DYNAMIC BUSINESS MODELS: A COMPREHENSIVE CLASSIFICATION OF LITERATURE

Norman Schaffer
fortiss GmbH, schaffer@fortiss.org

Matthias Pfaff
fortiss GmbH, pfaff@fortiss.org

Helmut Krcmar
Technical University of Munich, krcmar@in.tum.de

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Schaffer, Norman, fortiss GmbH, Munich, Germany, schaffer@fortiss.org

Pfaff, Matthias, fortiss GmbH, Munich, Germany, pfaff@fortiss.org

Krcmar, Helmut, Technical University of Munich, Germany, krcmar@in.tum.de

Abstract

Business models are vital to companies' success; to stay competitive, companies continuously adapt and innovate their business model. The conceptualisation of business models has received much attention from prior research and the focus of research is shifting from a static perspective to a more dynamic perspective. This research is a comprehensive and up-to-date literature analysis of the concept of dynamic business models. To achieve a systematic and objective penetration of the research field, we used a classification framework consisting of 15 evaluation dimensions. We identified the main research streams on the topic and present the most relevant approaches, such as system dynamics modelling. A total of 42 relevant literature sources were found. Finally, we highlighted gaps for future research, such as a need for more detailed analyses of the interdependencies between the components a business models consists of.

Keywords: Dynamic Business Model, Literature Review, Innovation, System Dynamics, Interdependencies

1   Introduction

Business models (BMs hereinafter) are vital to companies' success (Zott et al. 2011) and have gained increased attention in research and practice in recent years (Wirtz et al. 2016). Due to high-velocity markets, fast changing requirements of customers and stakeholders, and the increasing maturity of the concept itself (Foss and Saebi, 2017; Wirtz et al. 2016), scholars as well as practitioners have criticized the adaption of a too static perspective regarding BMs (Chesbrough, 2010; Cosenz and Noto, 2018; Demil and Lecocq, 2010; van Putten and Schief, 2012). This has led to a shift in focus of BM research toward a more dynamic perspective (Burkhart et al. 2011; Kranz et al. 2016; Saebi, 2015; Schneider and Spieth, 2013). In general, according to Burkhart et al. (2011) a dynamic point of view on BMs addresses the evolution process of a BM. This perspective allows a firm to adapt a BM flexibly and dynamically to stay competitive, to continuously manage it, to anticipate changes and to innovate it (Achtenhagen et al. 2013; Basole, 2009; Chesbrough, 2007; Cosenz, 2017; Kranz et al. 2016; Spiegel et al. 2015). Especially in the digitized world, companies have problems adapting their BM to the new challenges and the increased speed of the market and innovations (Saebi, 2015; Simmert et al. 2018). Additionally, companies often follow a trial-and-error approach or intensive experimentation to develop a new BM or change an existing one, which can be expensive and risky.

Firms with a proactive BM capture and generate high value in dynamic markets, compared to a reactive BM (Hacklin et al. 2018). However, it is not understood in detail how a BM evolves and develops over time. This evolution is caused, to a large extent, by the complex and dynamic relationships between the components of a BM, which are not sufficiently understood (Burkhart et al. 2011; Chen et al. 2019). Most BM representations still rely on static views (Chen et al. 2019) and there are only limited methods and tools to address the shift toward a dynamic perspective (Achtenhagen et al. 2013). More flexible BMs are needed, enabling firms to modify their strategic choices in a constantly changing environment (Trimi and Berbegal-Mirabent, 2012) and allowing practitioners to make better BM decisions (Täuscher and Chafac, 2016). Current approaches apply a variety of definitions on BMs from a dynamic perspective and focus on varying topics, leading to an unclear state of knowledge regarding the subject. To the best of our knowledge, no exhaustive review of dynamic business models (DBM hereinafter; see e.g., Cosenz and Noto, 2018) exists. Within this research, we aim to shed light on the concept of a "dynamic business model". The overarching question this study addresses is: **What is the current state of knowledge regarding Dynamic Business Models?** To address this question, this paper provides an up-to-date literature analysis based on four research goals (see Table 1).

