

Khodaei, Hanieh; Ortt, Roland

## Article

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Article

# Capturing Dynamics in Business Model Frameworks

Hanieh Khodaei \* and Roland Ortt

Faculty of Technology Policy and Management, Delft University of Technology, Jaffalaan 5, 2628 BX Delft, The Netherlands; J.R.Ortt@tudelft.nl

\* Correspondence: h.khodaei@tudelft.nl

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**Abstract:** Business model dynamics is important, because high-tech companies, the technology that they commercialize, and the market in which they operate all change over time. We build on the dynamic capability view of the firm to explain business model evolution and innovation, looking particularly at the dynamics that are created by interactions between business model components over time. We use the following four criteria to assess the degree of dynamics in business model frameworks: completeness of business model aspects, interrelationships between aspects, interrelationships over time, and framework changes over time and across contexts. Business model completeness involves internal company aspects and external environmental aspects. Interrelationships of business model aspects are required to assess business model coherence, which is an important indicator of business model quality. Interrelationships between the environment and business model aspects are required to assess the fit of a particular business model in its context. Interrelationships of these aspects over time are needed to understand business model evolution. Finally, business model frameworks need to be adapted over time and across contexts to keep frameworks simple and useful yet complete. Our analysis shows that current business model frameworks do not meet all four criteria, and thus only partly incorporate dynamics.

**Keywords:** business model canvas; business models; dynamics; criteria; dynamic capabilities

## 1. Introduction

Business models (BMs) are simplified representations of the aspects—and the interactions between these aspects—that an organization considers when creating, delivering, capturing, and exchanging value [1,2]. These aspects are, namely, “value proposition, the market segments, the structure of the value chain, which is required for realizing the value proposition, the mechanisms of value capture, and specific ways in which these elements are linked in an architecture”. BMs have received attention from various disciplines, such as e-business [3,4], information systems [5], entrepreneurship [6], innovation [7], and strategy and economics [8]. BMs are an important means for firms to “commercialize new ideas and technologies” [9] (p.354). Broadly, there are two different business model approaches. The first is a static approach, where the BM is a blueprint that fuels important functions, such as enabling description and classification [1]. Most current business model frameworks employ this static approach. However, this approach is often unable to describe BM evolution [10]. The second is a transformational or dynamic approach, where the BM is considered as a concept or a tool to address change and focus on innovation, either in the organization or in the BM itself [10]. This is in line with several studies that frame the business model as an evolving bundle of activities, a “complex set of interdependent routines that is discovered, adjusted, and fine-tuned by ‘doing’” [11]. Today, success is not dependent on product innovation alone, but also on business model innovation, and open innovation [12] is the starting point of new business model development [13]. In fact, new BMs have been acknowledged to potentially shake whole industries [10].

As such, successful and innovating BMs rely on creativity, experimentation, and the transformation of organizational processes, and consequently also on changes in the BM itself over time [9].

Following a dynamic approach, a BM that is sustainable over time is rarely found immediately, but it requires progressive refinements to create internal consistency and/or to adapt to its environment [10]. In the view of dynamic approach, studies perceive BMs as a process and they look at dynamic capabilities to facilitate the process [10,14]. The literature has been moving from conceptualizing, characterizing, and explaining a BM at a given point in time, towards a more dynamic view with various definitions being associated with business model dynamics (BMD) or change, such as business model “learning”, “evolution”, “innovation”, or “renewal”, “replication”, and “erosion” [6,7,10,14–16]. BMD is defined in terms of the frequency and the degree of changes in business model. Accordingly, when the business model needs to change very frequently and to a large degree to remain competitive, then the business model dynamics is high. While there is considerable agreement about the value of dynamics in BMs, we currently lack a strong theoretical foundation for understanding BMD [17] and how such dynamics can flow in a business model framework. Executives and researchers are still facing numerous unsettled perplexities when dealing with business model dynamics and when coping with internal challenges and environmental forces [17,18].

Therefore, this article focuses on dynamic approaches for BMs and addresses the following questions:

1. What is business model dynamics and how should dynamics be presented in business models?
2. What are the main criteria that reflect such dynamics in business model frameworks?

