A hierarchical taxonomy of business model patterns

Jörg Weking · Andreas Hein · Markus Böhm · Helmut Krcmar

Received: 23 May 2018 / Accepted: 19 November 2018 / Published online: 6 December 2018 © The Author(s) 2018

Abstract
Although business model innovation (BMI) is essential to remaining competitive, many firms fail at it. A promising approach is building on reoccurring successful solutions – business model patterns (BMP) – as a blueprint for BMI. However, existing patterns face constraints subject to a high diversity and overlaps among patterns. In addition, literature do not consider relations among BMPs, which limits their potential for BMI. This paper develops a hierarchical taxonomy of BMPs including generalizations and specializations based on inheritance. We conduct a literature review to identify patterns and a cluster analysis to create an inductive structure, followed by a qualitative analysis. The resulting hierarchical taxonomy includes 194 elements. It is the first hierarchical taxonomy of BMPs. The hierarchy addresses the diversity of patterns and overlaps with inheritance. It aids research to structure and understand BMPs. For practice, the taxonomy allows for the application of patterns and supports BMI.

Keywords Business model · Business model pattern · Taxonomy · Hierarchical structure · Cluster analysis

JEL classifications O310 Innovation and Invention · Processes and Incentives

Introduction
Market dynamics are changing at an ever-increasing pace and thus becoming more demanding for firms (D’Aveni et al. 2010; Teece 2018; El Sawy and Pereira 2013). Better information and a broader selection of firms has led to a shift in bargaining power toward customers (Teece 2010). To win this battle for customer attention, firms need to shorten development cycles, which increases competition and turbulence in the market (Schneider and Spieth 2014; Teece 2018). Consequently, firms have to adapt to market dynamics and changing demand continuously.

Business models (BMs) are a crucial aspect to remaining competitive in these turbulent markets (Martins et al. 2015; de Reuver et al. 2013; De Reuver et al. 2009). A BM defines how firms create, deliver, and capture value in a market (Teece 2010).² Firms adapt BMs to cope with changing market dynamics by harmonizing the business strategy, internal processes, and information systems (Al-Debei and Avison 2010; Schneider and Spieth 2014; Teece 2018).

However, many firms fail when trying to align BM change with dynamic market requirements (Christensen et al. 2016). Changing an entire BM can involve enormous transformations for an organization (Foss and Saebi 2017). Thus, it is not surprising that this concept of BM change or adaption, termed as Business Model Innovation (BMI), enjoys increasing popularity (Foss and Saebi 2017). However, practitioners often build on trial-and-error experimentation to innovate their BM and fail likewise (Martins et al. 2015; Chesbrough 2010; Sosna et al. 2010; Morris et al. 2005). One reason is a lack of supporting frameworks and tools (Osterwalder and Pigneur 2013; Veit et al. 2014; Heikkilä et al. 2016; Weking et al. 2018a).

This paper uses BMs as formal conceptual representations (Massa et al. 2017).
A promising approach that supports BMI is learning from recurring phenomena that have proven to be successful in the past in different industries or contexts: business model patterns (BMPs) (Amshoff et al. 2015). BMPs describe successful BM instances or components of it that are applicable on other firms (Osterwalder and Pigneur 2010; Gassmann et al. 2014; Amshoff et al. 2015). BMPs can either be used in isolation or in a combination to form a new complete BM or describe a BM instance (Osterwalder and Pigneur 2010; Böhm et al. 2017). We see BM instances as concrete real world BMs (Osterwalder et al. 2005). BMPs sometimes appear under different names, for instance BM archetypes (Bocken et al. 2014; Weill et al. 2005; Eickhoff et al. 2017; Weking et al. 2018b) or BM configurations (Taran et al. 2016). Gassmann et al. (2014) found that 90% of BMIs in practice are a combination of existing BMPs.

However, current BMP literature faces limitations that restrict their applicability in research and practice. There is a variety of different BMP (i.e., Gassmann et al. (2014), Taran et al. (2016) or Remané et al. (2017), which differ in two dimensions. First, BMPs differ in the covered BM elements. On the one hand, a BMP can relate to one distinct element of a BM, such as the pattern channel maximization (Remané et al. 2017), which refers to the BM element value delivery. On the other hand, a BMP can relate to several BM elements such as the pattern merchant model (Remané et al. 2017), which addresses the BM elements value creation, delivery and capture. Second, BMPs differ in the level of abstraction. BMPs can address a low level of abstraction, such as the pattern flexible pricing (Remané et al. 2017) or they can approach a high level of abstraction, such as the pattern multi-sided platform (Osterwalder and Pigneur 2010). Further, an HR broker is a specific form of a multi-sided platform, where a platform provider matches buyers and sellers. Thus, these differences in covered elements and level of abstraction lead to BMPs overlapping in terms of content and substance. Hence, this variety of BMPs leads to overlaps in both dimensions: the degree of coverage and the content resulting from differences in the level of abstraction. Ultimately, this results in a complex and chaotic collection of BMPs, which is hard to use when innovating a BM.

Two contributions aim to resolve this complex collection by structuring BMPs (Taran et al. 2016; Remané et al. 2017). However, no framework provides a compelling categorization that addresses the variety of BMPs in the covered BM elements, level of abstraction and resulting overlaps. To address these issues, it is important to characterize (Remané et al. 2017) and cluster individual BMPs (Taran et al. 2016), but also to identify a structure with relations among BMPs that describes many levels of abstraction with generalizations, specializations and inheritance.

The purpose of this work is to structure BMPs consistently and to leverage their potential for BMI. This paper develops a hierarchical taxonomy for BMPs. The taxonomy separates patterns present in the extant literature according to different degrees of coverage and levels of abstraction mitigating the issue of overlapping patterns. We build on an iterative taxonomy development approach (Nickerson et al. 2013) to tackle the complex field of BMPs by developing a hierarchical structure among BMPs. First, we perform an empirical-to-conceptual iteration with an agglomerative clustering of BMPs to generate an inductive structure (Kaufman and Rousseeuw 2009; Struyf et al. 1997). Second, we draw on a conceptual-to-empirical iteration with qualitative analysis to derive hierarchical levels within the structure. Scholars and practitioners can build on the hierarchical taxonomy to understand and use BMPs. The hierarchical structure helps to reduce the complexity of BMPs and to increase their applicability in the context of increased market dynamics.

### Related work

Extant BM literature provides a variety of frameworks that characterize the BM of a firm (Täuscher and Abdelkafi 2017; El Sawy and Pereira 2013; Fielt 2013). Research differentiates between general and specific BM frameworks. General BM frameworks focus on common elements to describe a BM. El Sawy and Pereira (2013), for example, show 26 general BM approaches. Common examples are:

- the Business Model Canvas with nine dimensions (Osterwalder and Pigneur 2010),
- the Magic Triangle with four dimensions (Gassmann et al. 2014),
- the BM framework according to Abdelkafi et al. (2013) with five main elements,
- the unified BM framework (Al-Debei and Avison 2010) as a conceptual BM framework and
- the STOF model (Bouwman et al. 2008; de Reuver et al. 2013) as a service oriented BM framework.

All of them cover the following elements to characterize a BM instance: value proposition, value delivery, value creation and value capture. In addition, there are BM frameworks that do not directly address value-based elements, but specific aspects. The casual loop diagram (Casadesus-Masanell and Ricart 2010; Casadesus-Masanell and Ricart 2011) as a logic oriented BM framework uses choices and consequences to describe BM instances and highlights their reinforcing cycles. The matrix-shaped BM framework according to Weill et al. (2005) focuses on four BM archetypes (i.e., creator, distributor, landlord and broker) and the type of asset involved (i.e., financial, physical, intangible and human) (Weill et al. 2011). IBM’s component business model (Chesbrough 2010; Pohle et al. 2005) illustrates the category...
of specialization-focused BM frameworks. It includes an accountability level (i.e., direct, control and execute) and does not cover a direct value capture dimension. Besides specialized BM frameworks, there are also BM frameworks tailored toward a specific context: digital BMs (Bock and Wiener 2017), big data (Hartmann et al. 2016), FinTechs (Eickhoff et al. 2017), car sharing (Remané et al. 2016), platform BMs (Täuscher and Laudien 2018), or sustainable BMs (Upward and Jones 2016). The large amount of frameworks as well as their differences emphasize the ambiguity of the concept of BMs.

BM frameworks are a promising solution to reduce the complexity in characterizing BMs with BM frameworks. BM literature provides many different collections of BM frameworks with diverse amounts of BMs. Osterwalder and Pigneur (2010) deduce five BMs. Gassmann et al. (2014) define 55 BMs. Both use their BM framework to derive and describe typical BMs including related example cases. Two contributions build on BMs from literature. Taran et al. (2016) initially found 97 BMs and conclude with 71 different BMs. Remané et al. (2017) started with 356 BMs and result with 182 different BMs.

However, the current literature about BM frameworks has two main limitations. First, the multitude of general BM frameworks leads to a wide range of BMs that address different BM elements, i.e., one or many. Consequently, some patterns include only a few BM elements, whereas others describe holistic BMs. Osterwalder and Pigneur (2010) deduce five BMs that change the general setup of a BM and influence all BM elements and many areas of a firm (e.g., long tail, multi-sided platform or open business model). Gassmann et al. (2014) define BMs that vary in their addressed BM elements. Some BM frameworks focus on a few elements of a BM. Examples are the patterns pay what you want and subscription addressing mainly value capture mechanisms, and white label addressing mainly the value proposition. Others affect all elements of a BM, such as no frills, peer-to-peer or two-sided market. Likewise, the work of Taran et al. (2016) covers BMs influencing all BM elements, such as broker (i.e., “bring together buyers and sellers and facilitate transactions”) and BMs influencing only a few BM elements. Channel maximization (i.e., “product is distributed through as many channels as possible to create the broadest distribution possible”), for example, refers to the value delivery. Remané et al. (2017) similarly covers very different BMs. Examples are e-mail (i.e., “communicate with stakeholders via e-mails rather than print and mail”) that influences the value delivery only, whereas connection (i.e., “provide physical and/or virtual network infrastructure to gain (internet) access”) or software firms (i.e., “create software and license/sell it”) describe holistic BMs.