Research Goals of this Paper
• Provide an up-to-date and cross-disciplinary overview of definitions and concepts related to dynamic business models
• Classify existing literature on the topic of dynamic business models
• Develop a clear definition of a dynamic business model, and the benefits this concept provides
• Uncover existing research gaps that should be tackled to provide conceptualizations and tools for dynamic business models

Table 1.   Research Goals of this Paper

The structure of the paper is as follows. In Section 2, we elaborate on the methodology applied to this study. Applying this methodology, Section 3 introduces different concepts, terms and definitions on the topic. To achieve a systematic and objective description of the research phenomena, in Section 4 the selected literature sources are classified within 15 dimensions, clustered into six categories in order to reduce complexity. Based on this, Section 5 presents the central themes in research about DBM. Before the conclusion in Section 7, avenues for future research are presented in Section 6.

2   Methodology of the Literature Review

This research is a systematic literature review following the guidelines of Webster and Watson (2002). A broad foundation of journal and conference papers was assembled using the database Scopus. The database was selected because it has a wide coverage of scientific literature. Additional databases were used to retrieve literature not available in Scopus. To guarantee the use of high-quality literature, we selected as sources the IS Basket of 8[1], the top 10 strategy and management journals according to their impact factor[2] and the top IS conferences (HICCS, ICIS, ECIS, AMCIS, MCIS). During a forward and backward search, it was clear that the journal *Long Range Planning* was of central relevance for the topic, so we added it to the initial list of primary sources.

Within these sources, we searched for the term "business model" in the title, abstract, or keywords, without further limitations of the search term, such as *dynamic**, *evoluti**, or similar terms. Prior to this research, it was not fully clear what topics and terms in the context of DBM would be addressed by the various studies. Applying a broad scope allowed a rather open approach, and did not limit possible results by a too restrictive search stream. This search provided us with a set of 326 articles. Additional journal articles, conference papers and studies appearing in books and dissertations were added with a forward and backward search.

Following a two-stage selection process, the articles were scanned and filtered in two rounds. The initial cursory analysis reviewed the titles, abstracts, keywords, and the introductions of the documents. This revealed that not all of the identified articles would be useful for the purpose of this review, because the respective work did not deal with the business model as a central concept within the article. In this step, the number of relevant articles was reduced from 326 to 177. In the second stage, the articles' results and conclusions were reviewed. In this stage, we deemed papers that solely applied the concept in a static way or as means of representation as not relevant and excluded them as well. The resulting sample papers were read in detail and classified. The final sample consisted of 42 relevant literature sources. To classify the selected articles, we used an explorative process that was repeated iteratively to develop conclusive classification constructs for each of the classification dimensions (Dongus et al. 2014).

3   Heterogeneous Definitions of Dynamic Business Models

The variety of research streams dealing with the concept of BMs lead to a diverse set of definitions. However, recent reviews to the emergence and conceptualizations of BMs exist, e.g., Wirtz et al. (2016), Massa et al. (2017), Zott et al. (2011) and Foss and Saebi (2017), who realize that the majority of current definitions of BMs are close to Teece's definition as "the design or architecture of the value creation, delivery, and capture mechanisms" (Teece, 2010).

On the topic of DBMs few reviews exist. Foss and Saebi (2017) offer a broad overview of BMs and business model innovation (hereinafter BMI), which also covers aspects of DBMs. However, coverage of BMI is regarded to be insufficient (Chesbrough, 2007; Ricciardi et al. 2016; Taran et al. 2015), as changes or reconfigurations of a BM and its constituting components often occur on a more nuanced level, not always leading to radical BMI (Clauß et al. 2019). Massa et al. (2017) give a comprehensive overview of BM research, briefly addressing DBMs. Currently however, there has been no exhaustive review regarding DBMs.

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[1] https://aisnet.org/page/SeniorScholarBasket

[2] https://www.scimagojr.com/journalrank.php?category=1408

To tackle the first research goal proposed in the prior section and attempt to grasp the different approaches, Table 2 provides a brief overview of different concepts and their respective definitions in relation to the concept of DBM. These guiding references provide an overview of selected studies using the respective term, but are by no means exhaustive. The concepts and definitions are relevant within the topic of DBM and proposed by, among others, the provided guiding references. Furthermore, pertinent research streams and approaches, such as BM transformation, are defined.