To answer these questions, we adopt a dynamic capabilities perspective and assume that dynamic capabilities are theoretically applicable in business models, as they are conceptually knitted to each other [19]. In fact, BM innovation is a strategic process that is based on the firm’s higher order dynamic capabilities [20]. These capabilities are a key factor for a firm’s survival and competitiveness [21]. Therefore, the strength of a firm’s dynamic capabilities increases its ability in designing and adjusting BMs, and hence it helps it to remain profitable in the long term. This is especially true for entrepreneurial firms and high-tech start-ups that aim to develop and introduce radically new high-tech products in the market and that have to cope with a dynamic, even turbulent, internal and external company environment. Therefore, they are dealing with more radical business model innovations. BMs may represent a form of entrepreneurial opportunity creation and a mechanism for opportunity exploitation [3]. As a result, their BMs should constantly be adapted and upgraded. Similarly, it is important to change and adapt BMs when entrepreneurial activities move from one context to another that might require radical changes. BMD “can range from incremental changes in individual components of business models, extension of the existing business model, introduction of parallel business models, right through to disruption of the business model, which may potentially entail replacing the existing model with a fundamentally different one” [22] (p. 324). Therefore, BMs can have different level of dynamics, then “the highest degree of dynamics requires an entirely novel combination of all BM components and the architecture linking them” [16] (p. 12).

However, most business model frameworks allow for companies/entrepreneurs to assess the situation at one point in time. A dynamic business model framework allows entrepreneurs to analyse the main changes in the context of the entrepreneurial endeavour that are required to envision potential logic sequences of or changes in business models over time. Dynamic business model frameworks are defined as business model frameworks that capture relevant changes in the internal and external company aspects, for example, by studying trends or sudden changes in those aspects and by studying how a trend or sudden change in one aspect of the framework can affect another aspect of the framework.

We explore what dynamics means in business model frameworks and we identify dynamic business model criteria and the way that the criteria can be formulated to truly dynamic business models. Our paper provides useful insights for identifying the necessary dynamic capabilities to achieve successful business model change and by following dynamic business model frameworks.

In the next section, we discuss the dynamic capability view of BMs and specify criteria to assess the degree of dynamics of business model frameworks. These criteria are used to compare the degree of dynamics that are captured in business model frameworks. Finally, we discuss the results, indicate practical and scientific implications, and suggest avenues for future research.

## 2. A Dynamic View of Business Models: A Dynamic Capability Perspective

The operation of business models is dependent on a firm's dynamic capabilities. "The crafting, refinement, implementation, and transformation of business models are outputs of high-order (dynamic) capabilities" [23] (p.40). Zollo and Winter [24] (p. 340) define dynamic capabilities as: "... a learned and stable pattern of collective activity through which the organization systematically generates and modifies its operating routines in pursuit of improved effectiveness".

These capabilities can be disaggregated into the capacity (1) to sense and shape opportunities and threats, (2) to seize opportunities, and (3) to maintain competitiveness by enhancing, combining, protecting, and, when necessary, by reconfiguring the firm's intangible and tangible assets. Dynamic capabilities include difficult-to-replicate enterprise capabilities that are required to adapt to changing customer and technological opportunities. They also embrace the firm's capacity to shape the ecosystem it occupies, develop new products and processes, and design and implement viable business models [23]. Dynamic capabilities and BMs concepts are fundamentally intertwined, since Eden and Ackermann [25] define the BM as the dynamic capability that links the firm's distinctive competencies to organizational aspirations and outcomes. A value network is created around the business's core value proposition [3,26] using the capabilities of the company and linking it to other value networks. This value network configuration is continually sustained and reinvented to satisfy stakeholder objectives.

