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EDITORIAL: Introduction to the Special Issue Based on Papers Presented at the Business Model Conference 2022

Marco Montemari[1], Associate Editor

The Business Model Conference 2022, held at the University of Lille in early June, provided members of the academic community with an excellent opportunity to discuss the latest research, innovative teaching methods, and best practices in business model research.

Approximately 100 academics and practitioners from multiple disciplines attended the conference, at which 62 papers were presented. Four influential keynote speakers inspired and challenged the participants—Professor Oliver Gassmann (University of St. Gallen), Professor Stefan Haefliger (Bayes Business School), Professor Ivanka Visnjic (Esade Business School), and Professor Wim Vanhaverbeke (University of Antwerp). The conference was further enriched by a PhD colloquium and a teaching forum.

The PhD colloquium, organized by Professor Xavier Lecocq and Professor Benoit Demil, provided doctoral students with an overview of the challenges associated with business model research. The colloquium also offered the students a valuable opportunity to present and discuss their research with distinguished international academics.

The teaching forum was organized by Professor Anna B. Holm and Professor Christina Bidmon with the aim of introducing participants to innovative teaching formats and best practices in business model teaching.

The Scientific Committee engaged in intense activity both before and after the conference. In the months preceding the conference, it reviewed all the papers submitted for possible presentation to ensure a high standard. The selected papers were subsequently organized into 16 streams — Challenges and Decision Making; Creativity; Data-driven dimension; Digitalization 1; Digitalization 2; Ecosystems; Entrepreneurship; Hybrid business models; Implementation and measurement; Innovation 1; Innovation 2; Resilience and flexibility; Sector-related challenges; Social dimension; Sustainability 1; and Sustainability 2.

After the conference, the Scientific Committee selected the seven papers that are included in this special issue of the *Journal of Business Models*. The selection process was guided by the three criteria of originality, significance, and rigor, leading to an assemblage of papers that address business model issues from various perspectives and through the application of different research methods. Here, I shall briefly introduce these papers, focusing primarily on their respective objectives and contributions.

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Bourkha addresses the concept of intra-industry business model imitation by clarifying its meaning and content and distinguishing different types of imitation of this nature. Drawing on existing literature, the author identifies four business model imitation types: (1) the perfect imitation, where all the components of a competitor's business model are imitated; (2) the value proposition-focused imitation, which implies an imitation at the level of the value proposition component of a competitor's business model; (3) the organizational-focused imitation that occurs when a company organizes its activities in the same way as a competitor; and (4) the resources-focused imitation, which involves imitating the competitor's resources and competences.

Papanikolaou, Angelis, and Moustakis analyze the nature and characteristics of a business model that aligns with the attributes of distributed ledger technology (DLT). In particular, the authors demonstrate that existing business model configurations (network-based business models, digital business models, and information business models) partially fit the characteristics of DLT given that existing business model configurations do not consider certain critical DLT parameters. The authors thus highlight the conditions that should be addressed when designing a DLT business model, thus underscoring how the following aspects should be managed within this configuration of business model: the relationship between actors who co-exist within the DLT ecosystem; the dimension of trust; the power dynamics between actors; and the value of data ownership.

Montakhabi investigates the factors that render a business model (un)investable by exploring the reasons behind venture capitalists' decisions to reject entrepreneurs' proposals. Taking cases that had been rejected from the American *Shark Tank* TV show as secondary data, the author identifies several motivations for rejection from the investors' perspective. In particular, barriers to investment may be related to the business' ownership structure, ownership profile, non-scalability, or replicability, among other factors. The study advances our understanding of how successful ideas might be better evaluated and generated and sheds light on the pitfalls that entrepreneurs should avoid when presenting business models to venture capitalists.

Van de Ven, Lara Machado, Athanasopoulou, Aysolmaz, and Türetken take as their starting point the consideration that the existing literature fails to offer a complete picture of the performance indicators that may be used to evaluate business models and monitor their performance. The authors conducted a semi-systematic literature review to determine which performance indicators the business model literature refers to. The catalogue compiled in the paper comprises 215 performance indicators categorized according to four pillars (frontstage, backstage, profit formula, and environment) and 12 dimensions (including channel performance, customer relationships performance, and value proposition performance, for example) relevant to business models. In addition to providing an overview of the current state of research on this topic, the authors also identify possible avenues for further research.

Havemo's paper lies at the intersection of business model innovation, sustainability, and visual thinking. In particular, the author develops a framework of sustainable trajectories for business model innovation using visualization techniques. The author identifies four different logics pertaining to how value creation may be conceptualized within a business model (classification logic, transactive logic, circular logic, and process logic) and integrates sustainable trajectories in these different logics — that is, mechanisms that may support the business model in achieving a higher level of sustainability. In so doing, the paper offers a more nuanced and detailed view of sustainability by highlighting that this phenomenon might unfold differently and follow different trajectories depending on the model's conceptualization and value creation adopted.

Mohamed, Ahokangas, and Pikkarainen explore the context of multi-platform ecosystems (MPEs), which are multiple platforms integrated with the aim of creating and capturing value together through coopetition. While previous research has focused on incumbent platforms, the paper explores how entrant platforms configure their business models to endorse coopetition with incumbents in MPEs.

Using a single in-depth case study of an MPE operating in the healthcare sector, the authors illustrate how entrant platforms adapt their business models to integrate into MPEs by means of a series of actions: they flexibly align their business model with the complementarity requirements that the incumbents specify; they combine inter- and intra-platform collaborative dynamics in their business models; and they build on coopetition with incumbents.

Ghoreishi begins with the assumption that data is considered an essential enabler of the circular economy given its potential to support decisions on resource usage, product design, or recirculation of materials. Despite this, only a limited number of studies have examined the role of digital technologies in circular business models. The author thus conducts a systematic literature review to identify the existing data-driven business models in the circular economy. The catalogue presented in the paper includes six different configurations of business models capable of leveraging data to enhance circularity (e.g., digital remanufacturing business model, digital recycling business model). The paper defines each configuration and clarifies the role that data play in the circular economy. In addition to providing an overview of the current state of research on this topic, the author also identifies potential avenues for further research.

This special issue is composed of *short* papers, an innovative publication format designed to fast-track the publishing process and thereby accelerate the development of business model research. This objective has been achieved thanks to the lean template and standardized content that ensures that the authors focus on a single clear message. Contributors are reminded that they are strongly encouraged to develop their submissions into full-length papers, which may be submitted to the *Journal of Business Models* or suitable alternative outlets.

