturity improvement. The consensus on the functionality of maturity models remains on descriptive, prescriptive, and comparative terms (De Bruin et al., 2005; Van Looy et al., 2017). Several authors conclude that research in BPMM is factually directed toward developing models for descriptive purposes of use, neglecting the call for more actionable BPMMs (Dahlin, 2020; Kalinowski, 2018; Tarhan et al., 2016). In support of this, Röglinger et al. (2012) concluded that even leading BPMMs in the domain only address the basic principles with minor reservations against the descriptive principles, mainly regarding model scope, audience, and identifiable assessment methods. The authors state that "none of the models provides a defined mechanism that allows adopters from practice to adapt the decision calculus for selecting improvement measures to organization-specific strategies and objectives. All models implicitly expect organizations to reach the top of the maturity ladder eventually. They neither consider cost-benefit relations nor the relevance of organization-specific objectives" (Röglinger et al., 2012). However, the prevalence of descriptive features in such models limits their usefulness (Akinpelu et al., 2021). For instance, the Process and Enterprise Maturity Model (PEMM) by Hammer (2007) provides basic descriptive attributes in assessing process maturity and limited guidelines on improvement measures (Van Looy et al., 2017). Thus, emphasizing the significant gap of most existing BPMMs embracing prescriptive PoU capabilities. Only the BPMM developed by OMG (2008) documents improvement measures for each level of maturity, fulfilling only one aspect of the prescriptive PoU. In addition, even recently published models lack

Table 5. Literature-based criteria for the evaluation of MMs adapted from De Bruin et al. (2005), Becker et al. (2009), Poeppelbuss et al. (2011), Felch and Asdecker (2020a).

BPMM Evaluation Criteria Name	BPMM Evaluation Criteria Description
Model Focus	Defined the targeted application domain
Development Stakeholders	Determined the stakeholders involved in the development of the model
Audience	Determined the needs of the targeted audience and how these would be met
Method of Application	Established the means of conducting the application of the model
Driver of Application	Established what drives model application, e.g., internal, external or both
Respondents	Defined the stakeholders involved in data collection
Application entities	Determining the implementing entities of the model
Domain Components	Identified and validated domain components
Domain Sub-components	Identified and validated domain sub-components
Assessment instrument	Determining the instrument for conducting the maturity assessment
Face validity	Assessed the translations of the constructs
Content validity	Assessed the extent of domain representation in the model
Instrument validity	Test assessment instruments to ensure validity and reliability
Organisational application	Application of the model with the initial organisation
Independent application	Application of the model independent of the involved stakeholders
Evolution tracker	Communication of the artifact to allow for change reflections over time
Comparison with other models	Development is justified through comparison with existing models
Iterative Procedure	Maturity models must follow an iterative development process
Model Evaluation	The principles of maturity models must be evaluated iteratively
Multi-methodological Procedure	Employment of multiple well-founded research methods
Problem Relevance	Demonstrated relevance of the problem solution
Problem Definition	Application domain, conditions and intended benefits to be documented
Targeted publication of results	Presentation of a maturity model in line with the application conditions and user needs
Scientific Documentation (Above)	The design process of the model must be documented
Basic Information	Application domain, prerequisites for applicability, PoU, target group, entities under investigation, differentiation from similar MMs, design process, empirical validation
Definition of Maturity	Defined maturity and dimensions of maturity, maturity levels, maturation paths and underpinning theoretical foundation
Central Construct Definition	Defined constructs related to maturity and maturation in relation to the application domain
Target-group Documentation	Documentation of central constructs and their interrelations according to the target-group
Verifiable Criteria	Defined assessment criteria for each level of maturity in a precise, concise and clear manner
Target group-oriented Assessment Methodology	Assessment procedure model, advice on assessment criteria, criteria adaption, configuration and knowledge from the previous application
Improvement Measures	Defined improvement measures for each maturity level in the form of sound or best practices
Decision Calculus	Explication of relevant objectives, relevant factors of influence and distinction between external reporting and internal improvement perspective
Target group-oriented decision methodology	Provision of an improvement procedure model to guide improvement measure selection and advice on the assessment of variables
Real-World problem	Established problem and solution requirements to justify the need to develop a new model or improve an existing one
Application of the artefact	Validation of the MM with the pre-assigned requirements to check the extent of consistency with reality and application implications
Development of the artefact	Incorporating the knowledge base according to the requirements through procedure models and development methods, e.g., literature reviews, case studies, and Delphi studies
Evaluation of the artefact	Assessing the model/method against relevant evaluation criteria through the use of evaluation methods, e.g., prototype demonstration, prototype experiments etc.
Scientific Grounding	Provides a reference to relevant existing theoretical knowledge of MMs, e.g., Pöppelbuß and Röglinger (2011)
Artefact Communication	Documentation and communication of essential elements