Increasingly, the literature has been moving from conceptualizing, characterizing, and explaining a BM at a given point in time, towards a more dynamic view. There are two streams of research that focus on dynamics in business model. The first addresses the changes occurring in existing business models over time, which are often in response to external triggers. These are related to the work on business model evolution [10], business model renewal [14], business model replication [15], learning [7], erosion [16], and lifecycles [6]. We define these changes as business model adaptation, i.e., the process by which management actively aligns the firm's business model to a changing environment, for example, to changes in customer preferences, supplier bargaining power, technological changes, and competition [17]. In contrast, the second type of studies addresses the need to create (typically, disruptive) innovation by means of implementing an innovative BM [27,28]. These second types of studies are related to the works, for example, regarding BM innovation [27,28] and business model transformation [28] (p. 460). In fact, "Business model innovation is the discovery of a fundamentally different business model in an existing business" [29] (p. 20). Therefore, BMD can have different level of dynamics in terms of the frequency and the degree of changes in business model. Accordingly, when the business model needs to be changed very frequently and to a large degree to remain competitive, then the business model dynamics is high. BMD are enabled by dynamic capabilities in the sense that a firm with high level of dynamic capabilities can rapidly implement, test, and refine new and revised business models.

## 3. Criteria Reflecting Dynamics Captured in Business Model Frameworks

Most current business model frameworks allow companies/entrepreneurs to assess the situation at one point in time after which a fitting business model can be formulated. Instead of redoing the business model analysis again and again with a static business model framework, it becomes important to not only design one business model, but also to design the likely evolutions (or sequences) of business models. That means that current static business model frameworks do not suffice. A dynamic business model framework allows for entrepreneurs to analyse the main changes in the context of the entrepreneurial endeavor that are required to envision the potential logic sequences of

or changes in business models over time. By identifying the main changes in the context, it is also possible to assess the ongoing changes and constantly monitor whether business model changes are required or not. This is far more useful than re-doing the same type of analysis over time with a static business model framework to see whether a new business model is required. Dynamic business model frameworks are defined as business model frameworks that capture relevant changes in the internal and external company aspects, for example, by studying trends or sudden changes in those aspects and by studying how a trend or sudden change in one aspect of the framework can affect another aspect of the framework.

We now specify the criteria to assess the degree of dynamics of a business model framework. These criteria will be used to capture the business model dynamics framework and to compare business model frameworks in terms of dynamics. To track changes over time, it is important to specify those aspects that need to be tracked to determine the right BM. We formulate four criteria that reflect dynamics in business model frameworks.

### 3.1. Completeness

Completeness of the BM is a key criterion for dynamics. Dynamics cannot be fully captured if important environmental variables that impact the business model variables are omitted, or when important business model variables that reflect strategic responses to changes in environmental variables are omitted. Even a completely static model, such as an audit list, can score high on this criterion of completeness. If a complete and static model is re-specified regularly, then some dynamic aspects are captured, but only in terms of the consequences for the BM and not in terms of the mechanisms causing changes.

Business model completeness involves internal company aspects and external environmental aspects [7]. Both BM adaption and BM innovation cannot be fully captured if company do not consider important environmental variables that impact the business model variables. In the company environment, on the macro-level of a country, the interplay between innovation in different sub-economies can create a kind of dynamics that require a dynamic response from companies in their micro-environment [30]. BM adaptation is a response to external causes, whereas BM innovation can be driven by internal as well as external factors [31]. Saebi, Lien, and Foss [32] found that an external threat in the business environment is a strong predictor of BM adaptation. Therefore, it is important to address a complete set of internal and external aspects. Some internal company aspects, such as company competences, as well as some crucial external aspects, such as competition, are missing in BM frameworks, such as the Business Model Canvas (BMC), although both aspects are critical [33].

To explore the dynamics in the internal and external environment, we assume that this environment comprises many different components, actors, and factors, such as: The company itself and the network of actors around company, the technology, products and competitors, the customers, and the stakeholders in the wider market environment.

In fact, the components of a BM are, if possessed by the firm, to some extent a type of organizational asset. Having a more complete list of such components can help in elaborating the capabilities that entrepreneurs need to master to learn, sense, filter, shape, and calibrate opportunities. These capabilities are in line with sensing capabilities, being open to external stakeholders and to the objectives of the BM, acquiring the necessary technologies and techniques that must be matched, and being responsive to the firm's external environment [34]. These capabilities are crucial for identifying, experimenting with, and fueling BM change to exploit new business opportunities [35].