Concept	Understanding / Definition	Guiding references
BM change	Four types of BM change exist: BM – creation; extension; revision; termination (Cavalcante et al. 2011)	Cavalcante et al. (2011); Kranz et al. (2016)
BM evolution	"[…] a fine tuning process involving intended and emergent changes both between and within its [a BM] core components." (Demil and Lecocq, 2010)	Bohnsack et al. (2014); Burkhart et al. (2011); Demil and Lecocq (2010)
BM adaptation	"[…] the process by which management actively aligns the internal and/or external system of activities and relations of the business model to a changing environment." (Saebi, 2015)	Kurti and Haftor (2014); Ricciardi et al. (2016); Saebi (2015)
BM innovation	"A business model innovation happens when the company modifies or improves at least one of the value dimensions." (Abdelkafi et al. 2013)	Abdelkafi et al. (2013); Foss and Saebi (2017)
BM transformation	"[…] a transformation process of the value creation caused by external or internal changes." (Augenstein et al. 2018)	Augenstein et al. (2018)
BM evaluation	(No explicit definition provided)	Burkhart et al. (2011); Kayaoglu (2013)
BM (re)configuration	"[…] the phenomenon by which managers reconfigure organizational resources (and acquire new ones) to change an existing business model." (Massa and Tucci, 2014)	Clauß et al. (2019); Di Valentin et al. (2013); Massa and Tucci (2014)
BM management	"A generic management process, building on the business model as central unit of analysis." (Terrenghi et al. 2017)	Ebel et al. (2016); Terrenghi et al. (2017)
BM improvement	Radical improvement as "the complete revision of their [a company's] business model" (Simmert et al. 2018) Incremental improvement as the revision only of parts of a business model (Simmert et al. 2018)	Simmert et al. (2018)
Dynamic BM	(No explicit definition provided)	Cosenz and Noto (2018); de Reuver et al. (2009); Meier and Bosslau (2012)
BM dynamics	(No explicit definition provided)	Achtenhagen et al. (2013); Di Valentin et al. (2013); Saebi (2015)

Table 2.   Concepts and Definitions Regarding Dynamic Business Models

Different authors, as presented in Table 2, use different approaches and a variety of concepts in the context. Often, the relation between these approaches seems unclear or is not defined. The variety and heterogeneity of these definitions and related concepts shows that DBM lacks clear conceptualization. To better comprehend and understand the variety of approaches dealing with DBM, it is first necessary to classify the existing literature (see Section 4).

4   Classification of Existing Literature

With the literature review specified in Section 2, we identified 42 relevant literature sources. These sources are classified based on 15 dimensions, which are aggregated into six categories (see Table 3). This classification helps to achieve the second research goal proposed in the first section.

We developed the categories and the respective dimensions within the iterative process of reviewing the literature. All of the categories and dimensions are supported by literature, notably, not one single source provides exactly these dimensions. Rather, these are parts of the results within this research. The totality

of the categories is not arbitrary and the justification for using the respective category is explained in detail within this section. Additionally, the dimensions within the categories are presented and analyzed. Table 3 presents the classification framework.

Category	Dimension		
Perspective	static		dynamic
Lifecycle stage	develop		exploit
Interdependencies	intra-BM	intra-organizational	external
Process view	change	management	capabilities
Tool support	representation	development	simulation
Focus	domain		use case

Table 3.   Classification Framework

First classification category: Perspective on business models

Static and dynamic perspectives on the concept of BM can be found in the literature (Burkhart et al. 2011; Demil and Lecocq, 2010; Kranz et al. 2016; Schwarz et al. 2017). From a *static perspective*, a BM describes the current state of a company and its methods for generating value. Literature in this context often refers to a *static blueprint* (Bouwman and MacInnes, 2006; Burkhart et al. 2011). This perspective is useful for discussion or analysis purposes. From a *dynamic perspective*, mainly the process of BM evolution is addressed. This includes internal and external factors influencing a BM (e.g., market changes, legal regulations, internal strategy, capabilities), the process of managing and changing a BM, as well as interactions between the components of a BM.

Dimensions: *static perspective, dynamic perspective*

Second classification category: Business model lifecycle stage

A BM evolves through different stages over time, posing different implications during the different stages (Christensen et al. 2016; Rong et al. 2018). Understanding in detail the different stages, and having the ability to locate a BM within the lifecycle, is important in decision making.