Second, there is a variety in the level of abstraction of BMs. Some are specializations, while others are generalizations of BMs. Multi-sided platforms, for example, bring together two or more customer segments (Hein et al. 2018c). The presence of each segment creates value for the other segments (Remané et al. 2017; Osterwalder and Pigneur 2010). Thus, multi-sided platforms are generalizations of brokerage that define two segments as buyers and sellers and add a commission fee (Remané et al. 2017; Weill et al. 2005). Further specializations are financial broker, HR broker, physical broker and information broker (Remané et al. 2017; Weill et al. 2005). Another example is subscription where customers regularly pay upfront for products or services (Remané et al. 2017; Rappa 2001). Specializations are flat-rate, where the customer receives unlimited access and member when the access to products or services and the time-dependent payment is the focus (Remané et al. 2017; Gassmann et al. 2014; Tuff and Wunker 2010). These differences in the level of abstraction of BMs and in the covered BM elements leads to overlapping BMs and increased complexity. Collections of BMs are hard to apply for BMs.

Two contributions aim to reduce this complexity by creating a comprehensive structure for characterizing BMs. Taran et al. (2016) introduce the five-V framework. It clusters the 71 BMs into five dimensions: value proposition, value segment, value configuration, value network, and value capture. Remané et al. (2017) introduce a matrix-shaped BM taxonomy. They used BMs to create a morphological box for characterizing BMs. The BM framework has four initial dimensions based on Günzel and Holm (2013): value proposition, value delivery, value creation and value capture (Remané et al. 2017). Remané et al. (2017) include two hierarchical levels in the form of prototypical as holistic patterns and solution patterns as specific building blocks. Both studies focus on clustering and classifying existing BMs by deriving typologies or BM frameworks to reduce complexity (Taran et al. 2016; Remané et al. 2017). They both cover the basic four elements ranging from value proposition, to value delivery, to value creation, and value capture. They can characterize BMs as well as BM instances from practice. However, both frameworks focus only on characterizing BMs. BM literature address neither the variety in covered BM elements of BMs nor the diversity in the level of abstraction of BMs nor the resulting overlaps among BMs. Likewise, general BM frameworks are not able to address these issues. The four BM elements are not enough to address the main drawbacks of BMs. Current literature only characterizes individual BMs. Despite the importance of reducing complexity among BMs by structuring, no paper has taken into account the relations and hierarchical structures among BMs yet. Thus, this paper focuses on relations among BMs in the form of a hierarchical taxonomy of BMs covering specializations and generalizations based on the inheritance of characteristics of BMs to address the differences in covered BM elements, the diverse abstraction levels, and the resulting overlaps among BMs.
Research method

We followed a two-step research approach. First, we used a structured literature review (Webster and Watson 2002) to identify a comprehensive set of BMPs. Second, we used an iterative taxonomy development approach (Nickerson et al. 2013) to structure BMPs according to their relationships.

To identify articles with BMPs and similar constructs, we built on a literature review conducted by Remané et al. (2017). With a literature review according to Webster and Watson (2002), they identified 182 different BMPs out of 22 collections of BMPs and six reviews of BMP collections. To ensure the validity of their findings, they conducted a follow-up literature review based on Webster and Watson (2002) to cross validate and supplement their results. We used the four databases: ProQuest – Business, EBSCOhost, Science Direct and Scopus with the following search string: “(Business model* OR framework* OR taxonomy OR pattern* OR design OR development OR evolution) AND (characteristics OR framework* OR taxonomy OR pattern* OR design OR development OR evolution)”. We reviewed 776 papers, from which we have chosen 33 relevant articles. The search included articles in academic journals and conference proceedings written in English. We included only articles that focus on BMPs or similar constructs that meet the definition of BMPs. We found two more papers through a backward and forward search resulting in 35 papers.

In the coding process, two researchers iteratively checked and consolidated the BMPs presented in each publication to ensure intercoder reliability. We confirm the comprehensiveness of the list of BMPs according to Remané et al. (2017) and found only two additional patterns (i.e., data as a service and R&D contractor). Overall, we derived a set of 184 BMPs.

Next, two researchers coded each of the BMPs to verify their relevance according to three criteria. First, we include only patterns that cover at least one of nine building blocks of the Business Model Canvas (Osterwalder and Pigneur 2010). We have chosen the Business Model Canvas for this relevance criterion and the coding in the first iteration for three main reasons. First, it is a widely applied and practical BM framework (Massa et al. 2017). Second, it is a general BM framework and not specific for certain contexts. Third, with nine dimensions and two to ten characteristics each, it is very comprehensive (Osterwalder and Pigneur 2010). Thus, we exclude patterns that do not cover any BM element and do not meet the definition of BMPs. An excluded example is e-mail (i.e., “communicate with stakeholders via e-mails rather than print and mail”) (Strauss and Frost 2016; Remané et al. 2017). Second, BMPs must not be specific for one industry. BMPs that are specific for one industry do not meet the definition of BMPs. An excluded example is misdirection for search engines (i.e., “send customers to locations different from what they initially searched for if the searched company did not pay sufficient listing fees to the search engine”) (Clemons 2009; Remané et al. 2017). Other examples are BMPs for the electric vehicle industry (Bohnsack et al. 2014). Third, BMPs must not solely build on a business practice that has established itself as common practice. Excluded examples are customer relationship management (i.e., “collecting and integrating all information on each customer touch point”) and enterprise resource planning (i.e., “use an integrated back office system to optimize business processes and thereby reduce cost”) (Strauss and Frost 2016; Remané et al. 2017). To ensure intercoder reliability and internal validity, two researchers alternatively created (researcher A) and revised (researcher B) the coding until both agreed. We excluded 19 patterns and concluded with 164 BMPs for the taxonomy.

We built on the iterative taxonomy development according to Nickerson et al. (2013) to develop the hierarchical taxonomy (see Fig. 1). Before starting with the method, Nickerson et al. (2013) suggests to determine a meta-characteristic (step 1). However, since this paper creates an inductive hierarchical structure, we refrained from this step so as not to affect the inductive result. In the second step, we defined ending conditions (step 2). In addition to conditions defined by Nickerson et al. (2013), we added the following criteria due to our research purpose. First, the resulting classification structure should be a hierarchical tree, consisting of several branches and layers. Accordingly, one ending condition is that the taxonomy considers hierarchical relations among BMPs, including specializations and generalizations based on inheritance. Second, the taxonomy structure should be free from unnecessary branches or layers to have a concise taxonomy without redundancy or duplication (Nickerson et al. 2013).

The first iteration followed the empirical-to-conceptual approach (Nickerson et al. 2013). Since there is significant data available (164 BMPs), an inductive, empirical approach is suitable to create an initial structure (Nickerson et al. 2013). In step 4e, we included all objects, since we build on a quantitative approach. To identify common characteristics between BMPs (step 5e), we built on an agglomerative cluster analysis with a preceding coding. Two researchers iteratively coded all 164 BMPs according to the dimensions and characteristics defined by Osterwalder and Pigneur (2010). To not bias results, we choose this widely applied, general and comprehensive BM framework as a coding scheme. Table 1 shows the coding scheme with the BMP razors/blades as an example (highlighted in italic). Within the coding, we stick to the definitions of the BMPs and the definitions’ overall essence. For example, the essence of razors/blades is not to offer complements, but to lock-in the customer with overpriced complements that are needed to use a product. During the coding, we noticed that some few characteristics fit for many BMPs and that some essential characteristics of BMPs were not part of the characteristics defined by Osterwalder and Pigneur (2010). Thus, we added some characteristics (*) to increase the discriminatory power and to ensure a collectively
exhaustive coding scheme (see Table 1). Two researchers alternatively created and revised the coding to ensure intercoder reliability. This resulted in three iterations of coding (researcher A) and revising (researcher B) all 164 BMPs until both agreed to the coding of all BMPs.

Thereafter, we used agglomerative clustering on the 164 coded BMPs to derive an initial inductive taxonomy (Nickerson et al. 2013). We used R with the package cluster, the function agnes and the ward method (Kaufman and Rousseeuw 2009; Struyf et al. 1997). It resulted in the best discriminatory power compared to single, complete or average linkage. We used the following indices to determine an optimal amount of clusters: McClain (McClain and Rao 1975), C-index (Hubert and Levin 1976), Silhouette (Rousseeuw 1987) and Dunn (Dunn 1974). The McClain and Silhouette index indicate seven clusters; the C-index suggests 27 clusters, whereas the Dunn index recommends 51 clusters. We applied all three suggestions to create a structure with three hierarchical levels, i.e., seven high-level clusters and 27 and 51 low-level clusters (step 6e). The left part of Fig. 2 shows the seven high-level clusters.