### 3.2. Interrelationships

The capability to identify and assess the interrelationships between variables is another key criterion for dynamics. Distinguishing between environmental variables and BM variables is a categorization that implies a kind of interrelationship. Interrelationships are also present among environmental variables and they can describe how variables in the environment co-evolve. A complete

and static model, such as an audit list, does not specify such interrelationships and thereby does not incorporate knowledge of environmental changes, knowledge of consistent BMs, or knowledge of contingencies between the environment and specific BMs. Rather, the framework must specify the “fundamental organization of a system embodied in its components, their relationship to each other, and to the environment, and the principles guiding its design and evolution” [36] (p. 108). This is what Baden-Fuller and Haefliger [37] refer to a business model as “containing cause and effect relationships”.

There are many interrelationships between the different components of the business model. For example, the market will develop after breakthrough technologies enter a market [38,39]. Companies in a network together develop, produce, supply, and maintain products and related services. Over time, various actors and network ties contribute to the growth or demise of high-tech companies [40–42].

This is necessary to leverage the information that is acquired from external stakeholders and associations, so that the firm can develop and gradually change its business model for sustainability. Knowledge about these interrelationships allows for managers to understand and more easily identify relevant changes in the environment. Knowledge about relationships among business variables allows managers to form consistent strategies, or consistent BMs. Knowledge of relationships between business variables and environmental variables, allows for managers to better understand and analyse the environment to specify BMs that fit the environment. These knowledge and capabilities are required for managers’ to better seize opportunities.

### 3.3. Interrelationships over Time

The capability to adapt and modify interrelationships over time is another key criterion for dynamics. Knowing cause and effect relationships helps to explain dynamics. Knowledge of variables that affect each other over time (without being able to distinguish cause and effects) allows for the explanation of more complex dynamics. Start-up companies that develop and introduce radically new high-tech products have to cope with dynamic, and sometimes even turbulent internal and external company environment overtime. This is line with reconfiguring capabilities, following incremental transformation. Teece [25] argue that business models can generate virtuous cycles—positive feedback loops that strengthen parts of the model over time. They consider such virtuous cycles to be crucial elements in successful BM operation, and thereby suggest that different aspects of managing business models can reinforce their consequences. [10] claim that a business model includes ongoing dynamics through “... interactions between and within the core model components”. Regarding those components, the authors state business model dynamics at the level of related resources and competences, the organization, and the value proposition. This type of revolutionary business model shows how a business model can also remain successful over a long time period through consistently revising the components. This level of dynamics is related to evolutionary BM innovation, which refers to naturally occurring changes that happen to individual components of the BM over time and adaptive BM innovation “involves changes in the overall business model that are new to the firm, but necessarily not new to the industry. An adaptive business model in an open innovation platform can identify new business models [12] and requires the adoption of new, open BMs designed for sharing or licensing technologies [9]. Open BMs facilitate the integration and commercialization of external resources [17]. These are cases where the firm adapts the architecture of its BM in response to changes in the external environment, such as in face of competition from a new business model in their industry” [17].

Empirical evidence illustrates the importance of dynamics in business models in the following proposed components, each of which evolve over time:

(a) The high-tech company. High-tech companies change over time and typically follow different growth stages [33,43].

(b) A network of companies around the start-up. Companies in a network together develop, produce, supply, and maintain products and related services. Over time, various actors and network ties contribute to the growth or demise of high-tech companies [40–42].

(c) The technology, products, and their competitors. Both technologies and products evolve over time. Technology life cycles, for example, are described in theories. An example is the punctuated equilibrium theory describing the market development after breakthrough technologies enter a market [38,39]. Product life cycle models describe how a product's customers and marketing mix change over time [44–46]. Several authors describe that prior to large-scale diffusion of a standard product in a mainstream market, a long and erratic phase of development and diffusion can be witnessed. This phase is described as a fluid phase [36], as a phase of market creation [47–50], or a phase of market adaptation [37]. On average this phase lasts about ten years, although, in practice, a large variation around this mean can be witnessed [37]. In this phase, on average, about three different product/market niches are explored that significantly differ from the standard product that later on starts to diffuse on a large-scale.