In conclusion, I am confident that the reader will find the short papers included herein valuable. I have been a member of the Scientific Committee of the Business Model Conference since its launch, and it has provided me with the ongoing opportunity to remain abreast of the various directions in which business model researchers have focused their efforts. This is indeed a privilege.

I would like to thank all the members of the Scientific Committee, who have contributed time and effort to reviewing the papers submitted for presentation at the conference as well as the process of selecting the papers included in this special issue. My heartfelt gratitude goes to Professor Robin Roslender and Professor Christian Nielsen for their support during the production of this special issue and to Mette Hjorth Rasmussen for her excellent, conscientious editorial assistance.

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Business Model Imitation: Definition and Typology

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Abstract

The concept of Business Model Imitation (BMIm) has not been developed adequately in the strategic management field, even though it has been recently used extensively by researchers. This gives us impetus to propose a definition of BMIm highlighting the distinction between several types of BMIm. On the basis of such an outlook, we will clarify the ambiguities in the literature related to this concept showing that imitating a competitor's Business Model (BM) does not necessarily mean imitating all the components of a BM.

Introduction

The Business Model (BM) literature agrees on the importance of BM Innovation (BMI) for value-creating companies (Wirtz et al., 2016). The BMI allows to create new markets (Kim and Mauborgne, 1999), competitive advantages (Johansen and Abrahamsson, 2014), and construct a new product or concept (Johnson, 2010). However, recent conducted research has demonstrated that BMI is not the only path to success in an industry. For example, Enkel and Mezger (2013) pointed out in their study that 60% of young German entrepreneurs use Business Model Imitation (BMIm) by imitating successful existing BMs in other industries. Another recent contribution showed that firms operating in the same organizational field apply relatively similar BM configurations (Montemari et al., 2022).

In recent years, the BM literature has begun to give special attention to the issue of BMIm. It therefore focuses on two forms of BMIm, the first of which is to imitate the successful BM of an organization in a different industry (Enkel and Mezger, 2013; Frankenberger and Stam, 2020), and the second is to imitate a BM of an organization present in the same industry (Frankenberger and Stam, 2020; Montemari et al., 2022). Our research is part of

Key words: Imitation, Business model, Business model imitation

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this intra-industry form, but with a particular focus placed upon competing firms, as the industry can include suppliers and customers in the case of business-to-business markets, which we call "competitive intra-industry imitation".

Montemari et al. (2022) proved that firms mainly imitate the BMs of their main competitors in the global industry and in their specific sub-groups. Bourkha et al. (2015) proposed the different forms of BMIm reaction after a new BM in a competitive market. This pioneering research in this intra-industry imitation BM does not distinguish between the different types of BMIm and generally focuses on the imitation of the value component of a BM while imitation can affect other components such as resources and organization. Given these theoretical gaps, this study aims to improve the theoretical understanding of BMIm through the proposal of a definition and the different types of "intra-industry competitive imitation".

In this article, we assume that imitation does not always consist of copying competitors' practices, but can rather take a more or less creative form which is difficult to distinguish from incremental type innovation (Dosi, 1988). This qualification is very close to what Bourkha (2019) has called "imovation", an English concept introduced by Shenker in 2010 that put much emphasis on a particular type of companies in a competitive market. These are firms that cannot innovate for a number of reasons and do not wish to be perceived as imitator organizations. According to this logic the imitator adopts the idea but with a different result and allows to respond to a different segment or even create new segments (Bourkha and Demil, 2016).

To theoretically answer our research question, we began by identifying the studies that have dealt with competitive imitation. Then, we classified them by the object imitated in order to identify whether it is an imitation of value, of resources or of organization. For this reason, we used the RCOV model of Lecocq et al. (2006), which is an analysis grid that allows us to delimit the contours of the BM. Each company is thus defined according to the three main components Resources and Competences (RC), Organization (O) and Value propositions (V). This analytical framework helps to circumscribe our object of study in a rigorous and systematic way.

Using the RCOV Model as a Framing Device for Business Model Imitation

The BM is a fuzzy concept (Porter, 2001). This famous criticism has urged the defenders of the BM to prove its pertinence in creating, delivering and capturing value (Amit and Zott, 2001; Lecocq et al., 2006). Our objective is not to defend or criticize the concept of the BM but to study it from an imitative perspective through the mobilization of the "RCOV" model (Lecocq et al., 2006). The famous BM "RCOV" is composed of three elements: (1) Resources and Competencies, (2) Organization and (3) Value propositions.

The basic hypothesis of the RCOV model is that a company builds its BM by clarifying how a company organizes itself to exploit resources and competencies to provide products and services to the market (value proposition). Organization refers to the organizational choices which a company makes in its value chain and the relationships with its suppliers, competitors and the state (external stakeholders) to exploit its resources and competencies which are the assets of a company. Resources can be developed internally or acquired externally, while competencies refer to the capabilities and knowledge developed to drive the services that resources can offer. Finally, value propositions are delivered to customers in the form of products and services.

We have chosen to use this model because it appears appropriate in several respects. First, this model offers a satisfactory compromise between the level of detail and simplification, allowing thus to highlight the essential and simple characteristics of the value creation logic of a company (Moyon and Lecocq, 2014). This is an advantage which assists in identifying the similarity between BMI and BMIm, and delineating which BM elements are imitated. Second, the pertinence of the RCOV model resides in its ability to be flexible, in that it can be applied to a variety of firms from both traditional and e-business sectors (Bourkha et al., 2015), an attribution allowing us