There are a variety of models describing the lifecylce of a BM, e.g., Burkhart et al. (2011); Christensen et al. (2016); de Reuver et al. (2009); Ebel et al. (2016); Gassmann et al. (2013); Pateli and Giaglis (2004); Simmert et al. (2018); Terrenghi et al. (2017). Varied authors use different stages to describe the lifecylce of a BM; these approaches mostly differ in focus and granularity of the respective stages. Yet, these models mostly share the same basic structure. We summarized the different models into a 6-staged lifecylce model. The two distinct stages, *develop* and *exploit*, are shown in Figure 1. Even though these two stages are rather generic, they help to understand in which stage the respective BM concept is applied in within the literature source.
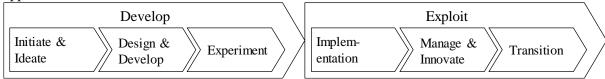

Figure 1.   Generic Lifecycle Stages of Business Models

Dimensions: *develop, exploit*

Third classification category: Interdependencies

To understand DBMs, it is important to understand the complex interactions (structural relations) between the constituting components of a BM as well as with other, external influences. We use the following three dimensions to classify literature addressing these interdependencies.

Literature considering *intra-BM interdependencies* looks at the complex interrelations between different components (often referred to as building blocks or elements) of one particular BM. Amit and Zott (2001) with their work on e-BMs have already noted the interdependencies of value drivers and their

mutual enhancement. These interrelations can occur between two distinctive components of a BM, as well as within one specific component, e.g., between resource configuration and the revenue model. Furthermore, the literature looks at the interrelations of a BM and its components with further *intra-organizational interdependencies*. These refer to interdependencies within the organization (e.g., the company's strategy) and lead to the evolution of a BM over time as well. This evolution process happens either consciously, to support the company's strategy, or mostly passively, meaning there is no specific involvement of the operator of the BM. The third dimension that considers interdependencies are papers focusing on e*xternal interdependencies* and the interplay of a BM with its external environment. Typically, external interdependencies are regulation, competition in general, ecosystem dynamics, changing customer satisfaction patterns, or the change of a partner's BM.

Dimensions: *intra-BM interdependencies, intra-organizational interdependencies, external interdependencies*

Fourth classification category: Dynamic process view

This classification category evaluates how a respective paper addresses DBM from a process perspective, i.e. how inherent dynamics are addressed. To classify the papers, we used the following three dimensions.

The dimension *change* mainly considers three streams: the evolution of a BM over time; the process of changing a BM; and the kind of changes that are possible to a BM at different lifecycle stages (Christensen et al. 2016). The dimension *management* refers to the process of controlling and monitoring a BM. The final dimension in this category focuses on the *capabilities* necessary to benefit from inherent dynamics of the BM, for example, by proactive change or by managing it accordingly. The biggest share of these approaches builds on dynamic capabilities (Teece et al. 1997; Teece, 2018), with different variations of the concept.

Dimensions: *change, management, capabilities*

Fifth classification category: Tool support

Researchers have been asking for tool support to develop and manage BMs. Existing tools are helpful within the process of BMI, but do not sufficiently support the design, exploration, and management of a BM and do not leverage the full potential of tools (Achtenhagen et al. 2013; Athanasopoulo et al. 2018; Ebel et al. 2016; Giessmann and Legner, 2016; Simmert et al. 2018; Veit et al. 2014). Additional, Athanasopoulo et al. (2018), in a recent paper about tooling for BMI, report that existing tools do not consider the creation of alternative BMs within a dynamic environment, which poses uncertainty. To understand if a respective paper provides tool support, in this review, we differentiate the category of tool support within the following dimensions: *representation,* as a tool for describing and communicating a BM; *development,* as a tool to support the development of a DBM; and *simulation* as a tool to simulate the behavior of a DBM.

Dimensions: *representation, development, simulation*

Sixth classification category: Focus

To classify the selected literature more comprehensively, we additionally evaluated the focus of the literature sources. This category supports understanding and reasoning why and how a specific approach may propose specific or generic results. Within this category, we differentiate between *domain specific,* when a paper considers a specific domain such as in the biomedical sector (e.g., Willemstein et al. 2007) or in the 3D printing industry (e.g., Rong et al. 2018) and *use case specific*, if one or several specific use cases are addressed (e.g., Moellers et al. (2019) studying cases within BMW or Demil and Lecocq (2010) studying the case of the English football club Arsenal FC). Some papers build on a generic framework, and then evaluate it with a use case. However, this does not necessarily mean the respective research focuses solely on a specific use case or domain.

