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Article

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Journal of Business Models (JOBM)

Provided in Cooperation with:

Aalborg University, Aalborg

Suggested Citation: Steinhöfel, Erik; Hussinki, Henri; Breunig, Karl Joachim (2022) : Framing a maturity model for business model innovation, Journal of Business Models (JOBM), ISSN 2246-2465, Aalborg University Open Publishing, Aalborg, Vol. 10, Iss. 2, pp. 110-128, <https://doi.org/10.54337/jbm.v10i2.7024>

This Version is available at:

<https://hdl.handle.net/10419/318988>

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JOURNAL OF BUSINESS MODELS

Framing a Maturity Model for Business Model Innovation

Erik Steinhöfel^{1,*}, Henri Hussinki², Karl Joachim Breunig³

Abstract

Purpose: The aim of this conceptual study is bridging established theory on maturity models and business model innovation. The paper identifies boundary conditions and necessary steps for the design of an integrated maturity model for business model innovation. Thus, this contribution establishes a foundation for assessing, improving and benchmarking corporate business model innovation capabilities.

Design/Methodology/Approach: The paper systematically assesses the extant literature to establish ontological consistency in the bridging attempt and defines the boundary conditions and specific steps for subsequent model development.

Findings: Prior published research only to a limited degree relates maturity models to business model innovation. Our assessment of extant literature reveals how innovation related maturity models exhibit an extensive variety with regard to their application domain, number, and descriptors of dimensions, level of granularity, the design process, as well as empirical validation and the consideration of business model aspects. Based on these insights, the focus, scope, and steps towards a maturity model for business model innovation are defined.

Originality/Value: The results of the research provide an important foundation for further research and development steps towards a maturity model for business model innovation. Furthermore, the detailed analysis of innovation related maturity models has potential to be used as a basis for the development of other maturity models in the innovation domain and as a blueprint for analysing future maturity models in detail.

Keywords: business model innovation, business model, maturity model, innovation management

Please cite this paper as: Steinhöfel, E., Hussinki, H., and Breunig, K. J. (2022), Framing a Maturity Model for Business Model Innovation, *Journal of Business Models*, Vol. 10, No. 2, pp. 110-128

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Introduction

Business model innovation (BMI) has recently attracted attention as a promising approach for providing a sustainable competitive advantage, particularly in the context of saturated markets, inter-industry competition, and substitutability of product and process innovations (Brasseur, Mladenow and Strauss, 2017; Steinhöfel and Inkinen, 2016; Steinhöfel, Kohl and Orth, 2016). Extant literature highlights how products, services, and processes tend to rapidly become obsolete due to imitation, therefore innovations in these areas depend on BMI to enable competitive advantages beyond the short- to medium-term (Amit and Zott, 2010; Chesbrough, 2010). Thus, the extant literature discusses BMI as a main determinant of competition and simultaneously as the most challenging type of innovation (Brasseur et al.; 2017; Minatogawa, Franco, Pinto and Batocchio, 2018) with a high rate of failure (Christensen, Bartman and van Bever, 2016), particularly due to the lack of the required skills, knowledge, and suitable processes and mechanisms to support BMI (Brasseur et al.; 2017). Any innovation, including BMI, must be ubiquitous, controlled, measurable, and strategically implemented, which is why it must be supported by suitable analytical models, processes, and instruments (De Fazio, 2017).

Based on the assumption that organizational change and development occur in predictable patterns, maturity models (MMs) represent theories about how organizational maturity evolves in a stage-by-stage manner along an anticipated, desired, or logical maturation path (Becker, Knackstedt and Pöppelbuß, 2009; Gottschalk, 2009; Kazanjian and Drazin, 1989; Röglinger and Pöppelbuß, 2011). Accordingly, van Steenbergen, Bos, Brinkkemper, van de Weerd and Bekkers (2010) define MMs as "means to support such [...] development, as they distinguish different maturity levels that an organization successively progresses through. As such they can be used as a guideline for balanced incremental improvement of a functional domain" (van Steenbergen et al.; 2010, p. 317). The MM is thus a helpful tool to assess the competency, capability, level of sophistication, and degree of progress of a selected domain based on a more or less comprehensive set of criteria. (Becker

et al.; 2009; de Bruin, Freeze, Kulkarni and Rosemann, 2005; Ofner, Hüner and Otto, 2009; Röglinger and Pöppelbuß; 2011). Despite a large number of different types of MMs in various application domains and different levels of detail, MMs share similar structures: They define a number of discrete stages or maturity levels for one or multiple dimensions, with descriptions of the characteristic performance per level building upon each other (Fraser, Moultrie and Gregory, 2002). The value for organizations applying such models varies according to the application-specific purpose. First, MMs are diagnostic tools that enable organizations to describe maturity in the context of a current assessment. Secondly, a MM provides guidelines on how to reach the next, higher maturity level. Descriptions of higher maturity levels can be regarded as best-practice guidance. Finally, MMs can be used for the purpose of comparison and facilitate, for example, internal and external benchmarking (de Bruin et al.; 2005; Ofner et al.; 2009; Röglinger and Pöppelbuß; 2011).