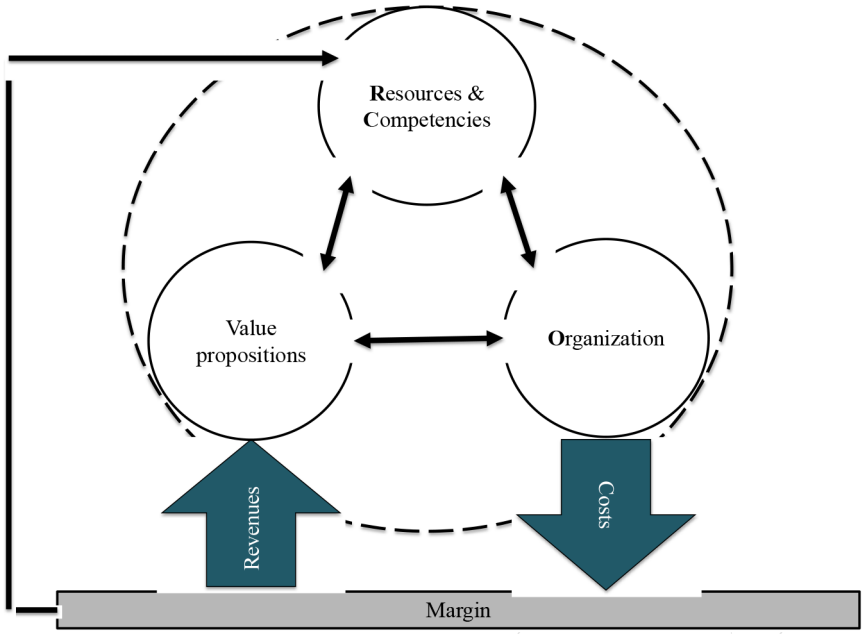


Figure 1: BM Elements Representation (Lecocq et al., 2006, p. 234)

to analyzie the BIMm typologies that we will subsequently propose. Third, the RCOV model is a dynamic analysis tool in opposition to the linear representations proposed in the literature (Demil and Lecocq, 2010), which enables us to assume that the imitation of a BM may involve only one or two elements and not necessarily all of the elements.

Typologies of "intra-industry competitive" BM Imitation

Wanasika and Conner (2011) summarized the different forms of imitation which we noticed in the literature. The authors distinguish between two types of imitation, strategic imitation and tactical imitation. Strategic imitation involves the commitment of substantial resources and long-term strategies to match the strategic actions of the innovator, while tactical imitation is often short term and consists of copying actions that do not involve a substantial commitment. This contribution opens up the debate on what a company can imitate in a market. Recently, the imitation of a BM has been extensively debated by authors like Otuya (2018) who qualifies imitation as the willingness of a company to replicate the successful BM of a competitor. He holds the idea that the imitator is not whatsoever limited to imitating the value (product), but also the process of creating this value as well, a view which is similarly corroborated by Montemari et al. (2022).

Finally, like products and processes, new BMs are difficult to protect from imitation as Casadesus-Masanell and Zhu (2013) maintain, justifying their view with the case of British Airways, which launched "Go", a BM similar to that of Ryanair. The latter is also imitated by several high-end companies such as Air France, which launched its low-cost subsidiary Transavia. This same line of argument is espoused by Bourkha et al. (2015) who highlighted the imitative reactions of French telecom operators after the launch of FREE mobile.

The absence of strong legal barriers to protect a BM presents a source of motivation for imitators in competitive markets. . The researchers called the imitation of a BM the "Business Model Copycats", expounding that entrepreneurs prefer to imitate existing BMs when they do not want to innovate (Fu and Tietz, 2019).

Consequently, using the line of argument of Haunschild (1993), we define inter-organizational

imitation of a BM by the following sequence: at time (t), a first organization adopts a new BM, after x time (t+x), a second organization adopts a BM composed of at least one same component (R&C, and/or O and/or V) of the first BM. When both organizations operate in the same competitive market, we call it "competitive imitation of a BM".

Based on our definition put forward above and the mobilization of the RCOV model (Lecocq et al., 2006), we propose four types of BMIm: (1) the perfect BMIm where all the components of a competitor's BM are imitated; (2) the "value proposition-focused BM imitation" which implies an imitation at the level of the "Value Proposition" component of a competitor's BM; (3) the "organizational-focused BM imitation" when a firm organizes its internal and extreme activities in the same way as a competitor; and (4) the "resources-focused BM imitation" when it is an imitation at the level of the BM's RCs. We develop below the last 3 types and we consider the first one as the sum of the last 3.

Value proposition-focused BM imitation

The "V" component of a BM is often debated based on its definition (Johnson et al., 2008). Researchers tend to associate value only with the supply side (Hedman and Kalling, 2001). This limited view of the value proposition in a BM makes it clear that firms can easily control the value of their competitors. The offerings are present in the market and competitors can collect information about the products easily; they can even procure a copy. Therefore, in this case we move from the imitation of a BM to the imitation of a product. Nevertheless, we consider that in this form of BMIm, the companies can deliver on a market the same offer as the competitors with the optimization of its own resources and competences which we suppose different from the innovative company. The organization of resources/competences of the imitator is also different from the organization of resources/competences of the innovator.

In another completely different view, some researchers prefer a general view (Warnier et al.,

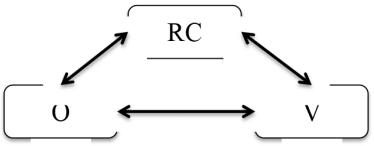
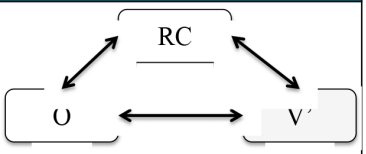
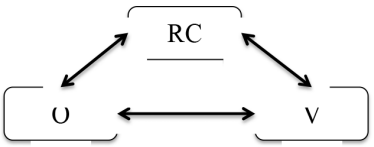
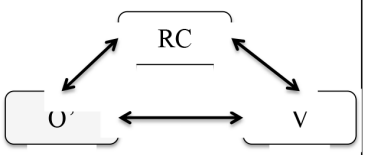
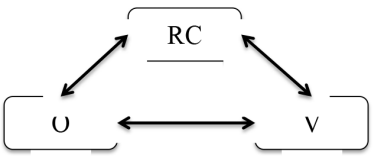
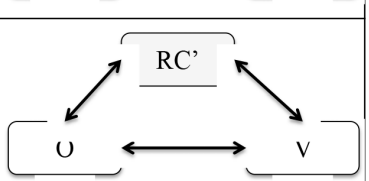
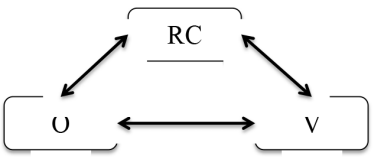
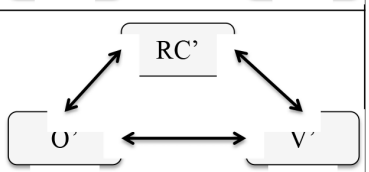
BMIm Typology	Representation	
	New BM	BM Imitation
Value proposition-focused BM imitation		
Organizational-focused BM imitation		
Resources-focused BM imitation		
Perfect BMIm		

Figure 2: BM Imitation typology

2016) that encompasses several axes such as customer benefits (Hamel, 2000), customer segment (Osterwalder, 2004), revenue model and margin model (Johnson et al., 2008b), and price (Afuah and Tucci, 2001). This, in turn, expands the object to be imitated in a competitor's value proposition. In other words, in this case, the imitator must answer the question, "what value to imitate?".

