Design Principles for SME-focused Maturity Models in Information Systems

Research Paper

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Abstract. Maturity models (MMs) are widely utilized within the Information Systems (IS) domain to assess organizational capabilities. However, their practical application remains limited, especially among small and medium-sized enterprises (SMEs). Existing frameworks focus on general MM development, lack tailored design knowledge for SMEs, and neglect SME-specific constraints. This study aims to address this gap by developing design principles (DPs) to enhance the usability and strategic impact of MMs for SMEs. Following a structured research design, we analyze 28 relevant SME-focused MM articles, derive six meta-requirements, and propose ten actionable DPs. The principles were validated by 18 recognized experts with experience in designing MMs for SMEs and relevant publications. The results show a high perceived usefulness, underscoring the practical relevance of the derived DPs. This study improves MM development by bridging MM theory with practical applicability and contributes to prescriptive design knowledge for MMs, particularly for SME-specific MMs.

Keywords: Design Principles, Maturity Model, Capability Assessment, SME

1 Introduction

Maturity models (MMs) have emerged as a valuable tool for assessing and guiding the evolution of organizational capabilities across various domains (Pöppelbuß & Röglinger 2011). In Information Systems (IS) research, they have become instrumental in supporting organizations through digital transformation and technological adaptation (Mettler & Ballester 2021). As small and medium-sized enterprises (SMEs) increasingly pursue transformation and innovation (Williams et al. 2024), well-structured MMs play an important role in addressing their unique needs and constraints (Petzolt et al. 2022). Given their limited resources, SMEs often lack strategic direction and clear guidelines, making MMs particularly valuable for providing structured support (Williams et al. 2024). Our literature review (Section 3) indicates a growing interest in SME-specific MMs, with 24 out of 28 papers being published in the last five years.

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Mettler and Ballester (2021) highlighted established frameworks in the MM development literature, such as those by Becker et al. (2009) and Pöppelbuß and Röglinger (2011). Despite these guidelines, research findings indicate that cost and time are among the key barriers to the low adoption rates of MM in practice (Felch et al. 2019). Resource constraints in SMEs intensify these challenges and underline the need for improved usability and practical applicability of MMs. Several studies emphasize that existing models are often perceived as overly complex, resource-intensive, and misaligned with SME-specific needs (Petzolt et al. 2022; Williams et al. 2024). In Design Science Research, design principles (DPs) are a typical form of design knowledge that guide the creation of effective and efficient artifacts to ensure their relevance and alignment with the intended purpose (Gregor et al. 2020; Möller et al. 2020). DPs are primarily derived from literature and/or extracted from interviews, focus groups, or workshops (Böhmer et al. 2024). While MMs are well-established in the IS research, existing literature lacks design knowledge to guide the development of more usable and SME-specific models. This study aims to bridge this gap by analyzing existing SME-focused MM literature and proposing a set of actionable DPs to improve the future development of MMs. To achieve this, we address the following research question (RQ):

RQ: *What design principles enhance the usability and practical applicability of maturity models, particularly for SMEs?*

To answer the RQ, this study adopts the DP development method proposed by Möller et al. (2020) (Section 3). Through a systematic literature review (SLR), we identified and analyzed relevant literature and derived meta-requirements (MR) (Section 4). Subsequently, we formulated ten actionable DPs (Section 5) and evaluated them by recognized experts (n=18), revealing high perceived usefulness (Section 6). The ten proposed principles improve prescriptive design knowledge for MMs, especially in the SME context (scientific contribution). By offering actionable guidance for researchers and MM designers, the DPs indirectly benefit SME stakeholders by enabling the development of more applicable and SME-friendly models (practical contribution).