In spite of the academic interest in MMs (Becker et al.; 2009) and the existence of various maturity models that focus on corporate innovation and support companies in fostering innovation systematically (e.g. Demir, 2018; Enkel, Bell and Hogenkam, 2011; Igartua, Retegi and Ganzarain, 2018), there is, to the best of the authors' knowledge, no holistic MM available focusing on BMI. A study by Rübel, Emrich, Klein and Loos (2018) develops a MM for business model management, which "links existing organizational and operational knowledge [to] new concepts and makes it accessible through a modified business model for Industry 4.0" (Rübel et al.; 2018, p. 2040). Even though the term "new concepts" implies novelty which is a key factor where innovation is concerned, Rübel et al. (2018) mainly focus on the design and further improvement of a specific BM by means of the single building blocks of the Business Model Canvas (see Osterwalder and Pigneur, 2010) in the very specific context of industry 4.0. The business model in its entirety - the combination of the different building blocks - and further important aspects related to its innovation such as required superordinate knowledge, structures, and processes are neglected though.

This study provides a targeted assessment of how

theory on MMs can be fused with theory on BMI. Our aim is to foster holistic conceptual integration between MMs and BMI based on an assessment of extant published research. Thus, providing a foundation for further research as well as for allowing managers to assess their organisations with regard to their current BMI status, identify potential for improvement on this basis, promote BMI through pre-defined measures and benchmark their organisations. Accordingly, this paper contributes to the ongoing discussion by establishing ontological consistency in our bridging attempt, as well as by defining boundary conditions and steps for subsequent model development.

Relevance and Challenges of Business Model Innovation

As outlined above the business model (BM) has recently been established as another promising innovation object in research (Foss and Saebi, 2017; Wirtz, Pistoia, Ullrich and Göttel, 2016). BMs have a much higher complexity than products, services and processes and are thus much more difficult to imitate by competitors (von den Eichen, Matzler, Freiling and Füller, 2014; Wirtz, 2021). In literature various different definitions of the term BM exist (e.g. Baden-Fuller and Morgan, 2010; Casadesus-Masanell and Ricart, 2010; Teece, 2010; Wirtz et al.; 2016; Wirtz; 2021; Zott, Amit and Massa, 2011). In this context, Zott et al. (2011) note that researchers repeatedly adopt idiosyncratic definitions that fit the purpose of their research, but are difficult to reconcile and prevent progress. Based on existing definitions and their underlying differences and commonalities we define BM as follows: A BM summarises the complexity of an organisation by reducing it to its essential components and their interrelations. It describes how an organisation achieves its overall goals by systematically designing and combining the components and thus enables the targeted description, analysis and development of organisations.

Analogous to the diversity of definitions with regard to BM, the concept of BMI is also not uniformly defined and a broad spectrum of synonymously used terms and definitions exists (Achtenhagen, Melin and

Naldi, 2013; Andries, Debackere and van Looy, 2013; Charitou and Markides, 2003; Demil and Lecocq, 2010; Doz and Kosonen, 2010; Hamel, 2002; Johnson, Christensen and Kagermann, 2008; Kim and Mauborgne, 1999; Osterwalder and Pigneur, 2010; Reymen, Berends, Oudehand and Stultiëns, 2017; Saebi, Lien and Foss, 2017; Velu, 2017; Wirtz; 2021). Building up on the differences and similarities of existing definition we define BMI as follows: BMI refers to both, the process of consciously and continuously adapting an existing BM and the proactive design of a completely new BM for an organisation. The objective of BMI is to secure the existence of an organisation and to achieve its overriding goals by maintaining or gaining competitive advantages. These are realised by adapting or designing individual or several components of a BM and/or their interrelations.

The relevance of BMI for research and practice is reflected on the one hand in the steadily increasing number of related publications (Steinhöfel, 2022) and on the other hand in its influence on corporate success (Al-Nimer, Abbadi, Al-Omush and Ahmad, 2021; Anwar, 2018; Aspara, Hietanen and Tikkanen, 2010; Bornemann, 2010; Clauss, Abebe, Tangpong and Hock, 2019; Heij, Volberda and van den Bosch, 2014; Lindgård, Reeves, Stalk and Deimler, 2009; Pohle and Chapman, 2006; Zott and Amit, 2007) as well as the perception of BMI by managers (Becker, 2011; Economist Intelligence Unit, 2005; IBM Institute for Business Value, 2021; Pohle and Chapman; 2006).