evidence of prescriptive capabilities (Felch & Asdecker, 2020b).

Other authors encourage enabling prescriptive functionalities of BPMMs by adding that BPMMs can be more useful if improvement methods are developed as auxiliary instruments to the reference model (Van Looy et al., 2011a). The improvement method assists practitioners in prioritizing the improvement measures in line with the design principles for prescriptive PoU that Pöppelbuß and Röglinger (2011) predict to achieve the anticipated "To-Be" state of the organization (Bandara et al., 2020). Hence, the lack of improvement methods limits the applicability and overall usefulness of BPMMs. In the best-case scenario, the BPMM by OMG (2008) can offer a set of improvement measures; however, without concise actions of how the measures should be implemented. As a result, organizations rely heavily on consultants to interpret such results and hope to achieve higher maturity levels instead of following a clear pathway the model offers (Dahlin, 2020).

Research in enhancing existing models or enabling the development of prescriptive BPMMs remains challenging (Felch & Asdecker, 2020b). Many authors have often emphasized the need to develop prescriptive capabilities to allow practitioners to use models for improvement measures and increase the widespread acceptance of such models in practice (Tarhan et al., 2016). Literature findings suggest there have been attempts to propose recommendations for researchers

to explore in the quest to develop such capabilities. Dahlin (2020) unveils a collection of potential approaches regarding the "how to do" pathway toward improvement. Key insights involve combining different strategies, methods, tools, and techniques with the reference model. Examples involve assessment or improvement methods, including qualitative data collection techniques or data-driven approaches that translate the assessment criteria into actionable measures toward achieving upper maturity levels and consequently leveraging the benefits toward performance (Dahlin, 2020; Zemlyakova et al., 2021). Meanwhile, Van Looy (2020) suggests situational maturity models that capture the context of the organization's environment, e.g., size, sector, and market, and provide improvement paths toward increased maturity.

Enabling prescriptive features

Although most of the published models fulfill the descriptive requirements, rarely do any models meet the criteria for the models to be prescriptive, affecting the applicability and usefulness of these models in practice (Tarhan, Turetken, & Reijers, 2015). The application of the existing models is limited to only assessing maturity and using such results to move to upper levels of maturity through interpreting the results by external consultants or other stakeholders involved in the project.

While using maturity models for descriptive purpose of use may generate positive insights in informing improvement initiatives, it is relatively challenging to translate these insights into actionable improvement plans to reach the desired maturity state (Akinpelu et al., 2021). This would require the involvement and assistance of external process improvement consultants to advise on the potential improvements organizations should undertake based on subjective interpretation of the model's results (Akinpelu et al., 2021; Britsch et al., 2012). Thus, requiring significant resources as part of achieving the subsequent maturity level and leaving room for uncertainty, unpredicted from the model. In addition, the uncertainty in the improvements undertaken to reach the subsequent level of maturity hinders researchers' ability to understand the model's implications toward operational efficiency, i.e., the economic impact on operational performance. This makes the models less applicable with significant resource requirements, without financial reassurance on the return on investment for such implementations (Van Looy, 2013).