Imitation of a "Value" is the most noted type in the imitation literature. Srinivasan et al. (2007) showed that the launch of camcorders in the United States can be explained by the existence of imitative behavior. Bourkha and Demil (2016) have also observed this behavior in Moroccan bank card market. They suggested that banks may imitate the product or even attack a new segment. Compared to competitors, imitator firms with their different resources and skills and a different way of organizing themselves seek to create the same value as competitors. This value can be enhanced in some cases by the imitator by further creating certain value attributes. For example, Lee and Zhou (2012) noted that creative imitation of a competitors' product contributes significantly to the imitator's financial performance. Similarly, Posen et al. (2013) found that imperfect imitation can generate surprisingly good results for follower firms, even better than the results they may get if they were perfect imitators.

Organizational-focused BM imitation

The organizational dimension of the BM is associated with several elements such as the internal configuration (Hamel, 2000; Chesbrough and Rosenbloom, 2002; Osterwalder, 2004), building partnerships (Osterwalder, 2004; Johnson et al., 2008), a value-creating organizational structure (Alt and Zimmermann, 2001), the relationship developed with customers (Hamel, 2000; Osterwalder, 2004), and the set of organizational processes for making decisions concerning a specific activity (Alt and Zimmermann, 2001; Johnson et al., 2008). We have identified in the literature on imitation objects such as those associated with this organizational dimension that we develop below.

Beyond product imitation, Henisz and Delios (2001) were the first to associate imitation with an organizational level. The authors noted that less experienced Japanese multinationals in the same industry imitate the internationalization strategies of their competitors. This contribution is also suggested by Sirmon et al. (2008) who found that imitation also explains the decision to invest in R&D to innovate.

Resources-focused BM imitation

Resources and competencies are considered essential components of the BM (Seelos and Mair, 2007). Resources are assets available to a firm and can take several forms: property rights (Chesbrough and Rosenbloom, 2002), brand image (Dahan et al., 2010), personnel (Johnson et al., 2008). Moreover, competences are the result of the integration of these resources in addition to individual and collective know-how (Warnier et al., 2016).

Much has been written about the importance of resources and competencies in a BM. The literature, using the work of Barney (1991), agrees that strategic resources are difficult to imitate, while ordinary resources (Weppe et al., 2013) are valuable but not scarce, imitable, and substitutable in the sense of Barney (1991). We refer to this BMIm as a strategic type that can take several forms depending on similarity between the innovator's resources and the imitator's resources.

Conclusion

This present study introduces important contributions to the research concerned with BMIm and competitive imitation. First, it is the first to propose the different types of intra-industry BM imitation. Previous research in this area has emphasized the importance of imitation in developing a BM (Fu and Tietz, 2019; Montemari et al., 2022). Others researchers have also illustrated the importance of imitation like a competitive reaction to a BMI in a competitive market (Bourkha et al., 2015). However, previous research has not clarified the concept of BM Imitation and its typologies. This paper addresses this theorical gap in both the BM literature and imitation literature. In doing so, we hope to pave the way for more systematic research on the role of imitation in BM conception and on the

success of the different types of BMIm proposed in the paper.

The second contribution regards the research on competitive imitation, although there are undeniably different works examining several imitated objects like product (Srinivasan et al., 2007), internationalization decision (Henisz and Elios, 2001), alliances (Garcia-Pont and Nohria, 2002), diversification (Vermeulen and Wang, 2005) and organizational innovation (Anderson and Semadeni, 2010). We see that our study contributes to this stream of literature by clarifying when the BM becomes an object of imitation in a competitive industry. Additionally, our research is in congruence with recent work held on imitation assuming that the latter can be a source of differentiation (Posen et al., 2013; Bourkha and Demil, 2016; Bourkha, 2019).

Still, our present contribution is not immune to some shortcomings opening up new horizons for further research. First, our views are purely theoretical which enables us to develop sound thinking about BMIm, but empirical research remains a necessity to confirm the typology proposed in this paper. Moreover, further research could explore the advantages and disadvantages of each form of BMIm proposed in the paper as well as the challenges related to the implementation of each form. Following along these lines, future studies could examine the type of BMIm that performs best in a competitive industry. Second, this paper proposes a typology based on a content-based approach, although mobilizing the process approach to explore the question of how to imitate a BMI is an interesting research area. Third, this study suffers from a defect relative to its ability to classify imitation though we have made it clear from the outset that we are not only dealing with perfect imitation but also imperfect imitation. Further research is needed to broaden the typology proposed in this paper or to develop finer types of BMIm.

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Unique or Adjustable Business Model for Distributed Ledger Technology?

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Abstract

We examine whether business model concepts, that demonstrate significant convergence to Distributed Ledger Technology (DLT) attributes, fit to DLT ecosystem characteristics and identify similarities and deflections. We answer the question whether the appropriate DLT business model is totally unique or adjustable and what conditions need to be met. The study follows a conceptual approach that is based on critical examination of three business model types that demonstrate similarities to the business model that an organization needs to adopt in order to fit in DLT ecosystem characteristics. Although each one of the network, digital and information business model types demonstrate similarities to DLT business model and reveal some resemblance with it, there are critical parameters that are neither addressed nor partially met. The main contribution of study is the exploration of the adjustable nature of the DLT business. Moreover, we highlighted the challenge for DLT ecosystem sustainability, defined and reviewed the conditions that need to be considered for DLT business model design.

Introduction

Technology itself has no singe objective value. When it is commercialized in some way by a business model, then its economic value becomes apparent (Chesbrough, 2010). Trust among interacting parties and data openness lie in the center of Distributed Ledger Technology (DLT) innovation, which promises disintermediation, transparency and visibility through a new decentralized way of information processing and sharing (Kuhn, Yaga, Voas, 2019). DLT, such as blockchain, creates attractive opportunities, since

Key words: Blockchain; business ecosystem; business model

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it changes the way that organizations interact, exchange information and create value (Van Rijmenam, 2019). There is a clear potential of DLT adoption but it has to make fit to the business model.