However, this is contradicted by the fact that BMI is one of the greatest challenges for today's organisations due to differing reasons, of which a variety are outlined in the following. Accordingly, for companies, especially small and medium sized enterprises, BMI is a challenging, very complex and difficult task to manage, for which time, financial and human resources are scarce (Buliga, 2014; Lindgren, 2012; Rieger, Bodenbenner, Wagner, Tilly, Schoder and Seltitz, 2015). Moreover, BMI in companies is largely reactive, intuitive and unstructured and no uniform, structured approach exists (Buliga; 2014; Halecker, Hözlé and Sittner, 2014; Lindgren; 2012; Marolt, Lenart, Maletič, Borštnar and Pucihar, 2016; Rieger et al.; 2015; Wagner, Tilly, Bodenbenner, Seltitz and Schoder, 2015). In this context, according to Halecker

et al. (2014) the initiation of BMI, which might be triggered through internal and external forces (Becker, Ulrich and Stradtman, 2018; Pucihar, Lenart, Kljajić Borštnar, Vidmar and Marolt, 2019) and the evaluation as well as implementation of BMI options represent further major challenges. Adding to that, especially small and medium-sized companies are mostly unaware of available methods and tools for BMI (Bouwman, Molina-Castillo and Reuver, 2016; Heikkilä, Bouwman, Heikkilä, Solaimani and Janssen, 2016) and if known they are only used to a limited extent (Marolt et al.; 2016; Wagner et al.; 2015) as they are partly perceived as too academic or complex to go through a full cycle of BMI (Heikkilä, Bouwman, Heikkilä, Haaker, Lopez-Nicolas and Riedl, 2016). An in-depth analysis of well-established methods (Bucherer, 2010; Gassmann, Frankenberger and Choudury, 2021; Osterwalder and Pigneur; 2010; Schallmo, 2018; Wirtz; 2021) identifies further relevant methodological shortcomings (Steinhöfel; 2022). These mainly consist in the lacking consideration of companies' existing resources in the design process and of its systematic documentation, the exclusive focus on a single BM as the design objective instead of the elaboration of a potential development paths for continuous BMI (roadmap) and limitations regarding the consistent allocation of roles and implementation orientation in the course of BMI as well as the systematic application of BM patterns (Steinhöfel; 2022). Furthermore, established companies fail in BMI due to conflicts with existing technologies, which is also due to the lack of clarity regarding BMI itself and the associated inability to innovate BM (Chesbrough; 2010). On top, Managers are also cognitively constrained by path dependencies, which keep them close to what they already know when it comes to BMI (Bohnsack, Pinkse and Kolk, 2014). Another shortcoming persists in the limited involvement of relevant stakeholders in the BMI process, as their involvement represents a decisive success factor (Ibarra, Bigdeli, Igartua and Ganzarain, 2020; Rieger et al.; 2015; Wagner et al.; 2015). While some companies advocate the involvement of heterogeneous teams from all areas of the company others prefer the exclusive involvement of senior management (Wagner et al., 2015). Furthermore, external stakeholders such as customers and partners are, if

at all, only involved indirectly in the BMI processes so that their potential insights remain largely untapped (Rieger et al.; 2015).

The broad spectrum of the selected challenges outlined above suggests that enabling companies to innovate their BMs requires considering a number of different structural, process, knowledge and capability-related aspects. Against this backdrop, holistic maturity models, which allow the current BMI status to be recorded along various dimensions, systematically provide targeted measures for further development along these dimensions and thereby ultimately enable companies to reap the benefits of BMI, are a suitable approach. In the following the first steps for developing a suitable MM for BMI are described.

Methodology

This conceptual study builds on Steinhöfel, Hussinki and Breunig's (2020) analysis of existing MMs as a basis for defining boundary conditions and additional steps for the development of a MM for BMI. The study was conducted by applying the framework for MM development created by Röglinger and Pöppelbuß (2011), as well as Knackstedt, Pöppelbuß and Becker's (2009) procedural model for developing MM, which was referred to by Röglinger and Pöppelbuß (2011). The framework was selected from a variety of articles focusing on methodologies for systematically developing MM based on literature research using practical and pragmatic support for MM development as well as the number of citations as selection criteria.