(d) Customers and other stakeholders (outside the network of supplying companies). Roger and Moor [47,48] describe how diffusion of products generally evolves over time.

(e) The wider market environment. These aspects are described in macro-environment models [49]. Changes in the macro-environment, such as demographic changes, can be quite predictable. However, other changes, such as competitive dynamics, can be difficult to predict. Specific domains, such as macro-economic or technology developments, have regular and long-term cycles, i.e., the Kondratieff cycle [50].

Accordingly, different BMs will be adopted over time for different elements, such as radically new high-tech products. Therefore, managers also need the transformation capability to maintain competitive by enhancing, combining, protecting, and, when necessary, reconfiguring the firm's intangible and tangible assets.

### 3.4. Framework Changes

The capability to adapt and modify BM frameworks is another key criterion for dynamics. This is more related to business model innovation, the discovery of a fundamentally different BM in an existing business [29]. Models are simplifications that hold in specific conditions or when specific assumptions are met. Changes in the model can refer to aspects or relationships in the model. The framework needs to highlight different aspects or relationships when the assumptions no longer hold. Assumptions can become invalid when the framework is applied in different contexts or in different time frames. In that case, the framework itself needs to be adapted, rather than the BM that is created with that framework [51,52]. We propose that the highest level of dynamics may require changes in the framework itself. This can imply, for example, that the selection of aspects that are covered in the framework changes over time. Different contexts may also require framework adaptations, especially in the case of high-tech start-ups in a turbulent external environment. These start-ups must adapt their BM constantly and they generally find transformation easier when compared to mature firms because they have fewer established assets and procedures to re-engineer. This is in line with the lean start-up approach that includes the capacity to pivot, or, quickly test, discard, and replace ideas and BMs that do not work [19,53].

The change in business model frameworks can be related to disruptive change in BMs, so-called complex BM innovation, which will affect the BM in its entirety [16] and have the potential to disrupt established industries (e.g., Airbnb in the accommodation industry, Uber in transportation) [54]. They offer a corresponding framework whereby business model can be equalized with the development or creation of entirely new business models [26], as opposed to only revising particular parts in the course of time. This level of dynamics is more related with Teece [21] business model's dynamic that distinguish between business model change and business model reinvention they state that "... new sources of sustainable competitive advantage can often only be attained from business model

reinvention that is based on disruptive innovation and not on incremental change or continuous improvement". Therefore, "the highest degree of dynamics require an entirely novel combination of all BM components and the architecture linking them" [17] (p. 12).

Thus, firms are unlikely to always choose business model frameworks that allow for the maximum level of dynamics. In fact, the choices is depend on the strength of the firm's dynamic capabilities [19]. Dynamic capabilities are multi-faceted and firms have different levels of dynamic capabilities. Firms with weaker dynamic capabilities will be more likely to adopt BMs that lean on past investments and existing organizational processes, whereas firms with stronger dynamic capabilities across the board are more likely to employ BM that entail radical shifts of resources or activities. "Firms might excel at sensing new opportunities but be relatively weak at identifying new BMs to exploit them, whereas other firms may be good at developing new BMs yet be mediocre at implementing and refining them". Having "strong dynamic capabilities means that a firm is strong (relative to competitors) in all relevant areas of sensing, seizing, and transforming" [19] (p. 43). Given that BMs differ in terms of adaptive and complex BMs [17,54], here, different levels of dynamicity, they require different dynamic capabilities.

#### 3.4.1. Assessing the Degree of Dynamics Captured in Business Model Frameworks

The four criteria (1) completeness; (2) interrelationships; (3) interrelationships over time; and, (4) framework changes can be used to assess the degree of dynamics captured in business model frameworks. We specify a rudimentary instrument to assess and compare the dynamics that are captured in business model frameworks (see Table 1).