The second iteration followed a conceptual-to-empirical approach (Nickerson et al. 2013) to analyze and validate the clusters qualitatively. A qualitative analysis is necessary since a cluster analysis cannot recognize the different levels of abstraction of BMPs. Further, we validate the clusters qualitatively. Figure 2 summarizes the development process. It shows the quantities of BMPs in each cluster (1. Iteration) or subtree (2. Iteration) and includes initial names for clusters (1. Iteration). Two researchers studied all BMPs in one cluster to detect generalizations (step 4c) and specializations (step 5c) and to revise the taxonomy continuously (step 6c). BMPs with a higher level of abstraction became superordinate BMPs. If there was no high-level BMP that covers the intersection of low-level characteristics, we created a new BMP. We also split high-level clusters by building on lower-level clusters that resulted in 27 and 51 clusters from the analysis. For example, the value proposition cluster from the first iteration has 70 elements (see Fig. 2). Thus, we used the low-level clusters within the value proposition cluster to further differentiate BMPs. Subordinate clusters supported the separation between payment/ pricing models, revenue streams, target customers, value propositions and development processes. Other clusters could be used with almost no changes for the hierarchical structure (i.e., merchant model, multi-sided platforms and value network). For splitting and merging clusters and forming the hierarchical levels, we highly built on subordinate clusters from the first iteration that resulted from the analysis with 27 and 51 clusters. Eventually, the classification structure included hierarchical relations and all ending conditions were met (step 7).

## Business model pattern taxonomy

The resulting hierarchical taxonomy of BMPs has 194 elements and comprises four hierarchical levels.\(^2\) It is similar to a class diagram including the inheritance of properties, generalizations and specializations. BMPs on a lower level of abstraction inherit all properties of superior BMPs of this branch. BMPs on the same level do not exclude each other, since a BM covers several BMPs. A BM instance from practice can apply several BMPs on several levels. Speaking in terms of a UML class diagram, the inheritance in the taxonomy is composed of partial or incomplete specializations since we cannot

\(^2\) Table 2 in the appendix shows the complete list of detailed definitions.
make sure that literature covers every possible BMP. The first level has eight high-level BMPs or subtrees, each one with several hierarchical layers. Figure 3 shows the first level of the hierarchical taxonomy. All elements that we added during the process and that are not directly defined as a BPM in literature are marked with an asterisk (*). In the following, we describe each of the eight subtrees.

Merchant model describes “wholesalers or retailers of goods and services” (Remané et al. 2017) (see Fig. 4). This BMP includes supermarket, where firms offer a great diversity of products with a low price (Gassmann et al. 2014) and three subordinate BMPs to further specify merchants in terms of what they offer (i.e., intangibles and/or physical products) and how they offer it (i.e., shop). On the one hand, merchant of intangibles and physical wholesaler further specifies the asset of trading in intangibles and physical assets (Weill et al. 2005). An e-retailer, for example, sells physical assets solely online (Rappa 2001; Wirtz et al. 2010). On the other hand, a shop describes that a provider uses a shop to offer his value proposition. Bricks and clicks, for example, defines that a shop has an online and offline presence (Johnson 2010).

Multi-sided platforms “bring together two or more distinct but interdependent groups of customers, where the presence of each group creates value for the other groups” (Remané et al. 2017) (see Fig. 5). This BMP include specialized platforms, such as collaboration platforms and trust intermediaries, as well as various forms of brokerage and portals. Brokerage concentrates on buyers and sellers only and charges a transaction fee. Brokers can again have specific assets (broker of specific assets) and/or can operate exclusively on the internet (internet platform). Portals bring together contents from diverse sources. For example, an e-mall aggregates several e-shops, whereas a search engine can be a horizontal portal.

Customer group comprises BMPs that focus on a certain customer group or market segment (see Fig. 6). It generalizes BMPs, such as long tail, which focuses on offering a large number of niche products, where each sells relatively infrequently (Osterwalder and Pigneur 2010). Other specializations are affinity clubs where a product is exclusively offered to members, aikido where offerings are opposite to the offering of the competition, and own the undesirable where the target customer group might not appear immediately attractive (Remané et al. 2017; Gassmann et al. 2014). We added one BMP in this subtree: serve convenience seekers targets customers valuing convenience over all other attributes. It involves offering more convenient, simple products (i.e., dial down features) and offering products in a convenient way (i.e., one-stop convenient shopping).

The subtree Payment/ pricing model cover BMPs that define how a price can be compounded and determined (see Fig. 7). It includes general pricing models, such as auction, disaggregated pricing or freemium, and specialized ones for low prices (sell at low prices). Examples for general pricing
models are demand collection system where a buyer’s final bidding is arranged (Rappa 2001; Remané et al. 2017) and disaggregated pricing where customers can buy exactly what they want (Tuff and Wunker 2010; Remané et al. 2017). Examples for low pricing are buying club where providers use high volumes to negotiate discounts (Linder and C antenn 2000; Remané et al. 2017) and under the umbrella pricing where provider underprice market leaders (Linder and C antrell 2000; Remané et al. 2017). Some patterns, such as add-on, free, freemium or product sales, are closely related to the value proposition. However, the essence of these patterns is the pricing, which leads to a changed value proposition in a second step. Therefore, the patterns are specializations of the payment/ pricing model.

Revenue streams describe how the BM generates revenues (see Fig. 8). In contrast to payment/ pricing models, revenue streams utilize pricing models to generate revenue. This can include general approaches (i.e., negative operating cycle and scaled transactions), revenues from advertising, revenues from lending out assets and revenues from usage fees. Lending/ renting/ leasing is “temporarily granting someone the (exclusive) right to use a particular asset for a fixed period in return for a fee” (Osterwalder and Pigneur 2010). Especially for this BMP, we found further differentiating patterns, for instance allowing customers to use software for a continuous service fee (application service providers) or other kinds of landlords. In subscription models, we found trust services. They include memberships with a subscription fee and specific code of conduct (Rappa 2001). With usage fees a customer pays depends on a certain variable, such as (short) time usage (pay per use) or the performance/ result of the product usage (performance-based contracting). Accordingly, the pricing for usage fee is variable, while the pricing for lending/ renting/ leasing builds on a fixed characteristic, such as a period of time.

The value network as a BMP involves changes in the actors of the value network or changes in how they interact (see Fig. 9). This also includes extending the value network with new forms of advertising (buy advertising), cover more parts of the value chain (integrator), and more closely link different actors of the supply chain (supply chain management). Examples here are the value chain integrator that distributes information and coordinates activities in the value network and the orchestrator that concentrates in core competencies with outsourcing and coordinates the value chain (Andrew and Sirkin 2006; Remané et al. 2017). Other examples are sharing of infrastructure (shared infrastructure), revenues (revenue sharing) or risks (risk sharing).

The BMP value proposition can further specialize in the products or services provided or the way providers offer them (see Fig. 10). Examples are lock-in, forced scarcity, breakthrough markets or reverse innovation and experience or premium value propositions. On the one hand, forced scarcity describes the limitation of the supply to boost demand and prices (Tuff and Wunker 2010; Remané et al. 2017). Breakthrough markets means investing in new markets to achieve a short-time monopoly (Linder and C antrell 2000), whereas reverse innovation refers to selling simple products in industrial countries that were developed for emerging markets (Gassmann et al. 2014). All three BMPs describe how to offer a value proposition. Customization BMs describe both the value proposition and how it is offered. It generalizes mass customization or customization for individual customers (i.e., custom supplier of hardware or software). On the other hand, various BMPs describe complementary products or services, for example: digitally-charged products, cross selling, service-wrapped commodity, servitization of products or value-added reseller. Vertical portals inherit properties of content providers since they specialize in a particular area by providing very deep content and functionality (Applegate 2001;
Clemons 2009). In this way, the pattern creates an own value proposition and is more than a multi-sided platform connecting two customer groups. Another content provider as a BMP is data as a service, where data is a key resource and the offering of data is the value proposition (Hartmann et al. 2016). We derived the BMP getting the job done from Osterwalder and Pigneur (2010) as “helping a customer get certain jobs done”. Thus, advisors, audience measurement services, R&D contractors and search agents are specializations. R&D contractors are engaged with technology development and building prototypes (Libaers et al. 2010).

Value proposition development describes how an offering is developed or produced (see Fig. 11). It generalizes BMPs, such as open business model, open content, reverse engineering, user designed or crowdsourcing. Reverse engineering, for example, describes to use information from a competitor’s product to build a similar one. (Gassmann et al. 2014), whereas trash-to-cash is when used products are sold in different markets or used in new products (Gassmann et al. 2014). It further covers BMPs, such as develop intangibles (i.e., digitization, entrepreneur, incomparable products/services and inventor) and internal use of data that describes the development process (i.e., business intelligence, context and knowledge management). Context as a BMP produces a value proposition by sorting or aggregating information and provide information for a specific context (Wirtz et al. 2010). Production further specializes BMPs according to the type of asset (i.e., produce physical products and produce intangibles). It further includes the concrete production approach from push to pull. The patterns crowdsourcing and user designed are assigned here and not part of value network since they have a higher impact on development processes than on the value network.