2 Theoretical Background

MMs are used across various fields, including management and digital transformation, to assess and improve organizational competencies (Pöppelbuß & Röglinger 2011). MMs facilitate the navigation of novel challenges in the domain of IS, contributing to their widespread popularity among researchers and practitioners (Mettler & Ballester 2021). A MM is characterized by several key elements: a set of maturity levels, dimensions, criteria or characteristics of each level, and an assessment approach (Fraser et al. 2002; Röglinger & Kamprath 2012). There are two main types of MMs. Descriptive models provide an assessment focused on the current state, while prescriptive MMs suggest improvement actions tailored to achieving higher levels of maturity (Meierkort et al. 2023). Mettler and Ballester (2021) categorize existing development guidelines according to their focus: *i) development of MM* (e.g., Becker et al. 2009; de Bruin, T. et al. 2005), *ii) implementation and learning with MM* (e.g., Kulkarni & Louis 2003) *iii) considering both* (e.g., Pöppelbuß & Röglinger 2011; Mettler 2011). Our study examines MM development and its practical application. Accordingly, we focus on the

most cited works in the development categories: (*i*) Becker et al. (2009) with 1925 citations and (*iii*) Pöppelbuß and Röglinger (2011) with 829 citations (retrieved from Google Scholar, June 5, 2025). Becker et al. (2009) introduced a structured procedure for MM development along eight phases, emphasizing iterative refinement, empirical validation, and comprehensive documentation. Mettler and Ballester (2021) extended this guideline by offering suggestions for improvement to increase relevance and rigor. Pöppelbuß and Röglinger (2011) proposed a general DP framework for developing MM in alignment with their intended purpose of use. They introduced nine DPs grouped into basic (four DPs), descriptive (two DPs), and prescriptive purposes (three DPs).

Despite these methodologies, the practical adoption of MMs remains limited. Felch et al. (2019) analyzed their usage in practice and highlighted four key reasons for not applying MMs: lack of operational focus, too standardized, high application costs, and time constraints. Most of the participants (84,8%) work for larger enterprises. Consequently, these challenges, particularly application cost and time, are even more pressing in SMEs, given their specific constraints. Petzolt et al. (2022) examined SME challenges when adopting MMs, recognizing that SMEs differ significantly from large organizations due to constrained resources, limited technological expertise, product specialization, lack of standardized processes, organizational structures, employee involvement, and reliance on alliances and collaboration. MMs are crucial for improving the competitiveness and strategic planning of SMEs as they increasingly undertake transformation and innovation efforts (Williams et al. 2024). Existing models are often perceived as overly complex, resource-intensive, inflexible, and misaligned with SME constraints (Petzolt et al. 2022; Williams et al. 2024).

This study aims to bridge the gap between MM theory and real-world applicability by developing DPs defining the form and function that artifacts of the distinct class of SME-specific MM should fulfill (Jones & Gregor 2007). Our research builds on and conceptually extends the framework proposed by Pöppelbuß and Röglinger (2011). While their foundational concepts inform our understanding, we derive new DPs tailored to the needs of SMEs, with a focus on enhancing the practical usability of MMs.

3 Research Design

Our research design follows the DP development method proposed by Möller et al. (2020). This method is particularly designed for the development and evaluation of DPs. The development procedure consists of seven method elements, including both supportive (S) and reflective (R) research approaches. We delineate our development steps accordingly. (**I**) The solution objective is to enhance the applicability and strategic impact of MM in SMEs. For this purpose, DPs shall be proposed to assist researchers in designing adequate MMs. (**II**) The research context is defined as SME-specific MMs. Design knowledge shall be derived from existing instantiations. Therefore, we aim to provide ex-ante guidance for justifying design decisions in future MM development projects within the SME context. (**III**) Our study employs a combination of supportive and reflective methods elements to enhance the quality of the outcome. This approach is justified by the availability of SME-MM instantiations, allowing us to reflect on the design process carried out by others (Möller et al. 2020).