We assume that the criterion 'completeness' can be assessed for three subcategories of aspects: internal company variables, external environment variables, and variables that can be changed as part of a strategy or business model. A business model framework is complete when it addresses all the relevant aspects. We also assess subsequent degrees of the other three criteria.

**Table 1.** The degree of dynamics in business model frameworks.

Criteria	Degrees in Which Criteria Can Be Met
1. Completeness	a. Complete in internal company environment variables b. Complete in external company environment variables c. Complete in business model variables
2. Interrelationships	a. No interrelationships distinguished b. Relationships assumed but not specified c. Relationships specified
3. Interrelationships over time	a. No interrelationships over time distinguished b. Relationships over time assumed but not specified c. Relationships over time specified
4. Framework changes	a. No framework changes distinguished b. Framework changes assumed but not specified c. Framework changes specified

#### 3.4.2. Analysing the Degree of Dynamic in Business Model Framework, the Example of Business Model Canvas

There are several BM frameworks [52]. Business Model Canvas (BMC) is one of the main frameworks that presents how an organization creates, delivers, and captures value from a product or service by communicating nine aspects: customer value proposition, customer segments, customer relationships, channels, key resources, key activities, partners, costs, and revenues [55]. Many authors criticize the BMC framework for its lack of dynamics [56–61]. Regarding the completeness, several authors confirmed that BMC is not complete [56,57,62].

Another critical issue can be referred to a lack of interrelationship within the BMC components. In fact, no interplays among the elements that are included in the nine building blocks are identified and made explicit in the framework [63]. Finally, a BM framework must also serve as a learning tool that is adaptive and flexible to both internal and external changes [9], which requires progressive and continuous refinements to create internal consistency and to adapt itself to the environment [10].

To conclude based on the Table 1, BMC is not complete in internal company environment variables nor in external company environment variables. The current version has not assumed any interrelationship or distinguished interrelationships over time. Finally there are no framework changes distinguished. Thus, the BMC as its current version has a minimum level degree of dynamics.

### 3.4.3. How Do Other Authors Elaborate the Degree of Dynamics in Business Model Canvas?

Some criticism has risen regarding the description of a business model into a nine box canvas. Among the studies criticizing the BMC, some focus on the completeness criterion [56,57,62]. For example, Maurya [62] suggests adding two aspects: unfair advantage and key metrics that are part of the internal company environment according to the lean business model canvas [62]. The BMC lacks a well-defined strategic purpose and, above all, of a comparison with market competitors [62]. Kraaijenbrink [56] improved the BMC by addressing two limitations: business goals and competition. He added two aspects: strategic values and key rivals and changed the name of the framework into Value Model Canvas. Therefore, they have shifted towards being more complete in internal as well as external company environment variables.

Other authors focusing on the relationship between elements of the BM. Fritscher and Pigneur [60] focus on the importance of interrelationships between variables, but does not specify them. Fritscher and Pigneur [60] also address the interrelationships between aspects in the BMC framework by proposing a guideline for the interaction of these aspects [35]. They use a computer-aided BMC tool to assess the inter-relationships between aspects and hence the coherence of business models. It is not enough to check completeness using a checklist without verifying the coherence of the resulting BM [35]. They specified some of these interrelationships. For example, they argued that each customer segment requires one or more value proposition and channel. Therefore, they have shifted towards not only assuming relationships but also specify relationships.