Business model can be exemplified as an activity system (Amit and Zott, 2012) conducted to address the customer, the value proposition, the organizational architecture and the economic dimensions (Fielt, 2013). Due to DLT traits and benefits that it brings at transactional level, such as disintermediation, transparency, data security, traceability and visibility triggered by near real time access to trusted information without the need of intermediaries and the significant impact that it has in ecosystem value generation, we recognize the need for either business model change or innovation to high level address all four business model basic notions mentioned earlier. DLT brings fundamental changes in the way that value is exchanged, the way the transactions that are executed among ecosystem actors, that way that ecosystems interact, the relationships among ecosystem actors and the way that resources and capabilities change based on capture of new knowledge.

This study seeks to explore the potential uniqueness of DLT business model investigating whether existing typologies fully address DLT business model features. Due to DLT characteristics we will emphasize DLT network facet and the dynamic character of the respective DLT business ecosystem. Our study provides scholars an insight into how the extant business model literature addresses the traits of the DLT conceptualization and to what extent it fits to DLT business model semantics. It allows managers to identify to what extent the business model types that seem to be closer to DLT business model conceptualization fit to DLT business morphology. Literature focuses into the technical aspect of technology and little research has been done on how DLT fits to the respective business model. Literature that addresses business model and business model innovation mainly focuses on DLT benefits that impact business model redesign needs, such as those addressed through operational capabilities that can be supported by blockchain (Li, Xue, Li and Ivanov, 2022; Morkunas, Paschen, and Boon, 2019). Other studies focus on the adoption of blockchain and what it means in terms of triggering business model innovation (Purusottama, Simatupang & Sunitiyoso, 2022; Tiscini, Testarmata, Ciaburri, and Ferrari, 2020). Archetypal patterns of business models levering blockchain technology investigate how blockchain impacts the main pillars of business model literature, meaning value creation, value creation, value propositions (Weking, Mandalenakis, Hein,et al. 2020; Tönnissen, Beinke, and Teuteberg, 2020).

To answer the question of whether the DLT business model is totally unique or adjustable, we need to address the conditions that stem from a sustainable DLT business ecosystem. A business model answers the question of how the benefits, driven by DLT adoption, flow back into the company in the form of revenue (Schlecht, Schneider and Buchwald, 2021). It does not assess the attractiveness of the opportunity. While we intensively related to business model literature, we did not use a systematic literature review into business model definitions. Business models have always been discussed and described in the context of the organizational concepts of value creation and design (Bock and Gerard, 2018). The organizational design aspect is defined by the interconnected and interdependent activities of each business DLT ecosystem actor and its directly related with the business model value logic. In a DLT business ecosystem the 'how' dimension of an organization's value logic is clearly designated by the organizational and ecosystem architecture. The 'why' dimension of the value creation, is associated with the realization of network effects in the ecosystem. In short, a business model creates and captures value (Chesbrough, 2007). The latter, for an organization that adopts DLT, is related with the information flow under a data-as-an-asset perception, that supports and reinforces the competitive advantage of the company.

What is DLT and How it Works

DLT allows multiple parties to add cryptographically protected transactions to the ledger in an immutable way that promises decentralization. In short, when digitally signed transactions are posted to the ledger, competing nodes need to approve them and after their validity is verified group them into a block. The

blocks are totally ordered, hence preventing a block from being appended if it contains transactions that conflict with transactions of the previous block (Mohan, 2019). The latter along with the fact that each DLT network member holds a copy of the shared ledger promise decentralization and immutability in the peer-to-peer network created. Decentralization is achieved since the block is broadcasted into the network using the consensus mechanism that, has been initially defined based on the DLT architecture. Consensus mechanism is a vital characteristic of DLT architecture, since it represents the method used by network members to reach agreement on whether the information transmitted can be committed to the extant chain of blocks (Zhang, Xui and Liu, 2020). DLT evolution introduced the idea of smart contracts and the development of decentralized applications (dApps), that extend the areas of DLT adoption through the new capabilities they promise. The former refers to the idea of a programmable DLT, where a computer program code stored in DLT blocks is self-executed when predetermined terms and conditions are met (Salviotti et al. ,2018).

Due to the inherent characteristics of the DLT, in respect to its network facet and the network effects created, we approve a business ecosystem approach for our research. Similar to the business ecosystem set up, DLT actors create value for actors, while at the same time they maintain their roles in the ecosystem and their loose interconnection. The business ecosystem approach that needs be conceptualized for a DLT network of interacting actors is also supported by the fact that in both formats the large number of interconnected participants and their interdependence for their mutual survival are among their foremost key characteristics (Iansiti and Levien, 2004). Network effects are created in the DLT network, meaning that the more ecosystem actors, the higher the benefits perceived for each individual in the system and the higher the value created by the system define the DLT network facet. The latter is vital for DLT ecosystem sustainability, since DLT ecosystem expansion is crucial for the security of the network (Mohan, 2019).

The more the actors that adopt DLT and interact, the more value perceived by each individual and the higher the value created by the system. In turn this incentivizes more actors to join the network and therefore the network effects created fuel the expansion of the ecosystem (Shapiro and Varian, 1999). Niche players, as referred in business ecosystem literature (Moore 1993; Cusumano and Gawer, 2002), constitute the group of actors that do not hold a dominant position in the ecosystem, neither control the maximum number of nodes in it, nor aim for leadership by regulating it. However, their participation is critical for the ecosystem expansion and consequently its survival and that role is usually delivered by SMEs that complement the dominant actors in the DLT business ecosystem create the critical mass participants that its preservation and expansion is directly related with DLT ecosystem sustainability.

DLT Business Model Comparison Against Other Business Model Types

To identify the unique or adjustable nature of the DLT business model, we critically examined the business model types that are closer to DLT conceptualization (see Table 1). Due to its specific characteristics of information exchange, access and validation, DLT defines the type of transactions, interactions, relationships of an organization. It eventually affects decisively the value created and exchanged between interacting parties in the ecosystem. It is therefore evident that the networked and information business model types are concepts close to the DLT business model approach. In addition to that, we examined the digital business model concept, compared against the DLT business model perception due to the fundamental role of information technology in both notions.