(**S.IV**) To identify the knowledge base, we conducted an SLR based on the established procedure proposed by vom Brocke et al. (2009). We formulated the search string of (*"maturity" OR "capability" OR "capabilities" OR "readiness") AND ("model" OR "assessment") AND ("small and medium" OR SME OR SMEs)*. To ensure comprehensive coverage of MM development in the IS domain, we based our literature search on three specific data sources: *1) Major IS and management-related journals.* In addition to the selection of Mettler and Ballester (2021), we added the AIS journals and affiliated journals to ensure full IS coverage, including all AIS Premier Journals. *2) Selected IS conferences* (ICIS, ECIS, PACIS, AMCIS, WI, DESRIST) and *3) forward search of the seed papers in MM development* (Becker et al. 2009; Pöppelbuß & Röglinger 2011). Here, we conducted a citation search via Google Scholar by browsing the search string: *allintitle: ("small and medium" OR SME OR SMEs)*. For the entire search and filtering process, we follow the PRISMA guidelines (Page et al. 2021). We applied the exclusion criteria: not written in English or German, fewer than five pages, not peer-reviewed, or published in less trustworthy outlets. The latter was determined through discussion between two researchers. For eligibility, the study must provide an SME-MM instantiation or valuable knowledge on the phenomenon. Finally, the SLR yields the following results (identified/included): Journals (615/2), conferences (2.385/6), and forward search (112/23). After eliminating duplicates, we identified a knowledge base of 28 distinct articles, providing conceptual examinations and instantiations of SME-specific MMs. The final set of included studies and the browsed journals are listed in the online appendix.

(**R.V** & **S.V**: Section 4) We analyzed the identified artifacts to extract key features, patterns, and recurring concepts for developing MMs tailored to the SME context. Thereby, the five early design concepts of Marohn and Li (2024a) provide a framework for the analysis. Subsequently, we elicit six specific meta-requirements of SME-specific MMs. (**S.VI**: Section 5) The DPs were derived from the examined knowledge base and formulated in response to the MR. In line with the concept of value grounding, each principle must address at least one MR (Goldkuhl 2004). Finally, we formulated ten prescriptive DPs based on the template of Chandra et al. (2015), detailing the properties, relevant activities, and boundary conditions. (**VII**: Section 6): To evaluate the DPs, we followed Möller et al. (2020) and conducted a two-stage evaluation. First, the researcher independently assessed whether the DPs met the fundamental criteria of prescriptiveness and abstractedness. Second, we conducted an expert survey to assess the practical applicability of the DPs by inviting the authors of the identified articles (S.IV).

4 Meta-Requirements for SME-specific Maturity Models

In this section, we present the MRs that define the essential characteristics of SME-specific MMs. Marohn and Li (2024a) provide five early design concepts: adaptability, comprehensive coverage, structured guidance, self-actionable processes, and strategic alignment. These concepts serve as a framework for structuring the analysis and derivation of MRs. Following Offermann et al. (2010), we formulate our MRs using "should" to indicate the criteria that such models are expected to fulfill.

MR1: Tailored or Configurable Adaptation. Adaptability ensures that the MM meets the diverse needs of SMEs, considering industry type, company size, and maturity level (Marohn & Li 2024a). Gräubig and Bley (2023) emphasize that general MMs are inadequate as they fail to address the unique needs of different industry sectors and company sizes. Some authors address manufacturing SMEs with models for Industry 4.0 and digital transformation (Spaltini et al. 2022), green business process management (Sohns et al. 2023), and smart manufacturing (Mittal et al. 2018). Petzolt et al. (2022) tailored the MM to the unique characteristics and needs of SMEs, as they differ from large organizations. Integrating data-driven configurational approaches and adaptive scoring methods can foster flexibility by enhancing the individual MM fit (Bley et al. 2021; Limpeeticharoenchot et al. 2022). Accordingly, the first MR is:

MR1: The artifact should be designed for given company sizes and industry sectors or should offer configurable settings that reflect company-specific characteristics.

MR2: Holistic and Pragmatic Scope and Focus. Comprehensive coverage ensures that a MM addresses all relevant dimensions, providing a holistic view of the ecosystem so that even less mature SMEs can establish a strong foundation (Marohn & Li 2024a). Covering a broad spectrum of capabilities enables SMEs to achieve high-level goals (Yigit Ozkan & Spruit 2023). In contrast, Williams (2024) argues that MMs should be streamlined to ensure ease of use while maintaining relevance for SMEs. Overly complex models might overwhelm SMEs with already limited resources (Leyh et al. 2017). Grooss et al. (2022) emphasize the importance of pragmatic approaches for SMEs to remain effective. Consequently:

MR2: The artifact should balance comprehensive coverage with simplicity and focus on the most significant dimensions and capabilities relevant for SMEs.