**Discussion**

A current limitation of BMPs is that they have varying degrees of coverage in terms of BM elements and have different levels of abstraction. Some BMPs are straightforward and illustrate how firms can adapt their value stream (e.g., membership), while others touch all aspects of a BM (e.g., multi-sided platform). The consequence is that BMPs are overlapping, hard to compare, and thus not easy to use when innovating a business model. Existing BMP frameworks (Remané et al. 2017; Taran et al. 2016) are designed to illustrate and define patterns. Thus, they are not intended to analyze relations among BMPs or to address the variety in the degree of coverage, the different levels of abstraction and the overlaps. This paper builds on hierarchical relations among BMPs and creates a hierarchical taxonomy including generalizations and specializations based on inheritance to address all three issues. This work’s literature review reveals 164 BMPs. Using an iterative taxonomy development method (Nickerson et al. 2013), we derive a hierarchical taxonomy with eight BMPs on the top level of abstraction and three further levels including more detailed BMPs. Since an instance of a BM in practice can comprise many BMPs, more than one BMP within one branch or subtree can apply to one complete instance of a BM.
The hierarchical taxonomy shows eight overarching BMPs that comprise dominant and holistic BMPs or cover common BM elements (i.e., value proposition, value delivery, value creation and value capture). On the one hand, two of eight high-level BMPs of the taxonomy cover holistic and well-known BMs. First, the merchant model describes wholesalers and retailers of goods and service (Remané et al. 2017). This BMP has existed for a long time and has been digitalized during e-commerce (Rappa 2001). Second, the multi-sided platform describes serving two or more customer segments, where the presence of each segment creates value for the other segments (Remané et al. 2017). This BMP similarly have existed for a long time (Osterwalder and Pigneur 2010). However, multi-sided platforms spread heavily with the rise and support of information technology (Parker et al. 2017; Hein et al. 2018a). Examples are Google, Facebook and Visa (Osterwalder and Pigneur 2010; Parker et al. 2017; Hein et al. 2018b; Schreieck et al. 2018). Both high-level BMPs, merchant model and multi-sided market, draw on a long history and show enormous business success in practice (Hein et al. 2016). The inductively derived taxonomy shows that both stand out as two very dominant BMPs in the BMP literature. On the other hand, the remaining six of eight high-level BMPs of the taxonomy address common elements of BM frameworks: value proposition, value delivery, value creation and value capture. The subtree value proposition addresses to the identically named BM element. The subtree customer groups refers to the value delivery, whereas the subtrees value proposition development and value network refer to the value creation. Payment/pricing models and revenue streams address the value capture element. Consequently, the taxonomy confirms dominant and common elements of BM frameworks. Moreover, the taxonomy highlights two dominant BMPs. For both aspects, dominant BM elements and dominant BMPs, it provides further specifications with its hierarchical structure of BMPs.

The resulting hierarchical taxonomy of BMPs addresses three shortcomings of literature. First, it creates a structure for the various BMPs in literature including the relations among BMPs. It considers individual BMPs as well as...
relations among them and thus mitigates the complexity of the large amount of BMPs in extant literature. Patterns are easier to find in the hierarchical structure than in an alphabetically sorted list. For example, if a user is looking for a pricing model, she can look at this subtree and see possible options. Second, the hierarchical structure takes into account the diversity of BMPs concerning their various degrees of coverage in terms of BM elements. The taxonomy with its different levels and relations among BMPs covers all kinds of different degrees of coverage and hence explains overlaps. The six of eight high-level BMPs that address common elements of BM frameworks and BMs clearly differentiate BMPs concerning their essence. The remaining two high-level BMPs (i.e., merchant model and multi-sided market) express two common holistic BMs. The taxonomy further specifies these BMs with lower-level BMPs, namely specializations. In this way, the taxonomy mitigates the various degrees of coverage in terms of BM elements by structuring BMPs according to BM elements and common holistic BMs. Hence, it also clarifies overlaps in the dimension of coverage. Third, the taxonomy addresses the various hierarchical levels of BMPs with specializations and generalizations based on inheritance. BMPs inherit characteristics of superior BMPs and, thus, are specializations of BMPs on a higher level. While BMPs on a higher level in the taxonomy address a higher level of abstraction, BMPs on a lower level in the taxonomy also show a lower level of abstraction and cover BM elements in detail. In this way, it also clarifies overlaps in the dimension of abstraction levels. Summarizing, the taxonomy considers the variety in the covered BM elements of BMPs and the diversity in the level of abstraction of BMPs and incorporates overlapping BMPs with its hierarchical structure.

This work has three main implications for theory. First, to the best of our knowledge, this is the first inductively derived BM classification as well as the first classification considering relations among BMPs. It is the first BM taxonomy that address the diversity of BMPs concerning their various degrees of coverage, different hierarchical levels of BMPs, and overlaps of BMPs and relations among BMPs. The taxonomy helps to structure and understand the vast amount of BMPs available in literature. In contrast to existing BM frameworks (Osterwalder and Pigneur 2010; Gassmann et al. 2014), the hierarchical taxonomy of BMPs is able to characterize individual BMPs and BM instances from practice. Additionally, it allows for putting a BMP or BM instance in relation to other BMPs. In this way, BMPs can be analyzed against the backdrop of other BMPs and in a higher order structure of BMPs with higher and lower levels of abstraction. Second, the taxonomy further serves as an extendable structure for future BMPs as well as current BMPs that literature does not cover yet.

Fig. 8 Business model patterns specifying revenue streams (own illustration)

Fig. 9 Business model patterns specifying the value network (own illustration)
contrast to existing BM frameworks, the taxonomy defines hierarchical dimensions for classifying BMPs and for describing them. The taxonomy functions as an overall structure. Currently, there are two holistic and overarching BMPs, namely merchant model and multi-sided market as well as six overarching BMPs that address different BM elements. Sparse parts of the taxonomy show possible areas for new BMPs and future research. Third, the hierarchical structure as a supporting tool for BMI addresses several calls for research. The hierarchical taxonomy represents a holistic, exhaustive and systematic classification structure for BMs (Fielt 2013) including the derivation of specific sub-classes of BMs (Veit et al. 2014). It supports the conceptual modeling and formalization of BMs (Osterwalder and Pigneur 2013).

For practice, the hierarchical BM taxonomy allows for the application of BMPs. The taxonomy consists of BMPs with examples cases from practice in a hierarchical structure. The structure makes it easier to use than an alphabetically sorted list of BMPs, and the example cases provide the basis for analogical thinking (Gavetti and Rivkin 2005). Thus it helps practitioners to identify related BMPs (sharing the same parent node) to find a creative solution for a specific problem of...
their BM (e.g. payment/pricing models). Furthermore, practitioners can characterize their current BM with the taxonomy of BMPs. They can decide for each branch and BMP if it is relevant for their current business or not. Then, they can identify analogies to BMPs and related example cases from literature. Practitioners can assess possible opportunities for BMI based on the taxonomy, the BMPs and example cases. For instance, they can assess related patterns within one branch as possible incremental BMI or analyze different branches as possible radical BMI. Here, the hierarchical taxonomy as a graphic tree helps to visualize the initial and planned combination of BMPs within an intended BMI. The taxonomy further shows the path that has to be traveled in the hierarchical structure for a certain BMI. This visualizes the changes of the current BM that are necessary to reach the target BM. In this way, the hierarchical taxonomy of BMPs can serve as a practical tool to support BMI. It addresses numerous calls for research. It helps to find options for BMI and new and viable BM alternatives as well as its visualization (Osterwalder and Pigneur 2013; Veit et al. 2014). The taxonomy supports incremental, i.e. similar BMPs within one branch, as well as radical changes of BMs, i.e. leaping from one branch to another, with example cases for each BMP (El Sawy and Pereira 2013).

This work has some limitations. First, the taxonomy solely relies on BMPs from literature. Thus, we cannot ensure that the taxonomy includes all available BMPs. There are probably new BMPs in practice that literature does not yet cover. However, we argue that the taxonomy is extendable and provides a good basic structure that is able to integrate future BMPs. Second, the taxonomy development process and especially the coding of BMPs as well as the second iteration with the conceptual to empirical approach can be subject to the researchers’ interpretations of BMPs definitions. However, two researchers discussed the coding and matchings iteratively to prevent a possible bias. Third, there are limitations regarding the taxonomy’s applicability in practice. Avoiding superficial analogies is important for strategy development (Gavetti and Rivkin 2005). An analogical case (source) has to be understood thoroughly before its similarities and differences can be assessed and it can be translated into a target case (Gavetti and Rivkin 2005). The taxonomy cannot consider the contextual factors and strategic path dependencies of an applying firm. Practitioners may find possible opportunities with example cases in the taxonomy. However, the taxonomy can only partly support practitioners in evaluating a specific BMP for their context and strategy by providing analogies in the forms of definitions and example cases (Gavetti and Rivkin 2005). Nevertheless, the taxonomy supports BMI in practice by structuring the many BMPs and make them utilisable. Fourth, the taxonomy has some sparse areas. Some dimensions of the structure are more detailed than others and include more BMPs. For example, brokerage as a specialization of multi-sided platform has many specializing BMPs, whereas trust intermediaries or buy/sell fulfillment have no specializing BMPs. We can see that e-commerce BMPs (e.g., online advertisement) and digital BMPs dominate the taxonomy. The reason for this is that we included BMPs from literature only. This leads to promising areas for future research.

The hierarchical taxonomy for BMPs provides four main opportunities for future research. First, in order to address sparse areas of the taxonomy, future research can investigate new BMPs and extend the taxonomy. The taxonomy reveals two overarching and holistic BMPs, namely merchant model and multi-sided platform. Future research can investigate whether both types are dominant and successful types in practice and extend the hierarchical structure with new patterns that further characterize both types. Likewise, the taxonomy shows six overarching BMPs that address BM elements. Future research can investigate in and extend these subtrees. For this purpose, the taxonomy serves as an overall structure and supports the identification of areas for new BMPs. Second, future research can use the taxonomy to describe certain BM instances and developments of a BMI. Like in practice, future research can apply the hierarchical taxonomy to characterize BM instances (e.g., an initial BM and a target BM) with existing BMPs to describe case studies, for example. Third, this work is a first step towards an ontology of BMPs and towards a BM distance measure. For now, the taxonomy includes hierarchical relations only. However, it would be interesting and further facilitate the usage of the taxonomy to include all kinds of relations. This ontology of BMPs would illustrate cross relations within the hierarchy, for instance BMPs that complement or exclude each other. Excluding examples are disintermediation, integrator and orchestrator. Whereas disintermediation and integrators aim to cover more parts of the value chain, an orchestrator tries to focus on core competencies, outsource remaining activities and only coordinate the value chain. An ontology of BMPs would further support a BM distance measure. With an indentified BMI including an initial BM (initial combination of BMPs) and a target BM (target combination of BMPs), the hierarchical taxonomy and ontology can support the calculation of a distance between these BMs (combinations of BMPs). It would indicate how many changes of the current BM are necessary to reach the target BM and suggest how revolutionary the BMI would be. Fourth, the hierarchical taxonomy including the definitions of BMPs (see appendix Table 2) can be developed further as a practical tool. For example, a software tool implementing the hierarchical BMI taxonomy would strengthen its practical relevance. In this way, the hierarchy can support practitioners with characterizing their current BM with BMPs and suggest possible opportunities for BMI. A hierarchical questionnaire based on the taxonomy can provide guidance for characterizing a firm’s BM. Building on the current BMP combination, the tool can suggest possible opportunities for incremental BMI based on the hierarchy.
Possible opportunities for revolutionary BMI can be suggested based on a case study database of successful BMIs where the initial and the target BM is characterized with the hierarchical taxonomy of BMPs. Hence, the hierarchy of BMPs can serve as an underlying logic of a practitioner-oriented tool. Overall, the hierarchical taxonomy of BMPs opens up fruitful areas for future research with theoretical as well as practice relevance.