The framework proposed by Röglinger and Pöppelbuß (2011) consists of general design principles (DPs) and several related sub-aspects of DPs that are helpful for designing useful MMs for specific application domains and purposes of use. According to the different application-specific purpose of MMs, the proposed DPs are grouped into (1) basic principles, (2) principles for a descriptive purpose of use, and (3) principles for a prescriptive purpose of use (see Table 2). Röglinger and Pöppelbuß (2011) have deliberately not considered the comparative purpose of use in their framework. In their opinion, DPs for this purpose of

Table 1.

Group	Design Principles
(1) BASIC	<p>1.1 Basic information</p> <ul style="list-style-type: none"> a) Application domain and prerequisites for applicability b) Purpose of use c) Target group d) Class of entities under investigation e) Differentiation from related maturity models f) Design process and extent of empirical validation
	<p>1.2 Definition of central constructs related to maturity and maturation</p> <ul style="list-style-type: none"> a) Maturity and dimensions of maturity b) Maturity levels and maturation paths c) Available levels of granularity of maturation d) Underpinning theoretical foundations with respect to evolution and change
	<p>1.3 Definition of central constructs related to the application domain</p>
	<p>1.4 Target group-oriented documentation</p>
(2) DESCRIPTIVE	<p>2.1 Intersubjectively verifiable criteria for each maturity level and level of granularity</p>
	<p>2.2 Target group-oriented assessment methodology</p> <ul style="list-style-type: none"> a) Procedure model b) Advice on the assessment of criteria c) Advice on the adaptation and configuration of criteria d) Expert knowledge from previous application
(3) PRESCRIPTIVE	<p>3.1 Improvement measures for each maturity level and level of granularity</p>
	<p>3.2 Decision calculus for selecting improvement measures</p> <ul style="list-style-type: none"> a) Explication of relevant objectives b) Explication of relevant factors of influence c) Distinction between an external reporting and an internal improvement perspective
	<p>3.3 Target group-oriented decision methodology</p> <ul style="list-style-type: none"> a) Procedure model b) Advice on the assessment of variables c) Advice on the concretization and adaption of the improvement measures d) Advice on the adaptation and configuration of the decision calculus e) Expert knowledge from previous application

Table 1: Framework of General Design Principles for Maturity Models according to Röglinger and Pöppelbuß (2011)

use largely depend on external factors, such as standardised and publicly available specifications, and can therefore only be partially influenced during MM design (Röglinger and Pöppelbuß; 2011).

The relevant MMs for analysis were selected based on a literature review whereas focus was put on maturity models that aim at fostering corporate innovativeness, specifically with focus on BMs (Steinhöfel et al.; 2020) to cover the domain of BMI to the most possible extent. Google Scholar and the meta-search engine Fraunhofer eLib, which covers scientific databases such as ECONIS (ZBW), Scopus and Wiley Online Library, were used for literature search. In accordance with the analysis focus for the search, the following terms and combinations of terms using the operator "AND" were applied: "innovation maturity model", "innovation maturity models", "innovation" AND "maturity model", "innovation management" AND "maturity model", "business model innovation" AND "maturity model", and "business model" AND "maturity model". After initial search, 26 MMs were discerned. Based on number of citations and year of publication, the six most relevant MMs were considered for in-depth analysis. These collectively comprise the Strategic Management Maturity Model for Innovation (S3M-i) by Demir (2018), the Open Innovation Maturity Framework (OIMF) by Enkel et al. (2011), the Innovation Capability Maturity Model (ICMM) by Essmann and Du Preez (2009), the Business Innovation Maturity Model (BIMM) by Carlson and Gupta (2014), the Innovation Maturity Model (IM2) by Igartua et al. (2018), and the Maturity Model for Business Model Management in Industry 4.0 by Rübel et al. (2018). Thus, five maturity models with focus on corporate innovation and one with focus on BM management built the foundation for the analysis.

Analysis of selected maturity models

We analyse the six selected MMs according to the categories of basic, descriptive, as well as prescriptive DPs and their related sub-aspects proposed by Röglinger and Pöppelbuß (2011) illustrated in Table 2. In the context of basic DPs, emphasis is placed on the design process and the extent of empirical

validation (DP1.1f) to gain specific insights into the definition of steps towards a MM for BMI. Moreover, the MMs are analysed regarding the explicit consideration of aspects related to the BM concept in order to gain insights in that regard.

4.1 Basic Design Principles

DP 1.1 Basic information

The analysis regarding the application domain (DP 1.1a) revealed that the major domain of the MMs is innovation management apart from strategic management, with a focus on innovation in terms of products, services, and BMs (Demir; 2018) and BM management regarding Industry 4.0 (Rübel et al.; 2018). In this context, the MMs with the domain of innovation management focus on open innovation (Enkel et al.; 2011), innovation of products, processes and/or strategies (Essmann and Du Preez; 2009), product, service, process, and BMI (Carlson and Gupta; 2014), as well as services, products as well as BMs in the light of innovation (Igartua et al.; 2018).