Dimensions: *domain specific, use case specific*

Table 4 provides an overview of the classification of the 42 literature sources. The detailed description of each of the classification categories already delivers first insights into the research stream. In the next section, we present the key insights based on this classification.

	perspective		BM stage		interdependencies			process view			tool support			focus	
	static	dynamic	develop	exploit	intra-BM	intra-organizational	external	change	management	capabilities	representation	development	simulation	domain	use case
Abdelkafi and Täuscher, 2016		x	x	x	x	x	x	x			x		x		x
Achtenhagen et al. 2013		x	x	x		x		x	x	x		x			
Amit and Zott, 2016		x	x							x					
Augenstein et al. 2018		x		x	x	x		x				x			x
Burkhart et al. 2011	x	x	x	x		x		x	x						
Bohnsack et al. 2014		x		x	x		x	x						x	
Bouwman and MacInnes, 2006				x		x		x			x				x
Cavalcante et al. 2011	x	x	x	x	x	x		x		x					
Chen et al. 2019		x	x		x								x	x	
Clauß et al. 2019		x		x	x	x		x	x					x	
Cosenz and Noto, 2018		x	x		x	x					x		x		x
Demil and Lecocq, 2010	x	x		x	x	x	x	x		x					x
Desyllas and Sako, 2013		x		x	x	x		x		x					x
Di Valentin et al. 2013		x	x	x	x	x	x		x			x		x	
Ebel et al. 2016	x		x			x	x		x			x			x
Giessmann et al. 2013		x	x									x	x		x
Haaker et al. 2017		x	x		x	x	x	x				x			x
Hajiheydari and Zarei, 2013		x	x		x		x	x					x		x
Kayaoglu, 2013		x	x	x	x	x						x			x
Kurti and Haftor, 2014		x	x					x							
Kranz et al. 2016		x		x		x	x	x		x					x
Krumeich et al. 2013		x			x						x				
Krychowski and Quélin, 2014		x	x		x		x	x						x	
Kulins et al. 2016	x		x			x								x	
McGrath, 2010		x	x		x	x		x		x					
Meier and Bosslau, 2012		x	x		x	x	x	x					x	x	
Moellers et al. 2019		x	x	x	x	x		x					x		x
Ojala, 2016		x	x	x	x	x	x	x							x
Rai and Tang, 2014	x			x	x		x	x		x				x	
de Reuver et al. 2009		x	x	x			x	x						x	
Ricciardi et al. 2016	x	x		x	x	x		x		x					x
Rong et al. 2018		x	x			x	x			x				x	
Saebi, 2015		x		x		x	x	x		x					
Schwarz et al. 2017		x	x	x		x	x		x						
Simmert et al. 2018	x		x			x			x			x			
Täuscher and Chafac, 2016		x	x		x	x	x	x					x		x
Teece, 2018		x	x		x	x		x		x					
Terrenghi et al. 2017		x	x		x	x	x	x	x						x
Valter et al. 2018		x		x		x	x	x							x
van Putten and Schief, 2012	x	x		x		x									
Weking et al. 2018		x	x		x	x		x						x	
Willemstein et al. 2007		x		x			x	x						x	
Total (n=42)	**9**	**36**	**26**	**26**	**25**	**31**	**20**	**29**	**8**	**12**	**3**	**8**	**8**	**12**	**18**

Table 4.   Classification of the selected literature on DBM

5   Central Themes in Research on Dynamic Business Models

In Section 4, the relevant classification categories were introduced and described in detail. Based on the classification shown in Table 4, several patterns in the comprehension of DBMs are identified and analyzed, including the most relevant approaches within these patterns. In the next section, we present avenues for future research, acknowledging gaps in the prior literature.

Analyzing the 42 literature sources in detail and building on the scientific state of knowledge, we argue to extend the definition of BM by Teece (2010) as "the […] architecture of the value creation, delivery, and capture mechanisms" by the following aspects to provide a current understanding of DBM. A BM:

  o   is exposed to uncertainty by various internal and external influences
  o   is a complex construct, consisting of interrelated components
  o   [and it's constituting components] evolves over time

Based on these aspects, we understand *DBM as a complex system of interrelated subcomponents of the value creation, delivery, and capture mechanisms, which is interacting with heterogeneous internal and external influences leading to the evolution of its components and the system itself.*