Other authors emphasize the interrelationship over time. Later, Fritscher and Pigneur [64] focused on other criteria of dynamics. They propose that the dynamics can be interpreted in three ways: (1) Considering the interactions between aspects; (2) Giving different representations of one model depending on the focus or the stakeholder; and, (3) Transforming the model into another version of itself. These criteria are similar to our current criteria. Their new BMC framework, supported by computer-aided design tools, provides a clearer picture of the business model as a strategic planning tool. They describe interrelationships over time but without specifying these relationships. They touch on the issue of framework changes, but without explicitly specifying these changes. Several other authors also discuss dynamics over time. Romero [61] and Cosenz [65] focus on the lack of dynamics and propose system dynamics to simulate BMC changes over time. They address the interaction between some aspects, but their work does not specify changes over time. Joyce [59] focused on the triple layered business model canvas as a tool to design more sustainable BMs and they extended the original canvas [66] to illustrate more business model relationships with respect to the environmental and social value. De Reuver and Bouwman [67] provide a BM and a technology roadmap to align current and future business needs. Combining a technology roadmap with BMC assumes that the technology development is the main aspect that drives business model changes. Finally, Toro-Jarrín [52] present a methodology to integrate the BMC framework and a technology roadmap, following other studies. They confirm the interrelationships between framework aspects over time but do not specify them. They also address framework changes and identify how the focus on different aspects in the canvas changes over time [52]. Therefore they have shifted towards specifying relationships over time and assuming framework changes.

The discussion above shows that improvements to the BMC relate to all four criteria. Several articles discuss interrelationships between aspects. Other articles explore interrelationships over time, and some articles even discuss that business model frameworks themselves might change over time or from context to context. Several gaps can be identified in the selected literature. First, an explicit specification of interrelationships of aspects is missing. Studies have examined the coherence of the

business model aspects but they have barely investigated the contingency between environment aspects and business model choices. Second, the explicit specification of how and when business model frameworks should be changed is lacking.

We conclude that several authors have proposed additions or changes to the BMC framework to make it more dynamic, yet all of these changes reveal weaknesses when evaluated using the four criteria. Many models seem to be incomplete, because they fail to specify interrelationships and ignore changes over time. However, most of all, they do not specify ideas regarding how to adapt the business model framework over time or from context to context. Business model frameworks have serious gaps when it comes to dynamics.

#### 4. Discussion and Scientific Implications

This paper follows a recent call for more research for understanding business model dynamics [17]. Although recent studies are towards a more dynamic view with various definitions that are associated with business model dynamics (BMD) [6,7,10,12–14], we lack a strong theoretical foundation for understanding BMD [15] and how such dynamics can flow in a business model framework. Current business model frameworks, such as business model canvas (BMC) [31], allow for companies/entrepreneurs to assess the situation at one point in time and such static business model frameworks do not suffice. Fritscher and Pigneur [62] mentioned the criteria of BMD in the BMC frameworks; they did not fully capture the full dynamic criteria. We defined dynamic business model frameworks and identified dynamic business model criteria and the way that the criteria can be formulated to truly dynamic business model frameworks.

The way that the four criteria are formulated implies that truly dynamic business models should score high on all criteria. Actually, we think that is not the case for two reasons. Firstly, the highest possible level of a particular criterion does not necessarily yield a model that is useful in the practice of entrepreneurs. For example, a very high score on completeness may imply incorporating a huge list of different aspects in the business model framework. In practice, that may be unworkable. A model is a workable simplification, and hence there is an optimum level of completeness. Below the level, the omission of aspects may lead to false representations of the relevant entrepreneur's internal and external environment and hence may lead to business models that are incomplete. Above the level, the inclusion of more aspects will blur the overview of the relevant environment and hence it will conceal the kernel of the business model. Similarly, optimal levels for the other criteria, the amount of different interrelationships (at one point in time or over time), and the degree of the framework changes, do hold. There is an optimum level of main interrelationships driving business model change that can be tracked over time, for example.

Secondly, truly dynamic business models do not have the highest possible score on all criteria, because there seems to be a trade-off between the degree to which the criteria can be met. If a framework focuses on a relatively small number of aspects when formulating business models, and thus scores low on the completeness criterion, it is relatively easy to explore interrelationships between aspects and create a coherent business model. Thus, a trade-off between completeness and interrelationships is visible. More trade-offs can be distinguished. For example, simple business model frameworks focusing on a limited number of aspects may facilitate agility or dynamics over time. However, simple models may ignore important dynamics because they score low on completeness. Rather than aiming for the highest score on all criteria, dynamic business model frameworks should allow a balance between the scores on these criteria. This balance, and the optimal rather than maximum scores on the four criteria, may then change over time or change per context. The fact, a business model framework needs to be a useful simplification that focuses on relevant aspects in specific contexts and time frames inevitably creates the need for framework changes. In specific markets the level of turbulence or dynamics may differ over time. Different levels of market dynamics require different dynamic capabilities from the firm. In order to create and implement truly dynamic business models, companies must possess strong dynamic capabilities, meaning that a firm is strong (relative to competitors) in all