The prescriptive features of the model are necessary, and researchers call for improving existing models toward prescriptive capabilities or developing new ones (Santos-Neto & Costa, 2019). Yet, little is provided with regard to how these models can be enriched with such capabilities. Studies that presented a functional evaluation of BPMMs support this, wherein the leading models struggle to adhere to the requirements of prescriptive features (Tarhan et al., 2016) and even with recently published models yet to reach such capabilities (Felch & Asdecker, 2020a). Therefore, the focus on this area must shift toward understanding why BPMM authors find developing maturity models that enable prescriptive features challenging. This may require initially defining prescriptiveness from other domains and further translating the requirements from Pöppelbuß and Röglinger (2011) into more specific guidelines or design process models for developing prescriptive maturity models, e.g., means of defining well-defined improvement measures for each level of maturity, guidelines on developing a decision-calculus based on the improvement criteria and providing an improvement model on guiding the implementation of the improvement measures.

Furthermore, it may be worthwhile exploring and integrating approaches from other domains into a framework that enables maturity models to be prescriptive and, as a result, more useful to practitioners. The support of IT solutions toward business process management, e.g., Enterprise Resource Planning, Customer Relationship Management, or any process-aware information system, offers opportunities for automated data collection and analysis, wherein an integrated tool with the maturity model could make the models more useful in practice (Britsch et al., 2012). For instance, Zemlyakova et al. (2021) suggest that organizations at the top of the maturity scale are likely to use quantitative analysis and improvement methods, i.e., from level three of maturity, which typically refers to standardized processes and data-driven performance management. Considering that most organizations worldwide stand at the third level of maturity (Brzychczy & Kostka, 2018; Harmon & Wolf, 2016), exploring data-driven approaches combined with the reference maturity models may enable their prescriptive capabilities by developing improvement frameworks or methods. There is, however, little mention of what, where, and how these approaches can be applied to BPMMs, for example, evaluating the suitability or addressing the feasibility of these approaches in relation to the reference BPMMs and whether assessment or improvement instruments will be used to communicate the end-artifact. In light of this, studies should focus on understanding whether these approaches are applicable to BPMMs so that they can enable the prescriptive capabilities and leverage

the full benefits toward managing and improving business processes.

Empirical evidence on economic impact

The lack of empirical studies about existing BPMMs is one of the most frequently raised limitations (Tarhan et al., 2016). This is in different dimensions of the model, including development, e.g., informed through scientific research methods for construct and instrument development, validation, e.g., scientific evidence to ensure relevance to theory and practice and application, e.g., scientific evidence on the performance of the organization (Lima et al., 2017; Szelagowski & Berniak-Woźny, 2020). The methodological foundation theme presents the relevance of empirical methods for the development and validation of model usefulness. In contrast, this section focuses on the model application and its economic impact on the implementing organization. Röglinger et al. (2012) report the lack of empirical evidence for validating the sampled maturity models. In addition, Tarhan et al. (2016) conclude in support of the previous studies that there is little empirical work on the leading maturity models.

Moreover, the lack of application practices and reporting results of generic process maturity models limits the ability of domain- or process-specific maturity models to compare results, leading to issues verifying the generalizability of maturity models (Matkovic et al., 2017). Frequently, the only documentation provided about BPMMs is regarding the reference construct and associated instruments, whereas results on the impact of BPMM application are scarcely reported (Kalinowski, 2018). Research on BPMMs struggles to report on empirical studies that document positive changes in economic indicators from the application of BPMMs in real-case scenarios (Szelagowski & Berniak-Woźny, 2020). Tarhan, Turetken, and Reijers (2015) emphasize the importance of defining the impact on business performance with increased maturity as an essential justification and motivator for using and implementing such models. Otherwise, there is a possibility that the transition toward the subsequent stage of maturity does not guarantee any improvements in business process performance (Albliwi et al., 2014).

Furthermore, using non-validated BPMMs without proof of enhancing the efficiency and effectiveness of business processes reflected in specific performance outcomes is discouraged due to the potential financial losses and staff demotivation that may arise from model adoption (Van Looy, 2013). Therefore, the applicability of the model for practitioners in industrial settings for any PoU is not justifiable from a practical point of view, hindering the model's overall usefulness. This implies it is not easy to exploit the full capabilities of maturity models to improve business (process) performance (Szelagowski & Berniak-Woźny, 2020).