MR3: Structured Guidance and Standardization. Structured guidance encompasses the provision of clear, actionable practices and recommendations that guide SMEs through defined maturity levels (Marohn & Li 2024a). This aligns with the purpose of prescriptive MMs (Meierkort et al. 2023). The literature presents several prescriptive SME-MMs (e.g., Spaltini et al. 2022; Marohn & Li 2024a; Jeanneret Medina et al. 2024). MMs typically contain 3-6 maturity levels (Bley et al. 2021; Marohn & Li 2024b), along with a general characterization of each. Certain models incorporate a nascent level, which more accurately reflects the initial stage of SMEs (e.g., Mittal et al. 2018; Spaltini et al. 2022; Marohn & Li 2024a). Williams et al. (2022) argue that common terminology should be used to ensure a reliable assessment. Consequently:

MR3: The artifact should enable capability improvement through structured guidance and standardization of maturity levels.

MR4: Autonomous and SME-Focused Processes. The integration of self-assessment is referred to as the concept of self-actionable processes, enabling SMEs to autonomously evaluate and manage their competence development (Marohn & Li 2024a). The utilization of self-assessments in the form of questionnaires that depict maturity levels on a Likert scale is a prevalent practice (e.g., Bohórquez & Herrera 2022; Petzolt et al. 2022; Marohn & Li 2024b). While self-assessment is crucial for SMEs to maintain their

independence (Mittal et al. 2018; Marohn & Li 2024a), managers may consider it as difficult and subjective (Jeanneret Medina et al. 2024). In contrast, Szedlak et al. (2020) receive objective results through an external assessor. Other studies follow a hybrid approach that integrates self-assessment followed by an interview phase (Spaltini et al. 2022) or offers assistance as required (Schuster & Waidelich 2022). Consequently:

MR4: The artifact should facilitate autonomous capability management and self-assessment tools, aligning with SME needs.

MR5: Strategic Alignment of Capability Development. Strategic alignment ensures that the capability-building initiatives are directly linked to an SME's overall business objectives, enabling business growth and innovation (Marohn & Li 2024a). Williams et al. (2024) emphasize that capability-building should be aligned with other stakeholder interactions, prioritizing those with the highest strategic impact. Another option is to prioritize capability development according to resource constraints (Marohn & Li 2024a). However, a tailored improvement plan is needed to concentrate on capabilities that are not completely realized (Yigit Ozkan & Spruit 2023). This implies that SMEs need the flexibility to prioritize and develop capabilities based on their specific needs and constraints rather than develop all capabilities simultaneously (Williams et al. 2022). Accordingly:

MR5: The artifact should ensure that the capability development aligns with the overall strategy of the SME.

MR6: Integration of Theory and Practice. A literature review on MMs emphasized the need for more theory-informed models to provide organizations with a stronger foundation for capability development (Marohn & Li 2024b). In their subsequent work, Marohn and Li (2024a) rely on the theory of teleological organizational change of van de Ven and Poole (1995). Williams et al. (2024) build their digital MM for SMEs on the interaction model developed by Kim et al. (2013). In contrast, Gräubig and Bley (2023) emphasize that MMs face limitations in practical application, highlighting the need for being practically developed rather than solely theory-based. The practical perspective is typically integrated into the development process, through interviews with domain experts (Mittal et al. 2018; Szedlak et al. 2020; Jeanneret Medina et al. 2024) or focus group discussions (Tomitza et al. 2024; Schuster & Waidelich 2022). Consequently, we formulate the following requirement:

MR6: The artifact should combine robust theoretical foundations with practical, empirical insights.

5 Design Principles for SME-specific Maturity Models

In this section, we report on the DPs to support MM designers in developing models with enhanced practical applicability, especially for SMEs. Based on the reviewed SME-focused MM literature, we formulated DPs in response to the identified MRs. Table 1 illustrates the relationships between requirements and principles, highlighting that each DP corresponds to at least one MR (Goldkuhl 2004).