The process of business model evolution

The prior literature has studied the process of BM evolution. Evolution is how a BM develops over its lifecycle. As presented in Section 4, the literature has proposed lifecycle stages for the construct of BMs. Yet, these stages show an idealized and generic process. However, the evolution of a BM happens on a more nuanced level, as its interdependent subcomponents experience varied changes (Ricciardi et al. (2016) refer to "microadaptations"). The existing literature mostly looks at this occurrence rather super-ficially. Even detailed studies, such as the study by Demil and Lecocq (2010) analyzing the case of the English football club, Arsenal FC, over a period of ten years, often lack detailed insights on the sub-component level. Other studies consider the actions or capabilities necessary to handle these dynamics, such as Achtenhagen et al. (2013), but do not consider the concrete process as well. Some studies even understand BM change as a dynamic capability in itself (e.g. Saebi, 2015). Other studies build on dy-namic capabilities, e.g., Ricciardi et al. (2016) who proposed the concept of "adaptive business model innovation". Further capabilities that are proposed to address inherent dynamics of a BM are: IP-man-agement capabilities; managerial capabilities in general; absorptive capabilities or organizational capa-bilities as constructs from organizational theory. These studies, however, give little indication on how to employ these capabilities to handle DBMs.

In general, the process of evolution is not understood sufficiently. A more detailed look at the concrete interrelations of the subcomponents, as well as the interaction of these components in the internal (or-ganization) and external (environment) surroundings is necessary (see the next sub-section). Further-more, empirical research studying successful, as well as failed cases over a longer period are needed to provide detailed insights from practice. If these empirical studies use a harmonized taxonomy to describe BMs and its evolution process, the development and testing of more generic hypothesis is possible.

Improving the understanding of the evolution process can help to evaluate the robustness of a BM, as proposed by Haaker et al. (2017), but more importantly, it helps to understand how the environment influences its evolution and the concrete impact of a specific change in a subcomponent on the other subcomponents. This knowledge will help managers to make better decisions regarding BM design and management (Christensen et al. 2016). Currently, changes in BMs are mostly either reactive or even unconscious. Having more profound knowledge, the evolution process of a DBM could be purposefully and actively steered to achieve the organization's desired goals efficiently and effectively. Necessary adaptions and beneficial changes can be evaluated and performed anticipative. Cavalcante et al. (2011) provided a detailed study, proposing four kinds of BM change and the respective key challenges; these results help to evaluate the impact of changes on a BM.

Interdependencies: Understanding dynamic business models as complex systems

We found three dimensions of interdependencies of DBM, which lead to reinforcing dynamics (feed-back loops): *intra-BM interdependencies, intra-organizational interdependencies,* and *external interde-pendencies*. The literature considering *intra-BM interdependencies* looks at the interrelations between different components of a BM. As the components change over time (Demil and Lecocq, 2010), the dynamics caused by these interrelations are again reinforced. This means that the evolution of one BM component might lead to an increasing significance or changing configuration of another component (Abdelkafi and Täuscher, 2016). Feedback loops arise, building vicious ("weakening") or virtuous ("strengthening") cycles. An example is the changing BM of the airline Ryanair described by Casadesus-Masanell and Ricart (2011). Some studies employ a systems perspective to understand intra-BM inter-dependencies, which are described in the next sub-section. *Intra-organizational interdependencies* con-sider the interrelations between a BM and its subcomponents with the BM's governing organization. Mostly qualitative interdependencies are used. The most frequent intra-organizational interdependency

considered in the literature is the strategy of a company[3]. Some studies looks at a company's information systems, its general network of partners (not for the specific BM, but the company as a whole), the organizational process, and the managerial cognition of the responsible executive. One specific intra-organizational influence can be seen in the interrelations between competing or complementing BMs of the same company. This research stream mainly focuses on the management of a BM portfolio (see for example, Schwarz et al. 2017), such as a news agency offering a printed newspaper, a basic online news homepage, and a premium online offering with detailed reports and analyses. The third stream found is the study of *external interdependencies* and their influence on the BM and its components. Typically, external interdependencies are regulation, competition in general, ecosystem dynamics (e.g., Rong et al. 2018 in the domain of 3D-printing), changing customer satisfaction patterns, and further external developments, e.g., sociological changes leading to a shift of the BMs of a whole domain. De Reuver et al. (2009) provide a detailed study of external influences on start-up BMs over their lifecycles.