Regarding the intended purpose of use (DP 1.1b), it was found that most MMs pursue a descriptive, prescriptive, and comparative purpose of use. Exclusively, Demir (2018) and Rübel et al. (2018) do not consider the comparative purpose.

With regards to the target group (DP 1.1c), the analysis revealed that focus is mainly on executives and on decision makers in SMEs (Igartua et al.; 2018), or more broadly practitioners (Rübel et al.; 2018).

The analysis of the MMs regarding the class of entities under investigation (DP 1.1d) demonstrates that the majority of MMs are intended for any type of organisation in any industry (Carlson and Gupta; 2014; Demir; 2018; Enkel et al.; 2011; Essmann and Du Preez; 2009). However, Rübel et al. (2018) refer to organisations which can implement Industry 4.0 components and Igartua et al. (2018) refer to micro-enterprises and small SMEs.

In line with the aforementioned application domains (1.1a), which are often indicated by the name of the respective MM, all MMs elaborate on differences regarding related MMs (DP 1.1e) of the same or similar

domains. A major difference can be observed with regard to the documentation and communication of the design process and extent of the empirical validation (DP 1.1f). Some authors document and communicate the design process in detail (Enkel et al.; 2011; Essmann and Du Preez; 2009; Rübel et al.; 2018), whereas others only touch on the design process briefly (Carlson and Gupta; 2014; Igartua et al.; 2018) or do not elaborate on it at all (Demir; 2018). Empirical validation has so far been provided for 50% of the MMs. This demonstrates that while all authors consider existing MMs and the majority conducts literature research to some degree for developing their MM, the scope of the design process differs greatly, as outlined in the following section.

DP 1.2 Definition of central constructs related to maturity and maturation

The analysis regarding maturity and dimensions of maturity (DP 1.2a) reveals that only one MM is one-dimensional (Carlson and Gupta; 2014), whereas the other MMs are multi-dimensional (Table 2). The multi-dimensional MMs differ greatly in terms of the number of dimensions, which ranges from three to eleven dimensions, as well as in terms of descriptors and the respective descriptions. These differences can be assigned to differences of the MMs with regard to the respective application domain and the purpose of use. In this context, it is noteworthy that it is difficult to determine the number of dimensions for the MM created by Essmann and Du Preez (2009). According to Röglinger and Pöppelbuß (2011), a one-dimensional MM comprises for example process or object maturity (one axis) whereas a multi-dimensional model comprises multiple dimensions for which maturity levels are defined individually (two axes). Thus, each dimension has a different description for each maturity level (own maturity path). The MM by Essmann and Du Preez (2009) does not comply with either of these descriptions, as it combines maturity with an innovation capability construct and an organisational construct (three axes). In this context, both constructs comprise dimensions as determined by Röglinger and Pöppelbuß (2011), which are further broken down in the case of the innovation capability construct, for which maturity levels are defined. Apart from this, the content analysis of

the various dimensions of the MMs shows that both internal and external factors are consistently considered and that certain aspects such as processes, knowledge and capabilities as well as leadership are almost consistently taken into account through differently termed dimensions (Table 2).

With regard to maturity levels and maturation paths (DP 1.2b), it can be observed that all MMs end at level five, whereas Demir's (2018) MM can be considered a minor exception as it formally suggests six maturity levels, starting at level 0. With regard to the descriptors and the description of the maturity levels, there are differences depending on the application domain and purpose of use. Therefore, with the exception Demir (2018), the only common feature is that they start at level 1, and end at level 5.

The available levels of granularity of maturation (DP 1.2b) exhibit a high degree variance. Essmann and Du Preez (2009) provide several levels of granularity of maturation and thereby a very high level of detail. As outlined above, the framework comprises three axes whereas the innovation capability construct is further broken down into three capability areas and 11 underlying items, while the organisational construct comprises five items. The MM of Enkel et al. (2011) presents a high level of detail with a detailed matrix, in which a maturity level description is provided for each dimension and the operationalisation of dimensions occurs through underlying sub-elements. Similarly, Rübel et al. (2018) measure maturity through underlying items of the BM building blocks. A lower level of detail can be determined for the MM of Demir (2018) and Carlson and Gupta (2014) as they assess maturity on the dimension level by providing different level descriptions for each dimension. Igartua et al. (2018) provide the lowest level of detail, as maturity levels apply to all dimensions and are only listed in the form of key points.