Table 1. Relationship between meta-requirements (MR) and design principles (DP)

	MR1	MR2	MR3	MR4	MR5	MR6
DP1: Tailored or Configurable Design	●					
DP2: Holistic Capability Perspective		●				
DP3: Foundational Tech-Organizational Dimensions		●				
DP4: Balanced Dimension-Capability Coverage		●				
DP5: Comprehensive and Tailored Guidance			●			
DP6: Standardized Maturity Level Assessment			●			
DP7: Intuitive Self-Assessment Tool			●			
DP8: Capability Improvement Management			●			
DP9: Pragmatic and Objective Assessment				●		
DP10: Balanced Theory-Practice Integration						●
	Influence:		● *Major*		*Supporting*	

Subsequently, we introduce the ten derived DPs. To ensure consistency, we formulate our DPs in alignment with the template set out by Chandra et al. (2015). Consistent with Gregor et al. (2020), we further describe the rationale behind each DP. While DPs provide prescriptive guidance, their conceptual nature can lead to indeterminacy and hinder the direct application in practices (Lukyanenko & Parsons 2020). To support the practical realization of design knowledge, we propose implementation-oriented recommendations to operationalize the derived DPs. These proposals serve as a first step toward bridging the gap between conceptual DPs and concrete design features (Strohmann & Khosrawi-Rad 2025).

DP1: Tailored or Configurable Design. *Provide the SME-specific MM with a tailored design for the specific size and sector that contains pre-defined maturity model variants or allows a dynamic configuration for SME stakeholders to receive an assessment that accurately reflects their unique context, given that SMEs vary in size, industry, and operating environment, especially compared to large enterprises.*

All-in-one models often fail because of their inability to capture the unique characteristics of an organization, which vary by company size, industry, and operating environment (Bley et al. 2021; Marohn & Li 2024b). Situational artifact construction enables the development of artifacts that remain flexible across different problem contexts (Winter 2011). A tailored or configurable design can provide an assessment that more accurately reflects an individual context (MR1). A pragmatic approach is to tailor the MM to specific sizes and sectors, e.g., manufacturing SMEs (Mittal et al. 2018; Spaltini et al. 2022; Sohns et al. 2023). While the manufacturing sector can be addressed in detail, this might not be given to other sectors, underscoring the necessity to tackle distinct issues faced by SMEs (Petzolt et al. 2022).

DP2: Holistic Capability Perspective. *Provide the SME-specific MM with a holistic capability perspective integrating resources, assets, and competencies for SME stakeholders to achieve a comprehensive maturity evaluation, given an all-encompassing view is essential to avoid overlooked gaps and foster consistent growth.*

Covering a broad spectrum of capabilities (MR2) is essential to meeting high-level objectives and getting a holistic view of the ecosystem (Szedlak et al. 2020; Yigit Ozkan & Spruit 2023). Given the constraints imposed by SMEs, it is imperative to consider all capabilities, including resources, assets, and competencies (Williams et al. 2024). This holistic perspective has the objective of identifying any potential gaps and ensures a reliable examination of a specific domain.

DP3: Foundational Tech-Organizational Dimensions. *Provide the SME-specific MM with foundational dimensions that encompass both technological and organizational aspects for SME stakeholders to holistically assess their capabilities and balance between technological and human expertise, given that SMEs face distinct challenges compared to larger enterprises*.

Literature indicates that both technological and organizational dimensions are essential for SMEs (MR2). While SMEs prefer a technology-focused assessment, expecting short-term benefits (Grooss et al. 2022), the *People and Organization* dimension is crucial for tackling other challenges (Rautenbach et al. 2023). Specifically, *Human Capital* is one of the key capabilities for SMEs´ digital transformation (Williams et al. 2024). Consequently, we propose that the dimensions of *Technology* and *Organization* serve as the smallest common denominator in SME-focused MMs. However, the model should extend beyond these two basic dimensions in a thorough and pragmatic manner.