Even though previous studies look at a variety of interdependencies affecting a BM [25/31/20 *intra-BM / intra-organizational / external*], it is still not understood sufficiently what concrete interdependencies influence a BM and in what manner. There are detailed studies available that look at competing BMs (Markides and Charitou, 2004) or BM portfolios (Schwarz et al. 2017); Krumeich et al. (2013) even provide a literature review on the topic of interdependencies of BMs. Yet, most of the studies found in this analysis only provide insights on which factors influence a BM, but do not specify how these factors influence the BM or what components are affected. To improve the understanding of DBM's interdependencies, the DBM should be understood as a complex system. According to Simon (1962), complexity occurs, "when a number of parts interact in a nonsimple way." Such complexity often takes the form of a system that is composed of interdependent (complementary) subsystems (Foss and Saebi, 2017; Simon, 1962). Several studies apply simulation approaches considering the variety of interdependencies in detail; these are presented in the next sub-section.

Simulation models for dynamic business models

The studies that take a systemic understanding of DBM use various modeling and simulation approaches to provide insights on the underlying causal effects. Most of the literature employs causal loop diagramming to study the implications of changes (i.e., mostly managerial decisions) and to understand feedback loops (virtuous cycles) within a DBM. On a more detailed level, simulation models are used to describe DBMs as complex and evolving systems. The most-used simulation approach is system dynamics, e.g., Cosenz and Noto (2018); Moellers et al. (2019); Romero et al. (2017). Additionally, agent-based modeling is used occasionally. System dynamics was developed in the 1950s to holistically model complex systems (Forrester, 1997); it can be used to evaluate different options in the design of a DBM by simulation and empirical assessment (Täuscher, 2018).

While these approaches mostly are case specific, they deliver concrete insights on the reinforcing dynamics of a BM and support an understanding of the evolution process. It is necessary to compare and analyze these specific findings in order to provide more insights into the interrelations and the underlying dynamics. Empirical investigations are necessary to identify specific interaction patterns within and between BM components as well as with external interdependencies, which can provide more generic propositions. Knowledge of this phenomena will help to further understand the internal structure of a BM and serve as a basis to support better decision making in BMs, to develop more flexible and long-lasting BMs, and provide a basis for more sophisticated tools for BM development and management.

Yet, for the existing simulation approaches, detailed knowledge to build the respective simulation models is needed. Furthermore, because there is no unified language to describe DBMs, it is difficult to build an empirical dataset to derive more generic hypotheses from the models. More sophisticated tools are needed, which can be used by practitioners without profound knowledge of simulation models. To do

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[3] Literature also looks in detail between the relation or distinction of a BM and the strategy of a company. A detailed discussion can be found for example in Massa et al. (2017).

so, a combination of explorative or strategic methods, which are easier to comprehend, could be helpful and should be tested in the future. To build different strategic options that can be modeled and simulated, scenario planning used by Haaker et al. (2017), scenario development used by Täuscher and Chafac (2016) or strategic thinking proposed by McGrath (2010) are suitable. The concrete combinations and the benefits will have to be evaluated in the future and can serve as a basis for future tools.

Tools to support the development and management of dynamic business models

Even though the literature frequently asks for IT-based tools for visualization, development, management, and evaluation of BMs (Veit et al. 2014), hardly any tools exist that consider the dynamic behavior of BMs. Terrenghi et al. (2017) provide an overview of the topic of BM management. Di Valentin et al. (2013) provide insights on how to build configuration and monitoring tools for BMs in the software industry. The studies that apply simulation models have built the basis for developing supporting tools. Yet, any tool for DBM has to allow for flexibility in a BM already during development and has to be applicable to users that do not have knowledge of simulation methods. These tools must recognize the need for flexibility in adapting DBMs in the future. Various strategic scenarios have to be incorporated, and the user must understand what kind of changes are possible, necessary, or permitted in the evolution of a BM. Furthermore, the tools should allow for experimentation with multiple settings and different options, to identify the underestimated, overlooked, or overrated factors and patterns that could be relevant in the future. Simulation-based tools help to reduce real-life experimentation in the development of BMs (Rong et al. 2018), which is costly and poses risks. Unlike real-life experiments, simulations can be performed ongoing, in a fraction of the time, and repeated, allowing for a greater number of experiments.