Why DLT business model is not fully addressed by the networked business model type

In business model literature there are studies that highlight the network perspective of business models. These studies identify the network of actors as an important business model substance (Helander and Rissanen, 2005; Komulainen et al., 2006), which at first sight seems to be a good match to the DLT ecosystem concept. However, network business

Table 1.

Business model types relative to DLT ecosystem and their main attributes		DLT Business Model attributes that differ
Network Business Model	Coordinated cooperation between a finite set of parties that promote long-term strategic cooperation	DLT ecosystem actor relationships can be cooperative, competitive and/or co-opetitive
	Value creation in organization's strategic business net	DLT ecosystem expands beyond the strategic business net of each one of its members
	The scope is to gain or sustain competitive advantage through information access or technology	Information access is a value generator but the objective is not necessarily to gain competitive advantage
Digital Business Model	Platform organizes the wealth creating activities	DLT architecture sets the boundaries of value creating activities but does not organize them
	Customer, value, partner and financial dimensions are imposed by platform characteristics	Value creating system is affected by the platform but is not relied on it
	Enterprises compete digitally with their content, customer experience and digitized platforms	DLT actors do not necessarily compete on any of these traits.
	Supplier, omnichannel, modular producer and ecosystem driver are the business model categories based on a "know-your-customer" perception	Only the platform provider in the DLT ecosystem may fall into one of those categories without the need of "know-your-customer" perception
		Transaction validator actors perform a specific role that is not related to the platform provider business model
	Role of complementors to digital or platform ecosystems	There is not any such equivalent role in the DLT ecosystem
Information Business Model	Explains how information is collected stored and delivered internally and externally	Interconnectedness and interdependency is supported and powered by information system integration but value capture, creation and delivery is only partially defined by the architecture.

Table 1: Comparison of DLT business model attributes against other business models

models describe the way that strategic business nets create value (Palo and Tähtinen, 2011). DLT business ecosystem is not necessarily the coordinated cooperation between a finite set of parties that promote long-term strategic cooperation (Zhou et al. 2022). In DLT business ecosystem, member relationships can be cooperative, competitive and co-opetitive (Carayannis et al., 2018). On the top of that, DLT business ecosystem expansion beyond the strategic business net of each member, is rather a fundamental factor for the ecosystem sustainability (Kwame, Kecheng and Effah, 2019).

Why DLT business model is not fully addressed by the digital business model type

Platforms are considered to be the technological resources that organize the wealth creating activities (Shaughnessy, 2016). An organization that adopts DLT, needs to acknowledge that the technology, meaning the DLT architecture, is vital to ecosystem value creation but it is not the driver of the ecosystem benefits that flow back to the company in the form of revenue. It is the leverage of data, seen as resources, that are considered as a value driver. In digital business models the customer, value, partner and financial dimensions are imposed by the platform characteristics (Schallmo et al., 2017). In a DLT business net, the set of activities that define the value creating system is affected by the platform but is not relied on it (Schlecht, Schneider and Buchwald, 2021). Digital business model frameworks consider that enterprises compete digitally with one or more of three capabilities: their content, customer experience and digitized platforms (Woerner and Weill, 2018). Although this approach can be perfectly applicable to e-business companies, it neither addresses the strategic intent nor can it be considered as measure of effectiveness of any organization that participates in the DLT business network.

Why DLT business model is not fully addressed by the information business model type

Information flow, knowledge management and data management are heavily determined by DLT infrastructure and are factors that promote ecosystem value creation (Lacity and Remko, 2021). However, the effect of the technology itself in DLT ecosystem should not be confused with the information model concept. At company level, the information model explains how information is collected, stored and delivered internally and externally (Korpela et al., 2013). In digital business or other platform ecosystems, the information model is almost equivalent in value to the business model. It would describe how ecosystem members integrate their business processes in information systems. In DLT business ecosystems members' interconnectedness and interdependency is supported and powered by information system integration (Xiwei, Weber, Staples, 2019). Trust created in the ecosystem, data management and knowledge creation prospects drive DLT ecosystem value genesis and share logic, irrespective of the DLT architecture adopted (Moore, 2006).

The Need of a Business Model That Addresses DLT Ecosystem Sustainability

Role changes, volatility in ecosystem member relationships and knowledge genesis form DLT business ecosystem dynamics (Kandiah, and Gossain, 1998). Subsequently, DLT business ecosystems are not static. The business model of a DLT business ecosystem member should be dynamic and constantly evolve. Organizations that join the DLT business ecosystem constantly learn new and better ways of doing things. They are engaged in multiple differentiated relationships and have the prospect to take up different roles (Kandiah, and Gossain, 1998). Dynamic capabilities literature recognizes that the external environment affects learning (Burgelman et al., 2021). At network level, DLT ecosystem dynamics influence learning. New knowledge is created both through problem solving and inter-firm knowledge transfer. Access to data and streamlined information flow are inherent characteristics of DLT, that when adopted lead to knowledge genesis in the ecosystem. On the top of that, DLT ecosystem sustainability depends on true member collaboration. We consider that there are specific DLT business ecosystem attributes and dynamics that foster business model changes for the members that need to sustainably participate in it.

Dimensions of DLT Business Model for Ecosystem Sustainability

To conceptualize the DLT business model we need to consider not only the characteristics that it pertains from the business model concepts closer to it but also realize the dimensions of a sustainable DLT ecosystem. The ecosystem approach and its sustainability aspect are notions inextricably linked with the value created and shared through DLT due to the necessity of positive network effects. We reckon trust, power attitude of actors, value of data ownership and relationship type between ecosystem actors as the conditions for DLT ecosystem sustainability (see Fig. 1).

The dimension of trust

In DLT business ecosystem, trust is established by collaboration, cryptography and some clever code, without the need of trusted intermediaries (Xiwei, Weber, Staples, 2019). Trust should be recognized not only as an outcome but also as a condition, which needs to be evaluated when an organization that adopts DLT forms or reviews its business model (Conway and Garimella, 2020). To preserve the dynamic attribute of DLT business ecosystem, we acknowledge that relationships among actors not only switch between competitive, co-opetitive and cooperative but also that these behavioral shapes coexist in the ecosystem (Yoon, Moon, and Lee, 2022). Based on literature, trust has been found to have positive effects on network performance (Rus, 2005). For small medium-sized enterprise (SME) networks, trust has been proven to be essential for SMEs to become productive and deliver according to their innovation potential (Pittaway et al., 2004). SME participation in DLT ecosystem is vital for its expansion and sustainability. Since they hold the role of non-dominant players, that create the critical mass for ecosystem safety and survival.