DP4: Balanced Dimension-Capability Coverage. *Provide the SME-specific MM with a balanced coverage of dimensions and capabilities that encompasses all essential aspects while focusing on the most significant ones for SME stakeholders to effectively perform a comprehensive assessment, given that a balanced approach is essential to ensure added value and practical usability for resource-constrained SMEs.*

While comprehensive coverage is necessary for a holistic and strong foundation (Marohn & Li 2024a), an overly complex MM can overwhelm SMEs with limited resources, reducing its practical applicability (Leyh et al. 2017; Williams et al. 2024). A pragmatic approach should prioritize the most significant dimensions with adequate detail, ensuring that the assessment remains effectively applicable while delivering actionable insights (MR2) (Grooss et al. 2022; Rautenbach et al. 2023). To ensure practical relevance, we highly recommend involving practitioners (MR6) in the evaluation of the model. Following Prat et al. (2015), the model could be evaluated according to its *completeness* and *simplicity*. An evaluation statement can be formulated as follows: *The MM encompasses all relevant dimensions to cover the domain holistically, ensuring ease of understanding without unnecessary complexity*.

DP5: Comprehensive and Tailored Guidance. *Provide the SME-specific MM with comprehensive and tailored guidance that incorporates actionable best practices, prescriptive recommendations, and personalized roadmaps for SME stakeholders to systematically drive capability improvement, given that clear, tailored guidance is essential for effective maturity progression in SMEs*.

Comprehensive and tailored guidance is essential for ensuring that SMEs can systematically improve their capabilities (MR3) (Yigit Ozkan & Spruit 2023; Marohn &

Li 2024a). Particularly, clear, actionable, and prescriptive recommendations can serve as an individual roadmap for SMEs to facilitate the transition from current to desired maturity levels aligned with the overall strategy (MR5). Consequently, it is advisable to create a prescriptive rather than a descriptive MM for SMEs. Prescriptive MM elements like a capability form or personalized capability-building roadmaps may be valuable for SMEs (Jeanneret Medina et al. 2024; Marohn & Li 2024b).

DP6: Standardized Maturity Level Assessment. *Provide the SME-specific MM with a standardized maturity level assessment that employs a uniform scale and consistent description for each maturity level for SME stakeholders to accurately and granularly evaluate their status, given that a fine-grained, standardized framework is essential to drive targeted capability development and ensuring applicability across diverse SME contexts.*

An additional "Level 0" precisely represents the real base level as a starting point for SMEs (Mittal et al. 2018; Spaltini et al. 2022; Marohn & Li 2024a). Furthermore, low-level granularity supports a practical capability progression (Yigit Ozkan & Spruit 2020), while common terminology for level descriptions ensures more accurate assessments (Williams et al. 2022). For SME-specific MMs, we propose six maturity levels, starting with Level 0, incorporating low granularity, and commonly used terminology to describe each level (MR3). A standardized assessment through a 6-point Likert scale can also enable a self-assessment (MR4).

DP7: Intuitive Self-Assessment Tool. *Provide the SME-specific MM with an intuitive self-assessment tool that incorporates the prioritization of dimensions, automated scoring, and user-friendly navigation for SME stakeholders to efficiently assess and autonomously evaluate their maturity, given that SMEs face limited resources (time, money, and expertise) and seek to reduce dependency on external expertis*e.

Self-assessment enables SMEs to evaluate their capabilities autonomously, reducing reliance on external experts and fostering continuous improvement (MR4) (Marohn & Li 2024a). The rationale originates from the SME's limited resources, requiring an efficient, intuitive, and easy-to-use self-assessment (Yigit Ozkan & Spruit 2023). Self-assessments not only reduce costs but also increase awareness and engagement among stakeholders (MR5) (Ritchie & Dale 2000). We propose the Likert scale as well-suited to assess maturity levels (MR3) and suggest that the MM should be freely accessible and allow for the prioritization of dimensions to better reflect the specific needs.

DP8: Capability Improvement Management. *Provide the SME-specific MM with a capability improvement management approach that integrates capability ranking, progress tracking, and iterative assessments for SME stakeholders to identify gaps and ensure strategically aligned, progressive capability development, given that SMEs' limited resources and inability to develop all capabilities at once require a self-regulated, targeted, and continuous improvement process.*

The utilization of progress tracking and iterative assessments facilitates a self-regulated improvement process (MR4) and structured guidance (MR3) (Mittal et al. 2018). SMEs operate under limited resources, making it impractical for them to develop all

capabilities simultaneously (Williams et al. 2022). A capability ranking ensures that SMEs can focus on high-impact areas and align capability-building with the overall strategy (MR5) (Marohn & Li 2024b; Williams et al. 2024). Porter (1985) underlines the importance of aligning business strategies with technological capabilities to ensure competitive advantage and innovation. We propose that the system should cover three assessments, the to-be-defined levels, and incorporate capability ranking.