relevant areas of sensing, seizing, and transforming [19]. The extent of business model reconfiguration varies with different open business models and with different open innovation strategies [35,68]. Certain open innovation strategies require more fundamental restructuring of business models as a result of the reconfiguration of the downstream activities and capabilities [69].

Each business model framework allows for the specification of many different BMs. However, the focus on specific aspects may not fit all contexts or all time frames. For example, frameworks can assume that the BM is formulated in a civil society with laws, rules, and values. In this case, culture and institutions do not need to be included in the BM. However, if this assumption is not met because the BM is to be applied in a tribal society where basic laws and rules are missing that are required to do business and protect the ownership of technological knowledge, then the framework as a whole requires re-specification. This is the reason why business model frameworks need to be adapted when they are applied in developing countries. We conclude that it is important to specify the situations in which a business model framework holds. Such assumptions are often missing.

## 5. Practical Implications

Our conclusions bring about several practical insights for companies and start-ups. The findings suggest that managers must know the ways, resources, and capabilities that are needed to diagnose their current business models and timely and properly reinvent their BM when necessary [70]. Hence, arguably for coping with forces pressurizing executives to rectify or reinvent their business models, the dynamic capability perspective is likely to provide useful insights in untangling the complex problem of business model dynamics. For example, entrepreneurs cannot change and adapt their BMs if they do not consider important environmental variables that impact the business model variables. BMD can help companies to recognize the need for change and ability to promote and implement such change [71]. High-tech start-ups are operating in a turbulent external environment. These start-ups must adapt their BM constantly and they generally find transformation easier when compared to larger companies. That means that current static business model frameworks do not suffice. A dynamic business model framework allows for entrepreneurs to analyse the main changes in the context of the entrepreneurial endeavour that are required to envision potential logic sequences of or changes in business models over time. By identifying the main changes in the context, it is also possible to assess the ongoing changes and constantly monitor whether business model changes are required are not. This is far more useful than re-doing the same type of analysis over time with a static business model framework to see whether a new business model is required.

Our proposed framework reflects the inherent complexity to support the coherent thinking that is necessary to grasp and understand different relevant components of driving dynamic business models. We do not attempt to propose one best solution. Rather, we provide a list of criteria that can help managers to systematically think about whether they pay enough attention to the necessary aspects that are relevant for dynamic business models to prepare for future innovation and adaptations.

## 6. Future Research

We see several important avenues for future research. First, the four criteria can be further operationalized to actually measure the degree in which the frameworks meet the criteria. This will facilitate the exploration of possible trade-offs between criteria. If trade-offs exist, then frameworks should not aim to maximize criteria fulfilment, but can specify optimal levels of criteria fulfilment. Second, by assessing interrelationships of business model aspects, we can evaluate business model coherence. If coherence of business model aspects can be considered as a kind of quality check, then BMs can be evaluated prior to influencing company performance in practice. This will allow for a systematic comparison of alternative BMs prior to commercialization. Third, new types of business model frameworks need to be formulated. The current frameworks lack logic algorithms to adapt the framework over time or from context to context. It would be interesting to explore what types of aspects are needed in specific contexts and that can be ignored in others. Static lists of aspects form a

first step in the creation of business model frameworks. The relevance of these frameworks and the dynamics in markets call for exciting new frameworks.

Besides, a different level of business model dynamics required a different level of firms or start-ups dynamic capabilities. Future research can operationalize and therefore test such hypotheses. Also, interesting studies can be linked to the entrepreneurs and TMT capabilities, since changing the BMs is a management task. Accordingly, it will be interesting to see, for example, whether diverse TMTs are better at changing and adapting new BMs.

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