The analysis regarding the theoretical foundations with respect to evolution and change (DP 1.2d) is complied with by all selected models as they build up on previous work and extant literature from the respective application domain as well as in terms of drivers and barriers of maturation.

Table 2.

Author/s	Model Name	Dimensions of maturity		Maturity levels	
		Dimensions	Descriptors	Levels	Descriptors
Demir (2018)	Strategic Management Maturity Model for Innovation (S3M-i)	7 (Multi-d.)	(1) Leadership (2) Planning & executing (3) Processes & tools (4) Structure & model (5) People & culture (6) Performance management (7) Innovation	6	0: Undefined 1: Initial 2: Planned 3: Performed 4: Optimized 5: Excellent
Enkel et al. (2011)	Open Innovation Maturity Framework (OIMF)	3 (Multi-d.)	(1) Climate for innovation (2) Partnership capacity (3) Internal processes	5	1: Initial/Arbitrary 2: Repeatable 3: Defined 4: Managed 5: Optimizing
Essmann and Du Preez (2009)	Innovation Capability Maturity Model (ICMM)	8 (Multi-d.)	Innovation Capability Construct (1) Innovation process (2) Knowledge and competency (3) Organizational support Organizational Construct (4) Strategy and objectives (5) Functions and processes (6) Organisation and management (7) Data and information (8) Customers and suppliers	5	1: Ad hoc innovation 2: Defined innovation 3: Supported innovation 4: Aligned innovation 5: Synergised innovation
Carlson and Gupta (2014)	Business Innovation Maturity Model (BIMM)	1 (One-d.)	Not explicitly stated	5	1: Sporadic 2: Idea 3: Managed 4: Nurtured 5: Sustained
Igartua et al. (2018)	Innovation Maturity Model (IM2)	11 (Multi-d.)	(1) Strategy (2) Competitiveness (3) Manufacturing excellence (4) Innovation (5) Value propositions and business model (6) Internationalization (7) Advanced management (8) Digitalization (9) Sustainability (10) People (11) Territory	5	1: Unaware 2: Aware 3: Manage 4: Defined 5: Performance
Rübel et al. (2018)	Maturity Model for Business Model Management in Industry 4.0	9 (Multi-d.)	(1) Key partners (2) Key activities (3) Key resources (4) Value Proposition (5) Customer relationship (6) Channels (7) Customer segment (8) Cost structure (9) Source of income	5	1: Implicit 2: Defined 3: Validated/ standardized 4: Analyzed 5: Optimized

Table 2: Dimensions and Maturity Levels of Maturity Models

DP 1.3-1.4 Definition of central constructs & target group-oriented documentation

The definition of central constructs related to the application domain (DP 1.3) is predominantly considered by the different authors. In this context, it demonstrates that the different constructs are not all explicitly defined though. Often constructs are explained and thereby defined to some degree. As outlined by Röglinger and Pöppelbuß (2011), the definition of central constructs secures intelligibility and language adequacy. The analysis regarding target group-oriented documentation (DP 1.4) revealed that for all MMs basic information and central constructs (DP 1.1-1.2) as well as their interrelations are primarily documented in a target group-oriented manner complying with the requirement of communication.

Design Principles for a Descriptive Purpose of Use

DP 2.1 Intersubjectively verifiable criteria for each maturity level and level of granularity

Intersubjectively verifiable criteria are provided to a differing degree. While Carlson and Gupta (2014), Demir (2018) and Enkel et al. (2011) combine maturity levels and dimensions of their models in a matrix and provide a criterion for each cell Igartua et al. (2018) only describe such a combination without providing a matrix with respective criteria. In this context, Enkel et al. (2011) operationalise their three dimensions via 10 elements and 31 associated items with related questions for the assessment, whereas for each item a specific maturity scale is provided.

Rübel et al. (2018) also combine levels and dimensions in a matrix, but only provide examples regarding criteria for maturity levels of one dimension. Additionally, Essmann and Du Preez (2009) combine their organisational construct and innovation capability construct in a matrix and provide 42 requirements and related questions as well as requirement-specific maturity scales for assessing maturity.

DP 2.2 Target group-oriented assessment methodology

The analysis regarding the provision of a procedural model (DP 2.2a) revealed that only Carlson and Gupta (2014) explicitly mention a procedural model, while some studies do not mention such a model at all

(Demir; 2018), some touch upon related steps (Enkel et al.; 2011; Rübel et al.; 2018), and some solely describe their model's application in practice (Essmann and Du Preez; 2009) or provide an illustration of the assessment procedure without further elaboration (Igartua et al.; 2018). Similarly, advice on the assessment of criteria and particularly on how to elicit the criteria's values (DP 2.2b) is only provided by Carlson and Gupta (2014) and Enkel et al. (2011). Essmann and Du Preez (2009) also cover this aspect by providing requirement or item specific scales for their respective maturity assessment, whereas only an exemplary scale for one requirement is provided. Advice on the adaptation and configuration of criteria (DP 2.2c) according to different situational characteristics is only touched upon by Enkel et al. (2011) who explicitly elaborate on the modularisation and adaption of their assessment according to organisations' requirements. Among the three models that have been empirically verified, knowledge from previous applications of MMs (DP 2.2d) is explicitly mentioned by two (Enkel et al.; 2011; Essmann and Du Preez; 2009).