DP9: Pragmatic and Objective Assessment. *Provide the SME-specific MM with a pragmatic assessment approach that mitigates subjectivity for SME stakeholders to obtain an objective and reliable evaluation of their maturity, given that SME decision-makers have a natural tendency to overestimate capabilities*.

SMEs often struggle with subjectivity and overestimation in self-evaluations (Leyh et al. 2017), given that decision-making often relies on intuition and "gut feeling" (Szedlak et al. 2020; Schuster et al. 2021). To ensure the autonomy of SMEs, it is essential that an objective and pragmatic assessment is implemented that mitigates bias while remaining applicable within the given constraints (MR4 and MR2). Therefore, we suggest a hybrid approach that integrates self-assessment with optional external assistance (e.g., Schuster & Waidelich 2022). In addition, using a more granular rating scale (e.g., intermediate scores like 1.75) may help reduce overestimation.

DP10: Balanced Theory-Practice Integration. *Provide the SME-specific MM with a balanced theory-practice integration that synthesizes established theories with practical insights from qualitative studies for SME stakeholders to benefit from a model that is both conceptually robust and applicable in the real world, given that valuable MM must balance theoretical rigor and practical relevance.*

A balanced integration of theory and practice (MR6) ensures that MMs are both scientifically robust and practically applicable in a real-world setting (Mendoza-Silva 2020). This aligns with the design science paradigm that integrates theoretical foundations with practical stakeholder needs to generate impactful output (Hevner et al. 2004). For SME-focused MMs, we recommend a design process aligned with existing guidelines and evaluation with practical subject-matter experts. In addition, theories like the TOE framework (Tornatzky & Fleischer 1990) can strengthen the model's foundation.

6 Evaluation and Discussion

The evaluation of our DPs is structured in two stages. First, we evaluate whether the DPs meet the basic conditions that characterize a valid principle by adopting the evaluation criteria of prescriptiveness and abstractness (Möller et al. 2020). Prescriptiveness is defined as the criterion that the DPs precisely prescribe a specific action for creating an artifact by formalizing design knowledge. Whereby abstractedness is defined as the criterion that the DPs remain adequately generalized to address a class of artifacts rather than one specific instance. Three researchers assess each DP independently against these criteria. Upon completing the assessment, they reached the consensus that all DPs meet the conditions of being prescriptive and abstract.

In the second stage, we perform an expert survey to evaluate the practical applicability of the DPs and assess their usefulness. While SME practitioners benefit from improved models, researchers and MM designers typically apply DPs in the development process. Therefore, we contacted 61 authors and co-authors from the identified literature in our SLR, all recognized for their experience in SME-focused MM design or relevant publications. These experts were best positioned to evaluate the practical applicability of our proposed DPs. Given the initial evaluation in the first iteration and the specific expertise of the participants, we simplified the original concept of perceived usefulness from Davis (1989), while a more comprehensive evaluation is planned for the next iteration. We defined perceived usefulness as the extent to which the DPs enable users to enhance their performance in designing an SME-specific MM. The questionnaire begins with a brief introduction to the study, followed by a definition of the evaluation criteria and an individual presentation of each DP. In the questionnaire, we employ a 5-point Likert scale to measure the agreement on the perceived usefulness of each DP, ranging from "fully reject" (1) to "fully agree" (5). Additionally, the experts were able to provide individual feedback for each DP. Finally, 18 experts completed the survey, achieving a response rate of 29.5 %. The resulting arithmetic mean score for the perceived usefulness of each DP is shown in Table 2.