Collaboration among ecosystem actors requires some level of minimum trust. Access to undisputable trusted evidence is precisely what DLT supports. We therefore set trust as the basis of the relationships required for an organization to collaborate and also to improve its efficiency (Papanikolaou, Angelis and Moustakis, 2021). Direct evidence, or else direct trust as mentioned in trust literature (Mayer, Davis, Schoorman, 1995), is supported by the decentralized way that data are kept, shared and accessed, without the need of any intermediaries to validate their trustworthiness. Data openness, decentralization, immutability, visibility and transparency promised by the nature of DLT transactions allow previously unknown actors to collaborate and set the basis for many forms of value creation for each individual DLT network member (Angelis and Ribeiro da Silva, 2019). Access of trusted data sets a strong trust base between interacting parties before they

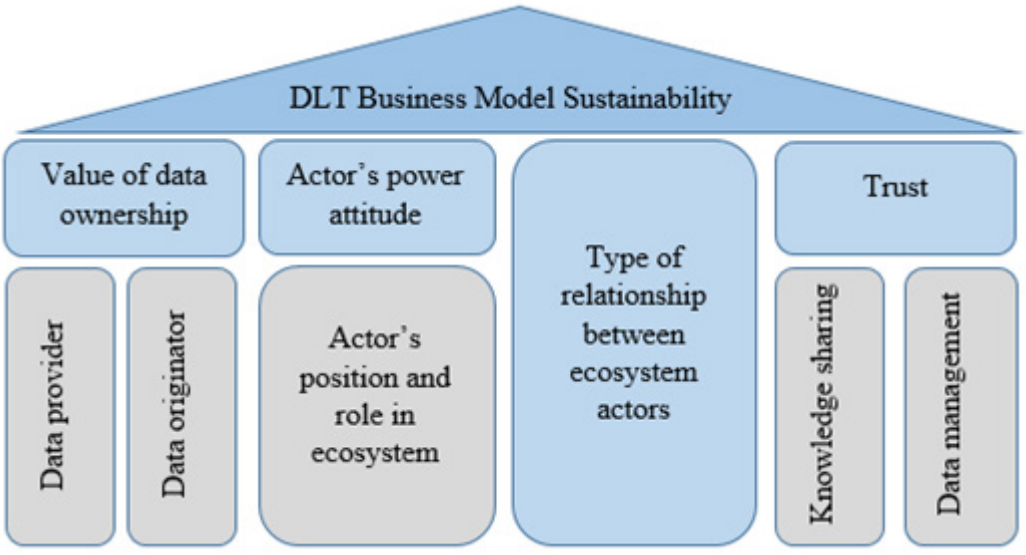

Figure 1: Pillars of DLT business model sustainability

establish their relationship. Moreover, during their interaction, irrespective of the relationship established among interacting parties, visibility and transparency achieved through DLT adoption due to trusted data access has been proven to be closely related both with their performance. The way that data are accessed, the transparency and visibility demonstrated offer DLT network members the perspective to exploit data and create new data driven knowledge. In DLT networks future participants are incentivized both by knowledge creation prospects and access to collaborative knowledge promised to reinforce the validity of their data driven decisions and evolve their capabilities (Papanikolaou, Angelis and Moustakis, 2021). It is therefore obvious that trust among interconnected parties affects mainly the business model value creation aspect, due to advance opportunities for analysis based on trusted data and capabilities reinforcement through new knowledge creation.

The dimension of cooperative relationships between ecosystem actors

The combined effort of businesses, that bring together their values to achieve a common purpose of higher results, includes cooperative relationships between businesses with the same focus (Lundan, 2002). In cooperative relationships ecosystem members act for common purpose and for common benefit. In a cooperative relationship enhanced by trust, the potential for organizations to share their expertise and knowledge for a common purpose and benefit is increased (Ross and LaCroix, 1996). Although literature demonstrates inconsistent findings in respect to whether cooperation is promoted by trust or the other way round (Yamagishi, 2005), it is evident that trust is positively correlated with cooperation (Lewicki et al., 2003). DLT business ecosystem members engaged in a cooperative relationship enjoy trust benefits, which in turn leads to higher level of cooperation. That is more obvious in the early stages of the relationship, where cooperation drives trust (Conway and Garimella, 2020). This specific attribute can be considered as a high value motivational trait for DLT business ecosystem engagement (Conway and Garimella, 2020). Trust boosts ecosystem actor cooperation, since it reduces control, coordination costs, conflict levels and influences knowledge sharing (Mooradian et al., 2006). The latter plays a significant role for DLT business ecosystem value creation.

The dimension of co-opetitive and competitive relationships between ecosystem actors

Working together with another ecosystem member that is a competitor in a way that benefits both parties or striving for a goal that cannot be shared, are actor's traits present in the DLT business ecosystem (Mäkinen and Dedehayir, 2012). In a DLT business ecosystem, cooperation and trust reinforce each other and enhance its sustainability. Complementary to that, competitive and / or co-opetitive relationships and trust in business model design need to be approached with attention. As the business network expands, the probability that disagreement and conflict among some of its member increases. Apart from the obvious probability that cooperation between ecosystem system members might change to competitive or co-opetitive relationship, the designed DLT business model must meet another significant challenge. This is related to knowledge sharing (Yoon, Moon, and Lee, 2022; Xiwei, Weber and Staples, 2019). In DLT ecosystem, all economic operators gain better visibility along the network and enhance their information capture capabilities. In the case of non-cooperative relationships, the knowledge sharing attribute of the business network might lead ecosystem actors to reconsider their decision to join the respective DLT ecosystem.

One of the benefits when participating in DLT business ecosystems is increased transparency. All economic operators gain better visibility along the network and enhance their information capture capabilities. It is therefore evident that trust not only facilitates but promotes and enhances knowledge sharing in DLT business ecosystem. In the case of non-cooperative relationships, such as competition and co-opetition, the knowledge sharing attribute of the business network might lead ecosystem actors to become more skeptical towards joining or even leaving the DLT ecosystem. In that case business model design should consider trust conditions under the prism of the type of the knowledge shared and the complementarity of business ecosystem actor interests. The underlying logic on that conclusion

is that these two factors have a direct impact on the cooperative or non-cooperative initiatives (Gausdal, Svare and Möllering, 2016).