Design Principles for a Prescriptive Purpose of Use

DP 3.1 Improvement measures for each maturity level and level of granularity

Specific improvement measures for each maturity level and level of granularity (DP 3.1) are generally not provided. Rather, the models are used to identify areas of improvement and derive related measures based on the respective maturity assessment.

DP 3.2 Decision calculus for selecting improvement measures

A decision calculus for selecting improvement measures is not provided by any model either (DP 3.2). This also applies to the explication of relevant objectives for selecting measures (DP 3.2a). Enkel et al. (2011) exclusively touch upon this aspect by referring to their model as a means to achieve corporate objectives. Factors that influence corporate performance and the effect of measures on such factors (3.2b) are also not considered. In general, the models are focused on the internal improvement perspective and neglect the external reporting perspective (DP 3.2c). Only Carlson and Gupta (2014) hint at this aspect by mentioning that

a first version of their model is targeted towards an internal audience.

DP 3.3 Target group-oriented decision methodology

In accordance with the minor consideration of the decision calculus (DP3.2), aspects of the target group-oriented decision methodology for selecting measures (DP 3.3a-3.3e) are not considered by any MM.

Consideration of business model aspects

The analysis regarding BM aspects determined that four of the six MMs consider BMs to some degree. Demir (2018) considers the BM as an aspect of one of seven dimensions, namely the dimension "structure & model". Here, organisational structure and BM are understood as tools to foster innovation and to support corporate strategies. The maturity levels of this dimension with regard to BM aspects are defined as follows: At level 0 the BM is unknown, at level 2 some of its components are known, at level 3 the BM is not innovative, and strategies are not supported, at level 4 the BM is redesigned to foster innovation and empower strategies, and at level 5 the BM is unique/innovative and fully integrated into strategies.

Rübel et al. (2018) use the building blocks of the Business Model Canvas according to Osterwalder and Pigneur (2010) as the structure for their MM. In this context, maturity of a BM with regard to Industry 4.0 is determined by the degree of process mastery of 28 BM elements underlying the nine building blocks. Each element is assessed using five generic maturity levels defining the overall maturity of the BM in focus. In this context, the five levels range from implicit where an element is simply described to optimized where the optimal state of an element is achieved and related control mechanisms are in place. Thus, the levels relate to how well an element is managed. Igartua et al. (2018) consider the BM through the MM category "Value propositions and business model," which is focused on the definition of the offered products and services as well as the related benefits for customers and differentiation potential. To assess the maturity of each of the total 11 dimensions, five generic maturity levels are defined ranging from unaware where little to no knowledge is available to performance where an open innovation approach is followed. Carlson and Gupta (2014) state that their model aims at innovating products, services, and

BMs; additionally, in the frame of the first (lowest) stage's description, it is mentioned that organisations must develop a dynamic portfolio of innovations that includes product, process, services, and BMIs. Furthermore, the description of the fourth stage states that most departments are innovating new solutions on an activity, process, product, or BM level as a lever of that stage. Besides, no specific BM aspects are considered.

Definition of Boundary Conditions and further Steps towards a MM for BMI

The analysis revealed several important insights that can be used to define a first set of boundary conditions and outline potential further steps to design an integrated MM for BMI. In the following section, the structure of design principles for MM according to Röglinger and Pöppelbuß (2011) is employed and the procedural model developed by Knackstedt et al. (2009) is considered. In the context of the latter model, the preceding analysis and the following explanations cover the following steps of MM development: problem definition, comparison of existing MMs, and definition of development strategy.

The application of the envisioned MM focuses on the domain of BMI putting the process of innovating BMs in the foreground (DP 1.1a). The purpose of the model persists in enabling the analysis of organisations or organisations' units' BMI maturity and in providing them with guidance on how to prosper regarding BMI as well as to allow benchmarking (DP 1.1b). The target demographic of such an analysis, derivation of measures and comparisons may comprise executives, managers, business developers, as well as entrepreneurs and researchers (DP 1.1c). In this context, the BMI maturity of organisations regardless of age, size, and industry, ownership, public or private, and units of such organisations are potential entities under investigation (DP 1.1d). Considering that no MM to date holistically focuses on the domain of BMI and following the previously described purpose of use, a clear differentiation from existing MMs is evident and will become even clearer once maturity, respective dimensions, and maturity levels are defined (DP 1.1e).