Given the critical consequences of the empirical results on the economic foundation of the model, authors have consistently called for empirical studies to demonstrate the usefulness of these models through case studies and other impact cases (Dahlin, 2020; Röglinger et al., 2012; Tarhan, Turetken, & Reijers, 2015; Wendler, 2012). One key issue in the inability to assess the impact of maturity models on business performance is the lack of model application in practice (Felch & Asdecker, 2020a) and the focus of researchers and model authors on developing new models (Tarhan et al., 2016). Moreover, even studies reporting the application of the maturity model in different cases do not report the impact of the model application on the implementing entity. For example, Matkovic et al. (2017) report the BPMM application in a higher education institution, but no analysis of the impact is presented in any follow-up studies. Hooda and Singla (2019) highlight the importance of BPM in governmental public sector processes and establish the application of BPMMs as a useful tool to improve process performance. Similarly, the study presents the analysis of applying PEMM for descriptive purposes without indicating the impact on performance. In addition, similar cases of model application are presented in other industries, e.g., mining, healthcare, science and technology parks, and power supply, but without any reports on any performance indicators (Brzychczy & Kostka, 2018; Correia et al., 2021; Novak & Janeš, 2019; Tarhan et al., 2016; Tarhan, Turetken, & van den Biggelaar, 2015).

Increasing empirical evidence on improved performance

The success of BPMMs revolves around the expectations that the more mature an organization is, the better the overall performance (De Bruin et al., 2005). Although it is often claimed that applying generic BPMMs is useful in improving business performance, the direct relationship between maturity assessment results and business performance is yet to be addressed (Tarhan, Turetken, & Reijers, 2015). The example provided on the case for the potential and significance of process maturity in organizations by Raschke and Ingraham (2010) employs cross-sectional data to empirically compare process quality and efficiency variations between mature and immature organizations. Evidently, the study does not particularly focus on the specific impact that recommendations or improvements

emerging from applying a BPMM may bring to the implementing entity. In addition, cross-sectional studies in the context of BPMMs cannot capture and distinguish other factors that may influence business performance. On the contrary, the impact of maturity level change with reference to the BPMM constructs while monitoring other organizational factors that may affect business performance needs to be reported and evidenced. Thus, longitudinal studies are encouraged in this context (Tarhan et al., 2016).

Interestingly, the limited prescriptive capabilities of BPMMs reported above may add to challenges with tracking impact on overall performance due to complexities with moving up the maturity scale. BPMMs should, at minimum, prescribe specific improvement measures to reach the desired level of maturity (Pöppelbuß & Röglinger, 2011). Otherwise, transitioning from one maturity level to the other would be subjective to translating the maturity level descriptors into improvement efforts from the project teams (Akinpelu et al., 2021). This would further complicate the process with regard to uncertainty, time, and resource requirements to understand business value evolving from the BPMM application (Staples et al., 2007). Enabling organizations to move across upper levels of maturity may facilitate tracking the impact of the improvement measures associated with the respective levels of the BPMM, wherein the preceding level can be used as a baseline for monitoring change.

The findings from this review suggested that despite some efforts to report the application of BPMMs in practice (Brzychczy & Kostka, 2018; Hooda & Singla, 2019; Mohammadi et al., 2021; Novak & Janeš, 2019; Sliż, 2021), no evidence was reported regarding the economic impact on performance indicators. This confirms the continuous insufficiency in establishing a solid reassurance on the usefulness of generic BPMMs in industrial settings to address major BPM challenges. The review supports the findings of Tarhan et al. (2016) and Felch and Asdecker (2020b). It re-emphasizes the need for further research to demonstrate the economic benefits of BPMM implementation, indicating that little progress has been made in this area of research. As noted, the economic impact is critical in justifying the practical use of such artifacts. Future work should, therefore, prioritize empirical studies that report the economic effect of BPMM implementation in industrial case studies.

Conclusions

Process maturity enables organizations to leverage benefits with regard to process and overall business performance. However, critics have often questioned the ability of BPMMs to improve process maturity and, consequently, demonstrate performance improvements. In order to tackle the challenges related to the usefulness of BPMMs and derive value from the application of these models in industrial settings, the literature on generic BPMMs was systematically investigated.