**Conclusion**

In increasingly turbulent markets and environments, BMs, their fit to a firm’s strategy and the capability to innovate BMs are essential to remain competitive (Martins et al. 2015; Zott and Amit 2008). In research, the concepts of BMs and BMI are gaining more and more attention (Massa et al. 2017; Foss and Saebi 2017). However, innovating a BM is a complex task and many firms fail (Christensen et al. 2016). One approach to supporting BMI is building on successful solutions of the past, i.e. BMPs (Gassmann et al. 2014; Amshoff et al. 2015). However, BMPs and available collections of BMPs have three major limitations that restrict their applicability in research and practice. First, a large amount of BMPs exists with diverse degrees of coverage, i.e., covered BM elements. Second, BMPs show diverse levels of abstraction and resulting overlaps. Third, extant literature only characterizes individual BMPs without considering the relations among BMPs to address diversity, hierarchy levels and overlaps. In order to mitigate these issues, this paper develops a hierarchical taxonomy of BMPs that includes generalizations and specializations among patterns based on inheritance to address this diverse degree of coverage, diverse hierarchy levels and overlapping BMPs.

In order to develop this hierarchical structure, we first build on a literature review (Webster and Watson 2002) to identify BMPs and second on an iterative taxonomy development approach (Nickerson et al. 2013). We coded all 164 BMPs according to Osterwalder and Pigneur (2010) and conducted an agglomerative cluster analysis, followed by a qualitative analysis to come up with an inductive structure. The resulting hierarchical taxonomy of BMPs includes 194 elements in its four levels of abstraction. On its highest level, it reveals two overarching, holistic BMPs (i.e., merchant model and multi-sided market) and six overarching elements of BMs. It is the first hierarchical taxonomy of BMPs, which takes into account relations among BMPs. The hierarchical structure reduces complexity by structuring the large amount of BMPs, respecting the diversity in the degree of coverage and abstraction levels and addresses overlaps with inheritance. It structures the complex field of BMPs and helps researchers to understand BMPs. For practice, the taxonomy allows for the application of BMPs, supports BMI and, thus, addresses several calls for research (Fiel 2013; Osterwalder and Pigneur 2013; Veit et al. 2014; El Sawy and Pereira 2013). The hierarchical taxonomy is extendable and, hence, serves as a robust foundation for further research with yet unidentified BMPs.

**Acknowledgements** For helpful comments and suggestions, the authors would like to thank two anonymous reviewers and the editors. This research is funded by the German Research Foundation (Deutsche Forschungsgemeinschaft – DFG) as part of the ‘Collaborative Research Center 768: Managing cycles in innovation processes – Integrated development of product service systems based on technical products’ (TP C1), and the Center for Very Large Business Applications (CVLBA)@TUM. In addition, this work is part of the TUM Living Lab Connected Mobility (TUM LLCM) project and has been funded by the Bavarian Ministry of Economic Affairs, Energy and Technology (StMWi) through the Center Digitisation.Bavaria, an initiative of the Bavarian State Government.