At this point of the MM conceptualisation, the design process of the MM is not concluded and has so far been documented in detail. The research and development process of the envisioned MM will be guided by the framework developed by Röglinger and Pöppelbuß (2011) and the procedural model to develop MM created by Knackstedt et al. (2009), as well as other approaches to MM development. In this context, the empirical validation is planned as a fundamental step in the sequence to conceptualising an initial version of the envisioned MM for BMI (DP 1.1f).

The conceptualisation of maturity and dimensions of maturity should be extended with different aspects related to the application domain of BMI. On the one hand, the content and architecture of BMs (business model components and interrelations), the process of innovating BMs (e.g., analysis and design), and organisational (e.g., culture, knowledge and leadership) as well as external aspects (e.g., partners and competition) will be considered. For this purpose, the procedure of MM development detailed by Essmann and Du Preez (2009) should be used as a guideline as it combines different approaches to dimension definition and outlines specific steps for an iterative model development in this context. Thus, the application of topic modeling techniques such as latent dirichlet allocation on BMI literature and literature of related fields as well as qualitative, explorative research represent promising approaches. As a multidimensional approach facilitates the definition of assessment criteria for a descriptive purpose of use and the classification of improvement measures for a prescriptive purpose of use according to Röglinger and Pöppelbuß (2011), maturity will be operationalised in a multidimensional manner (DP 1.2a).

Maturity levels should be oriented around existing models for ease of understanding and be complemented by detailed maturation paths for the same purpose (DP 1.2b). As the MM for BMI is intended to support organisations in applying it, the available levels of granularity of maturation should allow a detailed analysis but should not be complicated by unnecessary complexity (DP 1.2c). Throughout this study, the underpinning theoretical foundations with respect to evolution and change (DP 1.2d) are commensurable between the two domains of maturation

and BMI, and thus the ambition to fuse the two withheld. Central constructs related to the application domain that will be defined in detail in the course of the conceptualisation comprise the BM construct and the construct of BMI (1.3). In the frame of the conceptualisation, all results will be documented in a target-oriented manner to comply with the requirement of communication (1.4).

In order to comply with the descriptive DPs, according to Röglinger and Pöppelbuß (2011), the operationalisation of MM through specific assessment criteria (DP 2.1) and the target group-oriented assessment (DP 2.2a-2.2d) will be predominantly guided by the MM of Enkel et al. (2011) and Essmann and Du Preez (2009), as well as Carlson and Gupta (2014) in the case of DP 2.2a-2.2b. Complementary to the analysed models' approach of providing the basis for the derivation of company specific improvement measures, the MM for BMI should provide generic measures for each maturity level and available level of granularity (DP 3.1). In addition, a decision calculus for selecting measures and the possibility to be used internally and for external reporting (DP 3.2a-3.2c). Going beyond the analysed models, the model to be developed should also provide a target group-oriented decision methodology for selecting improvement measures.

Conclusion

The objective of this paper was to provide a conceptual integration between MMs and BMI based on an assessment of extant published research. This approach constitutes a first step towards the conceptualization of a MM for BMI and provides some initial valuable insights for how to proceed. For this purpose, the relevance and challenges of BMI were outlined before six relevant MMs were analysed using an established framework for MM development. One fundamentally important finding is that no holistic MM exists to date that is dedicated to BMI. Furthermore, the analysis showed that the majority of MMs considers BMs to some extent and thus confirm their general relevance for corporate innovativeness. In this context, BMs are mainly taken into account rather superficial as one of many determinants in the frame of assessing corporate innovativeness

though. Guidance on how to foster improvements with regard to BMs is so far only provided by one MM focusing on BM management, whereby BMI is essentially neglected here as well. Against this background and in the light of the absence of a holistic MM for BMI this research endeavour is justified. In order to provide the foundation for a holistic MM for BMI we defined fundamental boundary conditions in the form of design principles according Röglinger and Pöppelbuß (2011) and outlined steps in accordance with Knackstedt et al. (2009), which will guide the subsequent development of the model. This study thus contributes an important foundation for subsequent model development for a MM for BMI, which will eventually enable organisations to assess, improve and benchmark their BMI capabilities as a means to ultimately achieve competitive advantages. Furthermore, the detailed analysis of MMs has potential to be used as a basis for the development of other MMs in the innovation domain and as a blueprint for analysing future MMs in detail.

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