Developing respective tools will not only help to build long-lasting DBMs, but also support the management and evaluation of DBMs in the long run. Building on a unified taxonomy, it should be evaluated if and how the data of an organization's information systems, such as an ERP system, can be automatically assessed and analyzed. This would promote the concept of DBM to be an actual management tool. However, to do so, this unified taxonomy would need concrete and comparable metrics. Evaluations of other approaches, such as data-driven modeling, should be tested to provide a greater variety of fact-and metrics-based tools. An interesting approach by Valter et al. (2018) in a series of three papers experimented with deep learning methods in the context of BMI.

6 Future Research

Based on the analysis in this study, future research should consider the following aspects to drive the understanding, conceptualization and usage of DBMs (see Table 5).

Future Research on Dynamic Business Models
• Conceptualizing dynamic business models as living and complex systems
• Foster the use of a harmonized taxonomy of dynamic business models
• Understanding the complex interactions of the subcomponents of a dynamic business model and the influence of external triggers
• Long-term and large scale empirical studies about the evolution of business models
• Combination of modeling and simulation approaches (such as system dynamics) with suitable theoretical constructs (such as financial models, systemic thinking or scenario evaluation)
• Development of practice-oriented tools for the development and management of DBM, based on simulation models and explorative and strategic methods
• Data-driven modeling with a harmonized taxonomy, building on real-world data in organizations

Table 5.   Future Research on Dynamic Business Models

Future research can employ a systemic perspective on DBM in order to conceptualize the construct. The development and use of a unified taxonomy can enable empirical studies on a large scale. It is important,

however, to note that past research on BM has frequently asked for this unified language, without substantial success. The evolution process of a BM should be studied in detail, applying various research perspectives and looking at a variety of cases. The comprehension of the interrelated components of a DBM is very important. Simulation approaches, especially system dynamics, are suitable to study this phenomenon. The suitability and usefulness of other simulation approaches, such as complex adaptive systems, should also be evaluated in the future. Based on this, the influence of external triggers on the components of a BM could be understood in more detail, enabling better decision-making and long-lasting BMs. New tools have to be developed, that use simulation models in the background, and are easily comprehensible by practitioners without profound knowledge of modeling or simulation methods. Rather, combining simulations with further theoretical constructs, such as systemic thinking and scenario evaluation, as well as with financial models, such as real-options theory, could provide tools to support the complexity of the DBM and to evaluate different strategic scenarios. In the long run, it should be tested how data from the information systems of organizations can be used within the models. Further, publicly available data, could be used for modeling and simulation.

7   Conclusion

The concept of BMs has been criticized by research and practice for having a too static perspective. To address this gap, this paper focused on improving the understanding of DBMs by performing a structured research study. We first provided an overview of relevant definitions related to the concept of DBM. Conducting a literature review, we identified 42 relevant sources from the literature, which are classified into 15 dimensions. Based on these dimensions, we achieved a classification of the streams of knowledge on DBMs in the literature. The results of this classification show that there are different approaches with varying focus on the topic of DBMs. Despite the usefulness of existing research, there still are a variety of research gaps to be tackled in the future. Especially, interactions of the components of a DBM should be studied in detail. Additionally, tools that allow evaluation of different strategic scenarios, with a systemic and detailed perspective on DBM and the nuanced changes among its components, are necessary. A combination of strategic methods with simulation approaches seems suitable and should be tested in the future. Further research should focus on empirical and long term studies to understand DBM in detail.

Our research may have several limitations. Despite the broad scope of the search query of the literature review, other relevant topics might remain hidden. Furthermore, a more detailed look at corresponding research streams, such as the study of ecosystem dynamics, might reveal additional insights. Additionally, the selection and classification of literature by nature is partly subjective.

Our work contributes to research by providing a broad overview of the topic of DBMs. By classifying related literature, we describe the most relevant research streams and show the shortcomings of existing research. In tackling the future research opportunities, as shown in Table 5, the concept of DBM will help to understand the evolution of a BM on a very detailed level. Based on this, tools to support practitioners to make better decision regarding their BM can be developed, allowing incorporation of different strategic options as well as heterogeneous influences. Thus, a DBM can reduce experimentation, help anticipate future developments, improve the management of risks within a BM, and in general, allow the design and management long-lasting BMs. Yet, hardly considered in the prior literature is the issue of finding an equilibrium between stability and flexibility of a DBM - a BM should be flexible enough to allow for change but offer some stability for the development of a company's activities (Cavalcante et al. 2011).

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