### Appendix

**Table 2** Definitions of business model patterns (adapted from Remané et al. 2017) with added definitions (*)

| Pattern                | Definition                                                                 | References |
|------------------------|---------------------------------------------------------------------------|------------|
| Add-on                 | Offer a basic product at a competitive price and charge for several extras  | Gassmann et al. (2014) |
| Advertising model      | Provide a product or service and mix it with advertising messages         | Gassmann et al. (2014), Hanson and Kalyanam (2007), Rappa (2001), Tuff and Wunker (2010) |
| Advertising*           | Generate revenues with advertising                                        | Own definition |
| Advisors               | Provide consulting and advise                                             | Applegate (2001) |
| Affiliation            | Refer customers to a third party and receive a commission for a specific transaction completed (e.g., click, give information, buy product) | Gassmann et al. (2014), Hanson and Kalyanam (2007), Rappa (2001) |
| Affinity clubs         | Partner with membership associations and other affinity groups to offer a product exclusively to its members | Johnson (2010) |
| Pattern                        | Definition                                                                 | References                                                                 |
|-------------------------------|----------------------------------------------------------------------------|----------------------------------------------------------------------------|
| **Agent models**              | Represent the buyer or the seller and earn commissions for successful facilitation of transactions | Hanson and Kalyanam (2007), Strauss and Frost (2016)                      |
| **Aggregation**               | Build a specific form of broker preselecting products/services and target audience – hence, key process is matching of needs | Applegate (2001), Bienstock et al. (2002), Linder and Cantrell (2000), Rappa (2001), Tapscott et al. (2000) |
| **Agora**                     | Build a specific form of broker allowing buyer and seller to freely negotiate and assign value to goods – hence, key process is price discovery | Applegate (2001), Bienstock et al. (2002), Tapscott et al. (2000)         |
| **Aikido**                    | Offer products to the customer that are the opposite of what the competitors are offering, thereby making competitor’s strengths a weakness | Gassmann et al. (2014)                                                  |
| **Application service providers** | Allow customers to use software that is hosted on remote servers for continuous service fee | Applegate (2001), Eisenmann (2001)                                      |
| **Auction**                   | Make customers name the maximum price they are willing to pay; the highest price wins the product or service | Applegate (2001), Bienstock et al. (2002), Gassmann et al. (2014), Hanson and Kalyanam (2007), Johnson (2010), Rappa (2001), Tapscott et al. (2000), Timmers (1998), Tuff and Wunker (2010) |
| **Audience measurement services** | Conduct market research on online audience as agency for other customers | Rappa (2001)                                                           |
| **Banner advertising**        | Place advertising banners on websites | Hanson and Kalyanam (2007), Rappa (2001)                                |
| **Barter**                    | Allow customers to trade a non-monetary compensation in exchange for a product or service | Bienstock et al. (2002), Gassmann et al. (2014)                        |
| **Brand integrated content**  | As manufacturer of other products create content for the sole basis of product placement | Rappa (2001)                                                           |
| **Breakthrough markets**      | Invest in opening new markets to gain at least a temporary monopoly | Linder and Cantrell (2000)                                                |
| **Bricks + clicks**           | Integrate both an online (clicks) and an offline (bricks) presence to browse, order, and pick up products | Johnson (2010), Rappa (2001)                                            |
| **Broker of specific assets** | Broker that deal with specific assets | Own definition                                                          |
| **Brokerage**                 | Bring together and facilitate transactions between buyers and sellers, charging a fee for each successful transaction | Chatterjee (2013), Linder and Cantrell (2000), Johnson (2010), Tuff and Wunker (2010) |
| **Bundle elements together**  | Make purchasing simple and more complete by packaging related products together | Hanson and Kalyanam (2007), Johnson (2010), Tuff and Wunker (2010)         |
| **Business intelligence**     | Gather secondary and primary information about competitors, markets, customers, and other entities to predict important information | Strauss and Frost (2016)                                                |
| **Business Model Pattern**    | describe components of successful BM instances or holistic successful BM instances that are applicable in other firms | Osterwalder and Pigneur (2010), Gassmann et al. (2014), Amshoff et al. (2015) |
| **Buy advertising**           | Promote your value proposition with advertising | Own definition                                                          |
| **Buy/sell fulfilment**       | Take customer orders to buy or sell a product or service, including terms like price and delivery | Rappa (2001)                                                           |
| **Buying club**               | Round up buyers with attractive prices and use purchase volume to gain discounts | Linder and Cantrell (2000)                                                |
| **Channel maximization**      | Leverage as many channels as possible to maximize revenues | Linder and Cantrell (2000)                                                |
| **Classifieds**               | List items for sale or things of interest and charge listing or membership fees in exchange | Rappa (2001)                                                           |
| **Collaboration platforms**   | Provide a set of tools and an information environment for collaboration between enterprises | Timmers (1998)                                                          |
| **Complement a physical product** | Offer a complement in addition to a physical product | Own definition                                                          |
| **Complementary services**    | Offer complementary services | Own definition                                                          |
| **Complements**               | Offer complementary products or services | Own definition                                                          |
| **Content provider**          | Provide content such as information, digital products, and services | Applegate (2001), Clemons (2009), Eisenmann (2001), Strauss and Frost (2016), Weill and Vitale (2001), Wirtz et al. (2010) |
| **Content-targeted advertising** | Identify the meaning of a web page and then automatically deliver relevant ads when a user visits that page | Rappa (2001)                                                           |
| **Context**                   | Sort and/or aggregate available online information | Wirtz et al. (2010)                                                      |
| Pattern                        | Definition                                                                                                                                                                                                 | References                                                                                     |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Contextual mobile advertising | Tailor advertising to the context, e.g., location, preferences, or status                                                                                                                                                                              | Clemons (2009)                                                                               |
| Contractor                    | Sell services provided primarily by people, such as consulting, construction, education, personal care, package delivery, live entertainment, or healthcare                                                                                                            | Weill et al. (2005)                                                                          |
| Cool brands                   | Earn premium prices with competitive products through expert brand marketing                                                                                                                                                                             | Hanson and Kalyanam (2007), Linder and Cantrell (2000)                                         |
| Cost leadership               | Keep variable costs low and sell high volumes at low prices                                                                                                                                                                                            | Tuff and Wunker (2010)                                                                        |
| Cross selling                 | Offer complementary products in addition to the standard offering                                                                                                                                                                                       | Gassmann et al. (2014)                                                                        |
| Crowdsourcing                 | Solve a problem by outsourcing it to the crowd (e.g., an internet community)                                                                                                                                                                           | Gassmann et al. (2014), Johnson (2010)                                                        |
| Custom suppliers              | Design, produce, and distribute customized products and services                                                                                                                                                                                     | Applegate (2001)                                                                              |
| Custom suppliers of hardware  | Produce and customize IT equipment or components                                                                                                                                                                                                      | Applegate (2001)                                                                              |
| Custom suppliers of software  | Create and customize software and license/ sell it                                                                                                                                                                                                     | Applegate (2001)                                                                              |
| Customer group*               | Focus on a certain customer group or market segment                                                                                                                                                                                                     | Own definition                                                                                |
| Customer loyalty              | Increase customer loyalty by reward programs                                                                                                                                                                                                           | Gassmann et al. (2014), Rappa (2001)                                                          |
| Customization*                | Offer customized products or services                                                                                                                                                                                                                 | Own definition                                                                                |
| Data as a service             | Offer a provision of information to the customer as the value proposition. The key resource is represented by data.                                                                                                                                  | Hartmann et al. (2016)                                                                        |
| Database marketing            | Collect, analyze and disseminate electronic information about customers, prospects, and products to increase profits                                                                               | Strauss and Frost (2016)                                                                      |
| De facto standard             | Develop and use proprietary component technology to provide high product functionality, but also license it broadly throughout the industry to establish it as the dominant design                                                                 | Linder and Cantrell (2000)                                                                   |
| Demand collection system      | Let prospective buyers make a final bid for a specified good or service and arrange fulfilment                                                                                                                                                          | Rappa (2001)                                                                                 |
| Develop intangibles*          | Develop intangibles in an innovative way                                                                                                                                                                                                                 | Own definition                                                                                |
| Dial down features            | Target less-demanding consumers with products or services that may not be superior but are adequate and perhaps more convenient, simple, etc.                                                                                                                | Johnson (2010)                                                                               |
| Digital add-on                | A physical asset is sold at a small margin; over time, the customer can purchase or activate any number of digital services with a higher margin                                                                                                         | Fleisch et al. (2014)                                                                        |
| Digital infrastructure retailers | Take control of inventory and sell digital infrastructure                                                                                                                                                                                            | Applegate (2001)                                                                              |
| Digital lock-in               | Use digital technologies to limit the compatibility of physical products and thus lock customers to your ecosystem                                                                                                                                 | Fleisch et al. (2014)                                                                        |
| Digital service provider      | Produce and deliver a wide range of services online                                                                                                                                                                                                 | Applegate (2001)                                                                              |
| Digitally-charged products    | Charge classic physical products with a bundle of new sensor-based digital services and position them with new value propositions                                                                                                                                 | Fleisch et al. (2014)                                                                        |
| Digitization                  | Offer a traditionally physical product as a digital version                                                                                                                                                                                             | Gassmann et al. (2014)                                                                        |
| Disaggregated pricing         | Allow customers to buy exactly – and only – what they want                                                                                                                                                                                           | Tuff and Wunker (2010)                                                                        |
| Disintermediation             | Deliver a product or service that has traditionally gone through an intermediary directly to a customer                                                                                                                                              | Gassmann et al. (2014), Johnson (2010), Rappa (2001), Strauss and Frost (2016), Weill and Vitale (2001) |
| Distributive network          | Provide infrastructure to connect other actors of the economy such as logistics, energy, mobility, or communication                                                                                                                                 | Tapscott et al. (2000)                                                                       |
| Do more to address the job    | Look beyond your typical offering and address other jobs your customers are trying to get done                                                                                                                                                        | Johnson (2010)                                                                               |
| Educators                     | Create an deliver educational offerings, often online                                                                                                                                                                                                | Applegate (2001)                                                                              |
| E-Mall                        | Build a platform for a collection of e-shops, usually enhanced by a common umbrella, for example, of a well-known brand                                                                                                                                | Rappa (2001), Timmers (1998)                                                                  |
| Entrepreneur                  | Create and sell financial assets, often creating and selling firms                                                                                                                                                                                    | Weill et al. (2005)                                                                           |
| Pattern                      | Definition                                                                 | References                                                                 |
|------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| E-procurement                | Conduct tendering and procurement electronically                            | Strauss and Frost (2016), Timmers (1998)                                     |
| E-retailer                   | Assume control of inventory, set a non-negotiable price, and sell physical products online | Applegate (2001), Eisenmann (2001), Rappa (2001), Wirtz et al. (2010)         |
| E-shop                       | Build a web shop to sell products or services online                        | Gassmann et al. (2014), Strauss and Frost (2016), Timmers (1998)             |
| Exclusive market-making      | Bring together specific, highly targeted, qualified audiences for trading | Linder and Cantrell (2000)                                                  |
| Experience destination       | Use a carefully designed environment to attract customers who pay premium prices | Gassmann et al. (2014), Linder and Cantrell (2000)                           |
| Experience selling           | Allow the client to experience the product, often via a sales force and a pyramid commission structure; traditionally applied for cosmetic products | Linder and Cantrell (2000)                                                  |
| Experience*                  | Provide experiences                                                        | Own definition                                                              |
| Financial broker             | Match buyers and sellers of financial assets                               | Weill et al. (2005)                                                         |
| Financial landlord           | Let others use cash (or other financial assets) under certain (often time-limited) conditions | Linder and Cantrell (2000), Tuff and Wunker (2010), Weill et al. (2005)       |
| Financial trader             | Buy and sell financial assets without significantly transforming (or designing) them | Weill et al. (2005)                                                         |
| Flat-rate                    | Charge a fixed price and allow the customer unlimited access in exchange    | Gassmann et al. (2014)                                                      |
| Flexible pricing             | Vary prices for an offering based on demand                                 | Strauss and Frost (2016), Tuff and Wunker (2010)                            |
| Forced scarcity              | Limit the supply of offerings available to drive up demand and prices       | Tuff and Wunker (2010)                                                      |
| Franchising                  | Allow franchises to use a business concept, including brand and products, in compensation for financial compensation | Gassmann et al. (2014)                                                      |
| Free                         | Provide customer with a free-of-charge offer and use other sources such as advertising to generate revenues | Linder and Cantrell (2000), Osterwalder and Pigneur (2010)                   |
| Freemium                     | Offer basic services for free, while charging a premium for advanced or special features | Gassmann et al. (2014), Hanson and Kalyanam (2007), Tuff and Wunker (2010)   |
| From push-to-pull            | Make production more flexible in order to ideally produce a product just when it is ordered and not upfront as stock article | Gassmann et al. (2014)                                                      |
| Getting the job done*        | Helping a customer get certain jobs done                                    | Osterwalder and Pigneur (2010)                                              |
| Haggle                       | Allow the buyers to negotiate over the price                               | Bienstock et al. (2002)                                                     |
| Horizontal portals           | Create a portal that provides a gateway to Internet’s content and offerings, such as search engine, e-mails, news etc. | Applegate (2001), Eisenmann (2001), Rappa (2001), Strauss and Frost (2016) |
| HR broker                    | Match buyers and sellers of human services                                 | Weill et al. (2005)                                                         |
| Incomparable products / services | Use deep R&D skills to develop and exploit proprietary technology to offer unique products that command high margins | Linder and Cantrell (2000)                                                  |
| Information broker           | Match buyers and sellers of information or other intangible assets          | Applegate (2001), Hartmann et al. (2016), Rappa (2001), Timmers (1998), Weill et al. (2005) |
| Information collection       | Collect and commercialize information gathered from the Internet            | Hanson and Kalyanam (2007)                                                  |
| Infrastructure services firms | Produce and deliver complementary services for the internet                | Applegate (2001), Hartmann et al. (2016)                                   |
| Ingredient branding          | Build a brand of a product component that is part of an end product        | Gassmann et al. (2014)                                                      |
| Integrator                   | Cover most parts of the value chain in-house in order to keep control of innovations, efficiency, etc. | Andrew and Sirkin (2006), Gassmann et al. (2014)                            |
| Internal use of data*        | Use available data internally to develop new offerings                      | Own definition                                                              |
| Internet platform*           | Broker that operate exclusively in the internet                            | Own definition                                                              |
| Inventor                     | Create and then sell intangible assets, such as patents and copyrights     | Weill et al. (2005)                                                        |
| IP trader                    | Buy and sell intangible assets                                             | Rappa (2001), Weill et al. (2005)                                           |
| IT Equipment/ component manufacturers | Produce IT equipment and components                                      | Applegate (2001)                                                           |
| Knowledge management         |                                                                           | Strauss and Frost (2016)                                                    |
Table 2 (continued)