Although the literature on the development, application, and validation of maturity models in BPM is still in its early stages, there has been a significant increase in research over the past decade. Nonetheless, it remains necessary to gain a thorough understanding of BPMMs' limitations and progress toward overcoming them to stimulate innovative approaches for improving the usefulness of such artifacts in practice. Thus, a SLR was conducted in which 47 papers about the usefulness of generic BPMMs were analyzed to address the following questions: "*Why are existing BPMMs considered to be not useful in practice?*" (*RQ1*); and '*What has been done or proposed to improve the usefulness of these models?*" (*RQ2*).

For *RQ1*, it was found that the significant limitations of maturity models revolve around the methodological foundation, limited capabilities in the model's purposes of use, and empirical evidence on the economic impact of the model. This paper explains the relationship between these limitations concerning the model's usefulness by stating literature-based arguments and extending them to the authors' knowledge and interpretation. Regarding *RQ2*, while significant attempts were made to address methodological issues with DSR proposed as a paradigm, little progress has been made in enhancing the limited capabilities of BPMMs toward prescriptive and comparative purposes of use despite the numerous calls from many researchers. Applying the model for descriptive purposes may generate informative insights for practitioners; however, it is merely the prelude to the potential that BPMMs can convey through prescriptive features. Moreover, this raises challenges in measuring the impact of the model in the implementing organization from such improvement measures.

This review examines the relationship between reported limitations against model usefulness, e.g., the methodological foundation of BPMMs, BPMMs' purpose of use, and empirical evidence on the economic impact of BPMMs. It further investigates literature-proposed approaches to overcoming such limitations. This paper contributes by suggesting new directions for addressing domain issues that mainly focus on the theoretical and practical usefulness of BPMMs. As a result, the research agenda proposes several potential avenues for further research. Table 6 summarizes areas requiring

Table 6. Summary of research agenda proposed by the authors.

Themes	Research Need	Future Research Recommendations	Potential Research Questions
Methodological Foundation	Researchers and designers need to raise awareness to adopt the recommended guidelines for more useful models from a methodological standpoint.	An integrated framework that holistically addresses methodological concerns for BPMM researchers, designers, and developers.	(1) How can we increase awareness for making models more useful from a methodological standpoint? (2) Why do most BPMM authors disregard implementing the guidelines recommended from the methodological standpoint?
BPMMs' Purpose of Use	The need to enable prescriptive capabilities for BPMMs to improve applicability and overall usefulness in practice.	Measurable, implementable, and achievable guidelines on designing BPMMs for prescriptive purposes of use	(3) How can we translate the requirements from Pöppelbuß and Röglinger (2011) into measurable and implementable guidelines to develop prescriptive maturity models? (4) Can data-driven approaches that supplement reference BPMMs meet prescriptive requirements? (5) How can data-driven approaches be incorporated to meet prescriptive requirements for BPMMs?
Empirical Evidence on the Economic Impact	There is a need for empirical studies to demonstrate the economic impact of BPMM application on overall business performance.	Understanding the rationale behind the lack of empirical studies on the economic impact of BPMMs. Conducting longitudinal studies to measure the extent of change from generic BPMM application toward business performance.	(6) What is the extent to which the application of BPMMs positively affects business performance? (7) Why do researchers find conducting longitudinal studies for BPMM implementations challenging? (8) Does the lack of prescriptive purposes of use in BPMMs hinder the ability of the model to demonstrate the economic effect on overall business performance empirically? (9) What are the generic key performance indicators likely to be affected by the application of BPMMs?

further investigation of the emerging limitations of BPMMs derived from the analysis. The research agenda proposes a non-exhaustive list of possible research questions that could directly address the identified gaps.

Nevertheless, it should be noted that this review comes with its limitations. Firstly, only studies from two information sources whose scope encompasses maturity models in BPM were included, whereas white papers and other publications from consultancy firms reported in the gray literature were excluded from the sample. Secondly, studies referring to maturity models in specific domains, e.g., Software Engineering, were not included to provide a focused review of the literature about the limitations of generic BPMMs. Although the rationale of the concentrated scope of research was due to the need to explore the limitations of scientifically documented generic BPMMs, this may limit the scope of the review in other dimensions. It may hinder identifying approaches that may be used in other specific domains apart from BPM or best practices from the industry to overcome the limitations of generic BPMMs. As a result, future work can complement the findings of this review with studies in other industries and domains.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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