Table 2. Results of the expert survey: perceived usefulness of each design principle (DP)

	Ø Perceived Usefulness
DP1: Tailored or Configurable Design	4,11
DP2: Holistic Capability Perspective	4,11
DP3: Foundational Tech-Organizational Dimensions	4,44
DP4: Balanced Dimension-Capability Coverage	3,94
DP5: Comprehensive and Tailored Guidance	4,22
DP6: Standardized Maturity Level Assessment	3,89
DP7: Intuitive Self-Assessment Tool	4,11
DP8: Capability Improvement Management	3,89
DP9: Pragmatic and Objective Assessment	4,00
DP10: Balanced Theory-Practice Integration	4,11
	1=fully reject; 5=fully agree; n=18

Several experts showed interest in further collaboration, while the additional feedback was valuable. Exemplary, Expert 5 reported that the principles are well-structured, but some DPs remain too broad and lack specificity (in particular, DP1 and DP5). Therefore, in Section 5, we outline recommendations to operationalize each DP. While not included in the survey, these insights aid in assessing their practical implementation. Regarding DP3, Expert 10 suggests separating the people-related aspects from the organizational dimension, while Expert 6 calls for a strategic basic dimension. Expert 16 noted minor overlaps between DP3 and DP4 and suggested that DP9 could be integrated with the assessment principles (DP6 or DP7) while DP8 could be merged with DP5. Further, Expert 10 raises the issue that the relevance of the DPs may extend beyond SMEs to MMs in general. The feedback highlights the potential for further refinement to ensure that the DPs effectively increase the practical applicability of MMs. The high perceived usefulness (overall arithmetic mean: 4.08) confirms the practical value

of the DPs and underscores the relevance of this study. Furthermore, the evaluation demonstrates that the DPs successfully fulfill their objective by providing researchers with a structured foundation for designing more effective SME-specific MMs. Considering the research findings, it is anticipated that the proposed DPs will enhance the applicability and strategic value of MMs in SMEs. This, in turn, marks a step toward broader adoption and increased practical utilization of MMs.

7 Conclusion

This study reports on a robust DP development process, following Möller et al. (2020). The integration of both supportive and reflective methods results in ten scientifically grounded and practically relevant DPs for SME-focused MMs. Based on relevant literature, we propose six MRs and formulate ten actionable DPs. A survey among recognized experts evaluated the principles, revealing their high perceived usefulness and highlighting their relevance for practical application. From a research perspective, our primary contribution lies in providing design knowledge in the form of operational DPs (*Level 2* artifact according to Gregor & Hevner 2013). Our work improves existing MM development approaches by offering new and actionable guidance intended to enhance the applicability of MMs in SMEs (*Improvement* contribution according to Gregor & Hevner 2013). Researchers and MM designers can use the principles to create and refine MMs for SMEs. These DPs serve as prescriptive guidelines, ensuring that models are not only theoretically robust but also practically applicable and strategically aligned with SME needs. Furthermore, we operationalize the DPs by decomposing their abstract level into actionable recommendations for implementation, which already informs the contextualization of design features. From a practical perspective, our DPs enable the creation of MMs that are more accessible, relevant, and usable for SMEs. Additionally, stakeholders and managers may use our proposed requirements and principles as a checklist to assess the suitability of existing MMs. By providing actionable DPs that enhance the usability and strategic impact of MMs, we aim to take a step towards bridging the gap between MM theory and real-world applicability.

While the proposed DPs offer valuable guidance, limitations must be acknowledged. The principles are derived from literature and evaluated by experienced researchers familiar with SME-focused MMs. While this provides a strong scientific foundation, a practical instantiation and validation in real-world settings remain outstanding. This might limit the ability to generalize their applicability across different SME contexts. The DPs should be regarded as meta-artifacts that support designers in creating a MM more efficiently, but not as a stand-alone promise of success. Rather, they serve as an extension of existing guidelines (e.g., Pöppelbuß & Röglinger 2011), providing additional insights tailored to the SME context and enhancing the model´s applicability. As for the next steps, we aim to further refine the DPs in collaboration with the contacted experts and evaluate them according to the usability framework proposed by Iivari et al. (2021). This interaction with professionals will lead to an enhanced practical relevance of the DPs (Nunamaker et al. 2015).

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