| Pattern                      | Definition                                                                 | References                                                                                           |
|------------------------------|---------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| Landlord*                    | Sell the right to use an asset                                            | Own definition                                                                                       |
| Lending/renting/Leasing*     | Temporarily granting someone the exclusive right to use a particular asset for a fixed period in return for a fee | Osterwalder and Pigneur (2010)                                                                        |
| Leverage customer data       | Collect customer data and use them commercially, e.g., for targeted advertising | Clemons (2009), Gassmann et al. (2014), Rappa (2001)                                                  |
| Licensing                    | License or otherwise get paid for limited use of intangible assets        | Andrew and Sirkin (2006), Gassmann et al. (2014), Rappa (2001), Tuff and Wunker (2010), Weill et al. (2005) |
| Lock-in                      | Lock the customers to your ecosystem by strongly increasing the switching costs through high hurdles | Fleisch et al. (2014), Gassmann et al. (2014)                                                        |
| Long tail                    | Focus on selling a large number of niche products, each of which sells relatively infrequently | Gassmann et al. (2014), Osterwalder and Pigneur (2010)                                                |
| Low-touch approach           | Offer standardized, low-price version of a product or service that is traditionally customized and higher priced | Gassmann et al. (2014), Johnson (2010), Linder and Cantrell (2000)                                    |
| Make more of it              | Offer internal know-how and other resources also as external service to other companies | Gassmann et al. (2014)                                                                             |
| Marketplace exchange         | Build a specific form of broker also offering a full range of services covering the transaction process, from market assessment to negotiation and fulfillment for an industry consortium | Rappa (2001)                                                                                         |
| Mass customization           | Customize a commodity products to the customers’ specific preferences    | Gassmann et al. (2014), Linder and Cantrell (2000), Strauss and Frost (2016)                         |
| Membership                   | Charge a time-based payment to allow access to locations, offerings or services that non-members do not have | Tuff and Wunker (2010)                                                                            |
| Merchant model               | Act as a wholesalers/retailer of goods and services                      | Bienstock et al. (2002), Rappa (2001)                                                               |
| Merchant of intangibles*     | Wholesalers or retailers of intangibles                                   | Own definition                                                                                       |
| Micro transactions           | Sell many items for as little as a dollar—or even only once cent—to drive impulse purchases | Tuff and Wunker (2010)                                                                            |
| Multi-sided platforms        | Bring together two or more distinct but interdependent groups of customers, where the presence of each group creates value for the other groups | Gassmann et al. (2014), Osterwalder and Pigneur (2010)                                                |
| Negative operating cycle     | Generate high profits by maintaining low inventory and having the customer pay up front | Gassmann et al. (2014), Johnson (2010), Tuff and Wunker (2010)                                        |
| Network value                | Provide a platform that leads to repeated purchases by a core group of loyal customers | Chatterjee (2013)                                                                                  |
| Networked utility providers  | Create and distribute downloadable software programs that facilitate communication | Eisenmann (2001)                                                                                  |
| Object self service          | Provide physical products with the ability to independently place orders on the internet | Fleisch et al. (2014)                                                                              |
| One-stop convenient shopping | Use broad selection and ubiquitous access to attract busy buyers who will pay a premium for convenience | Linder and Cantrell (2000)                                                                          |
| One-stop low-price shopping  | Use low price and the convenience of broad selection to attract buyers, then convert volume into purchase discounts | Linder and Cantrell (2000)                                                                          |
| Online advertising and public relations | Buy advertising on products or services of another companies | Strauss and Frost (2016)                                                                           |
| Online brokers               | Use the internet to facilitate a transaction between buyer and seller     | Bienstock et al. (2002), Hartmann et al. (2016), Rappa (2001), Strauss and Frost (2016), Timmers (1998), Weill and Vitale (2001) |
| Open business models         | Create innovations by systematically integrating partners into the company’s R&D process | Gassmann et al. (2014), Osterwalder and Pigneur (2010)                                              |
| Open content                 | Develop openly accessible content collaboratively by a global community of contributors who work voluntarily | Rappa (2001)                                                                                         |
| Open source                  | Develop a product not by a company, but by a public community with all information being available publicly | Gassmann et al. (2014), Rappa (2001), Tapscott et al. (2000)                                        |
| Orchestrator (Value chain)   | Focus on core competencies and outsource/coordinate all other activities along the value chain |                                                                                                       |
### Table 2 (continued)

| Pattern                          | Definition                                                                                           | References                                                                 |
|---------------------------------|------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| Own the undesirable             | Seek to serve segments of the market that might not appear immediately attractive                     | Andrew and Sirkin (2006), Gassmann et al. (2014), Timmers (1998)            |
| Pay per use                     | Charge for each use of a product or service                                                            | Gassmann et al. (2014), Hanson and Kalyanam (2007), Johnson (2010), Rappa (2001), Tuff and Wunker (2010) |
| Pay what you want               | Invite customers to set the price they wish to pay                                                    | Johnson (2010)                                                             |
| Payment/ pricing model*         | Use a specific payment/ pricing model                                                                   | Gassmann et al. (2014), Tuff and Wunker (2010)                            |
| Peer-to-peer                    | Facilitates a transaction among peers, i.e., two or more consumers, through provision of a platform   | Own definition                                                             |
| Perceived value-based           | Position company’s output as a “want” item and command a price premium – invest in knowledge professionals such as scientists, engineers, programmers, or data experts | Chatterjee (2013)                                                         |
| Performance-based contacting    | Determine the fee for usage of a product not by frequency of use but rather by the quality of the result from the use | Fleisch et al. (2014), Gassmann et al. (2014), Weill et al. (2005)          |
| Physical broker                 | Match buyers and sellers of physical assets                                                              | Weill et al. (2005)                                                       |
| Physical freemium               | A physical asset is sold together with free digital services while charging a premium for advanced digital services | Fleisch et al. (2014)                                                    |
| Physical landlord               | Sell the right to use a physical asset                                                                  | Weill et al. (2005)                                                       |
| Physical manufacturer           | Create and sell physical assets                                                                          | Applegate (2001), Weill et al. (2005)                                     |
| Physical wholesaler             | Buy and sell physical assets                                                                             | Rappa (2001), Weill et al. (2005)                                         |
| Portal*                         | bring together contents from diverse sources                                                              | Own definition                                                             |
| Premium                         | Price at a higher margin than competitors for a superior product, offering, experience, service, or brand | Tuff and Wunker (2010)                                                    |
| Produce intangibles*            | Produce intangibles                                                                                     | Own definition                                                             |
| Produce physical products*      | Produce physical products                                                                                 | Own definition                                                             |
| Produce as point of sales       | Make physical products become sites of digital sales and marketing services that the customer consumes directly at the product or indirectly via another device | Fleisch et al. (2014)                                                    |
| Product sales                   | Sell a product for a fixed price                                                                         | Hanson and Kalyanam (2007), Rappa (2001)                                 |
| Production*                     | Produce a certain offering or produce it in a certain way                                               | Own definition                                                             |
| Quality selling                 | Attract customers with high quality and / or hard to find products or services for premium prices        | Hanson and Kalyanam (2007), Linder and Cantrell (2000)                     |
| R&D contractor                  | This type of firm is fully engaged in technology development in essence, building prototypes. Furthermore, these R&D contractors provide consulting services in highly technical subjects. | Libaers et al. (2010)                                                    |
| Razors/ blades                  | Offer a cheap or free basic product (“razors”) together with complements (“blades”) that are overpriced and thereby subsidize the basic product | Gassmann et al. (2014), Johnson (2010), Linder and Cantrell (2000)          |
| Reliable commodity operations   | Provide predictable commodity products or services for which customers are willing to pay a small premium, as they are reliable | Gassmann et al. (2014), Linder and Cantrell (2000)                        |
| Remote usage and condition monitoring | Equip products with digital technologies that allow to detect errors preventatively and monitor usage | Fleisch et al. (2014)                                                    |
| Rent instead of buy             | Temporarily lend a product to the customer and charge a rent                                            | Gassmann et al. (2014), Johnson (2010), Rappa (2001)                      |
| Revenue sharing                 | Share the revenues with other companies in order to create a symbiotic relationship                     | Gassmann et al. (2014), Hanson and Kalyanam (2007), Rappa (2001)          |
| Revenue stream*                 | Use a specific revenue stream                                                                           | Own definition                                                             |
| Reverse auction                 | Set a ceiling price for a product or service and have participants bid the price down                    | Bienstock et al. (2002), Johnson (2010)                                  |
| Reverse engineering             | Break down a product of competitors into its components and use this information to build a comparable product | Gassmann et al. (2014)                                                    |
| Reverse innovation              |                                                                                                       | Gassmann et al. (2014)                                                    |
| Pattern                      | Definition                                                                 | References                                                                 |
|------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| Reverse razors/ blades       | Offer an expensive basic product (“razors”) that allows for usage of cheap or even free complements (“blades”) | Johnson (2010)                                                              |
| Risk sharing                 | Waive standard fees or costs if certain metrics are not achieved, but receive outsized gains when they are | Tuff and Wunker (2010)                                                      |
| Robin Hood                   | Charge wealthy customers more than poorer customers for a products or service | Gassmann et al. (2014)                                                      |
| Scaled transactions          | Maximize margins by pursuing high-volume, large-scale transactions when unit costs are relatively fixed | Tuff and Wunker (2010)                                                      |
| Search agent                 | Search out the price and availability for a good service specified by the buyer | Rappa (2001)                                                                |
| Self-service                 | Delegate a part of the value chain to the client                            | Gassmann et al. (2014)                                                      |
| Sell at low prices*          | Offer your value proposition with low prices                               | Own definition                                                              |
| Selling experience           | Offer new experiences through participation in a community, often virtually  | Clemens (2009)                                                              |
| Selling online services      | Offer to use software services online                                       | Clemens (2009)                                                              |
| Sensor as a service          | Collect, process, and sell sensor data for a fee                           | Fleisch et al. (2014)                                                      |
| Serve convenience seekers*   | Target customers valuing convenience over all other attributes              | Own definition                                                              |
| Service-wrapped commodity    | Distinguish commodity products by services that are added                   | Linder and Cantrell (2000)                                                  |
| Servitization of products    | Sell ongoing services in addition to the product or even sell the service the product performs rather than the product | Johnson (2010)                                                              |
| Shared infrastructure        | Share a common infrastructure among several competitors                     | Weill and Vitale (2001)                                                     |
| Shop*                        | Offer your value proposition with a shop                                    | Own definition                                                              |
| Shop-in-shop                 | Build a store within another store                                          | Gassmann et al. (2014)                                                      |
| Software firms               | Create software and license/ sell it                                       | Applegate (2001)                                                            |
| Solution provider            | Provide a full range of services in one domain directly and via allies and attempt to own the primary consumer relationship | Gassmann et al. (2014), Linder and Cantrell (2000), Weill and Vitale (2001) |
| Subscription                 | Continuously provide customers with products or services and regularly charge upfront fees | Gassmann et al. (2014), Hanson and Kalyanam (2007), Johnson (2010), Rappa (2001), Tuff and Wunker (2010) |
| Supermarket                  | Offer a large variety of products at a low price                            | Gassmann et al. (2014), Linder and Cantrell (2000) |
| Supply chain management      | Connect suppliers and distribution channels more closely                    | Strauss and Frost (2016)                                                    |
| Target the poor              | Focus on the bottom-tier clients of the income pyramid and sell a large number of cheap products with low margin | Gassmann et al. (2014)                                                      |
| Transaction service and exchange intermediation | Provide integrated portal to coordinate complex transactions among involved several parties for spot markets | Hartmann et al. (2016), Linder and Cantrell (2000) |
| Trash-to-cash                | Reuse already used products                                                 | Gassmann et al. (2014)                                                      |
| Trust intermediary           | Provide a third-party payment mechanism for buyers and sellers to settle a transaction | Hartmann et al. (2016), Rappa (2001)                                        |
| Trust services               | Establish membership associations that abide by an explicit code of conduct, and in which members pay a subscription fee | Rappa (2001)                                                                |
| Trusted product leadership   | Develop long-lasting product platform architectures to create a non-disruptive product upgrade path for locked-in customers | Linder and Cantrell (2000)                                                  |
| Ultimate luxury              | Focus on selling to the top-tier customers of the income pyramid            | Gassmann et al. (2014)                                                      |
| Under the umbrella pricing   | Under-price the market leader and use marketing to convince customers your offerings are equivalent, fast follow in product/ service development | Linder and Cantrell (2000)                                                  |
| Usage fee*                   | Customers' payments depend on a certain variable of the usage               | Own definition                                                              |
| User designed                | Customers invent products that afterwards are produced by the company       | Gassmann et al. (2014)                                                      |
| Value chain integrator       | Coordinate activities across the value net by gathering, synthesizing, and distributing information | Timmers (1998), Weill and Vitale (2001)                                      |
|                             |                                                                            | Gassmann et al. (2014), Timmers (1998)                                      |
Table 2 (continued)

| Pattern                                | Definition                                                                 | References |
|----------------------------------------|---------------------------------------------------------------------------|------------|
| Value chain service provider           | Only support parts of the value chain such as logistics or payments – but for several companies |            |
| Value network*                         | Change your value network or the way you interact with it                  | Own definition |
| Value proposition development*         | Develop your offering in a certain way                                     | Own definition |
| Value proposition*                     | Offer certain products or services, or offer them in a certain way          | Own definition |
| Value-added reseller                   | Sell a comprehensive range of undifferentiated products based on value-added services, e.g., through consultative selling, product availability, service, and promotional pricing | Linder and Cantrell (2000) |
| Vertical portals                       | Create a portal that specializes in a particular area and provides very deep content and functionality in this area | Applegate (2001), Clemens (2009) |

Open Access This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made.

References

Abdelkafi, N., Makhotin, S., & Posselt, T. (2013). Business model innovations for electric mobility—What can be learned from existing business model patterns? International Journal of Innovation Management, 17(1), 1340003.

Al-Debei, M. M., & Avison, D. (2010). Developing a unified framework of the business model concept. European Journal of Information Systems, 19(3), 359–376.

Amshoff, B., Dülme, C., Echterfeld, J., & Gausmeier, J. (2015). Business model patterns for disruptive technologies. International Journal of Innovation Management, 19(3), 1540002.

Andrew, J. P., & Sirkin, H. L. (2006). Payback: reaping the rewards of innovation. Boston: Harvard Business Press.

Applegate, L. M. (2001). E-business models: Making sense of the internet business landscape. In G. Dickson & G. DeSanctis (Eds.), Information technology and the Future Enterprise: New Models for Managers (pp. 49–94). Upper Saddle River: Prentice Hall.

Bienstock, C., Gillenson, M., & Sanders, T. (2002). The complete taxonomy of web business models. Quarterly Journal of Electronic Commerce, 3(2), 173–186.

Bock, M., & Wiener, M. (2017). Towards a Taxonomy of Digital Business Models – Conceptual Dimensions and Empirical Illustrations. In Thirty Eighth International Conference on Information Systems, Seoul, South Korea.

Bocken, N. M. P., Short, S. W., Rana, P., & Evans, S. (2014). A literature and practice review to develop sustainable business model archetypes. Journal of Cleaner Production, 65, 42–56.

Böhm, M., Weking, J., Fortunat, F., Müller, S., Welpe, I., & Krar, M. (2017). The business model DNA: Towards an approach for predicting business model success. In 13. Internationalen Tagung Wirtschaftsinformatik (WI 2017) (pp. 1006–1020). St. Gallen, Switzerland.

Bohnsack, R., Pinkse, J., & Kolk, A. (2014). Business models for sustainable technologies: Exploring business model evolution in the case of electric vehicles. Research Policy, 43(2), 284–300.

Bouwman, H., Faber, E., Haaker, T., Kijl, B., & De Reuver, M. (2008). Conceptualizing the STOF model. In H. Bouwman, H. De Vos, & T. Haaker (Eds.), Mobile service innovation and business models (pp. 31–70). Berlin, Heidelberg: Springer.

Casadesus-Masanell, R., & Ricart, J. E. (2010). From strategy to business models and onto tactics. Long Range Planning, 43(2–3), 195–215.

Casadesus-Masanell, R., & Ricart, J. E. (2011). How to design a winning business model. Harvard Business Review, 89(1/2), 1–9.

Chatterjee, S. (2013). Simple rules for designing business models. California Management Review, 55(2), 97–124.

Chesbrough, H. (2010). Business model innovation: Opportunities and barriers. Long Range Planning, 43, 354–363.

Christensen, C. M., Bartman, T., & Van Bever, D. (2016). The hard truth about business model innovation. MIT Sloan Management Review, 59(1), 31–40.

Clemens, E. K. (2009). Business models for monetizing internet applications and web sites: Experience, theory, and predictions. Journal of Management Information Systems, 26(2), 15–41.

D’Aveni, R. A., Dagino, G. B., & Smith, K. G. (2010). The age of temporary advantage. Strategic Management Journal, 31(13), 1371–1385.

De Reuver, M., Bouwman, H., & Maclnnes, I. (2009). Business model dynamics: A case survey. Journal of Theoretical and Applied Electronic Commerce Research, 4(1), 1–11.

de Reuver, M., Bouwman, H., & Haaker, T. (2013). Business model Roadmapping: A practical approach to come from an existing to a desired business model. International Journal of Innovation Management, 17(1), 1340006.

Dunn, J. C. (1974). Well-separated clusters and optimal fuzzy partitions. Journal of Cybernetics, 4(1), 95–104.

Eickhoff, M., Muntermann, J., & Weinrich, T. (2017). What do FinTechs actually do? A Taxonomy of FinTech Business Models. In Thirty Eighth International Conference on Information Systems (ICIS 2017), Seoul, South Korea.

Eisenmann, T. R. (2001). Internet business models: Text and cases. Boston: Irwin/McGraw-Hill.

El Sawy, O. A., & Pereira, F. (2013). Business modelling in the dynamic digital space: An ecosystem approach (Vol. 1, SpringerBriefs in digital spaces). Heidelberg: Springer-Verlag.

Fliet, E. (2013). Conceptualising business models: Definitions, frameworks and classifications. Journal of Business Models, 1(1), 85–105.

Fleisch, E., Weinberger, M., & Wortmann, F. (2014). Business models and the internet of things. White Paper (pp. 1–19): Universität St. Gallen, Bosch Internet of Things & Services Lab.
Tuff, G., & Wunker, S. (2010). Beacons for business model innovation. In Doblin, Deloitte Consulting LLP. Chicago, USA.

Upward, A., & Jones, P. (2016). An ontology for strongly sustainable business models: Defining an enterprise framework compatible with natural and social science. Organization & Environment, 29(1), 97–123.

Veit, D., Clemons, E., Benlian, A., Buxmann, P., Hess, T., Kundisch, D., Leimeister, J. M., Loos, P., & Spann, M. (2014). Business models - an information systems research agenda. Business & Information Systems Engineering, 6(1), 45–53.

Webster, J., & Watson, R. T. (2002). Analyzing the Past to Prepare for the Future: Writing a Literature Review. MIS Quarterly, 26, xiii-xxiii.

Weill, P., & Vitale, M. (2001). Place to space: Migrating to e-business models. Boston: Harvard Business School Press.

Weill, P., Malone, T. W., D’Urso, V. T., Herman, G., & Woerner, S. (2005). Do some business models perform better than others? A study of the 1000 largest US firms. MIT Center for coordination science working paper, 226.

Weill, P., Malone, T. W., & Apel, T. G. (2011). The business models investors prefer. MIT Sloan Management Review, 52(4), 16–20.

Publisher’s Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.