Under those conditions, business model design should capture trust under the prism of shared knowledge and the complementarity of ecosystem actors' interests (DeMaio, 2001).

Ecosystem actor's power dimension

Although the concept of power is perceived quite differently by academic disciplines, we considered the definition of the power as an organization's capacity to influence change in another company (Phillips and Srai, 2018). That approach refers to all kinds of influence, including those exercised in exchange transactions (Hart and Saunders, 1997). To achieve deep versus superficial collaboration, as a prerequisite for DLT business ecosystem sustainability, we need to consider DLT expansion but not under the logic of coercing the weaker actors. Although in literature power is discussed as the functional equivalent to trust (Luhmann, 1979), for DLT business ecosystem expansion trust and power should be examined separately. Some authors see power as the greater deterrent to trust, while other researchers underline that when power is used for the purpose of dominance, it diminishes trust and weakens collaboration (Kähkönen, 2014). The same applies on DLT ecosystem, where power exercised between two actors is relative to their current ecosystem position and the relationship they wish to develop, to gain a different position in the future (Phillips and Srai, 2018).

Rules of collaboration in a DLT business ecosystem are affected by the position and power dynamics developed in the network. Power relations affect actors' intentions to exercise influence other actors or partners, hence imposing a superficial collaboration. In addition to that it configures the motivation of the potential DLT business ecosystem participants to join the network. Niche player participation is critical for the DLT ecosystem expansion and survival. Dominant players in terms of network relationship, power dynamics, brand or financial strength are positioned at the center of the ecosystem and initially set the rules of collaboration (Cusumano and Gawer, 2002). This underlines primary the keystone, or else dominant, DLT ecosystem players need to consider the power dynamics that stems by their ecosystem position so that they do not impose superficial collaboration to niche players or allow them to enjoy a disproportionate amount of value created in the network that will eventually discourage their participation in it.

Value of data ownership

Increased transparency in a DLT business ecosystem raises some issues with respect to the incentives of its members to disclose formerly private information. One of the main challenges of DLT diffusion is the minimal data to be opened to network (Beck et al., 2018). In DLT business ecosystem, certain parties might refuse to do business with each other because they might feel they are providing excess power to the entity that owns and manages data (Conway and Garimella, 2020). Visibility of unique identifiers and related transactional histories raises privacy concerns (Bφhme et. al, 2015). Transparency is one of the major drivers and properties of DLT (Lee and Pilkington, 2017) ince digital records are auditable by a predefined set of participants, albeit they are more or less open. DLT applications are based on the benefits of the technology pertaining to decentralization and transparency (Rφckeshφuser, 2017). They might see the value of participating in the ecosystem but due to data ownership and management by other entities they might also become skeptical in joining the ecosystem and request restrictions or specific legislation before doing so.

It is beyond the scope of this study to dive deep into the mechanism of information interoperability, meaning the exchange and sharing information between distributed and random systems and entities. However, acknowledging that the real value stems from the ownership and management of the data shared, it is nonetheless important to consider that enabling access to and analysis of these new collections of data and information will enable ecosystem members to generate new knowledge (Treiblmaier and Beck, 2019). Data is an asset to the company. Data view and transaction driven data sharing among ecosystem

members leads to increased value to the entity that owns and manages data (Lake and Crowther, 2013). To explore data manipulation possibilities in relation to actor roles in DLT business ecosystem, we focused on the roles of data provider and data originator. Data origination is related to data provenance. Data provider role is held by the ecosystem actors that can retrieve data from relational data sources. In DLT business ecosystem data originators contribute to data providers' value creation (Janssen and Zuiderwijk, 2014; Zuiderwijk and Janssen, 2014)

Since almost any DLT ecosystem actor can become a data provider, what is at stake is the visibility depth of data collected by its first tier partners (Lee and Pilkington, 2017). That will consequently define the value of analysis performed, the knowledge gained and finally the power gained from data access. On the other hand, data management alternatives in DLT business ecosystem give data originator the flexibility to select the level of openness of disclosed data. Obviously, this will have a direct impact in data provider's gained value (Kitchin, 2014; Grover et. al, 2018). We could therefore conclude, that in terms of the power gained from data ownership and management in a DLT business ecosystem, actors need to select which role they will adopt in it and how they will capture the network value stemmed from their data management approach. Put differently, the condition that needs to be considered is what incentivizes data originators to feed data providers and what is the depth of visibility of the data granted. Based on that decision the respective business model will acknowledge what routines need to be formulated to capture the value created by the data management approach, as described above.

Conclusion and Discussion

DLT is currently receiving significant attention but its commercialization through a business model will unveil its creating potential. In our study we discussed business models under the organizational concepts of value creation and design and adopted an ecosystem. We critically examined three business model types that demonstrate similarities to the business model that an organization needs to adopt in order to fit in the DLT ecosystem characteristics. We explored the main attributes, similarities and differences of each one of the network, digital and information business model types against the DLT business model. We conclude that although each one of those types demonstrates some resemblance with DLT business model, there are critical parameters that are neither addressed nor partially met. To explore the adjustable nature of the DLT business model we addressed the dynamic character of DLT ecosystem. We highlighted the challenge for ecosystem sustainability, defined and reviewed the conditions that need to be considered for DLT business model design that are: relationship type between ecosystem actors that co-exist in the DLT ecosystem, trust, power dynamics between actors and the value of data ownership based on the data provider and data originator traits of the interacting actors.

Further development of this study could focus on defining what elements could have been included in the DLT business model and how would they fit in an existing or a new business model ontology. Organizations that adopt DLT need to decide what elements constitute the value creation and value capture aspect of their business, considering the conditions described in our study that address DLT ecosystem sustainability.

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What Makes Your Business Model (Un)Investable?

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Abstract

This paper seeks to find out what makes a business model (un)investable. In particular, the study explores the reasons for venture capitalists' rejection decisions on entrepreneurs' proposals. The study digs into rejected cases in the American Shark Tank TV show as the source of secondary data. Data is transcribed, coded, synthesised, narratives are built, and storytelling techniques are applied to present the findings. The study deviates from the mainstream research on business models, based on primary data. In doing so, the study bridges between the business model research and communication sciences.

Introduction

Whether an innovation is likely to be successful is the holy grail of innovation management. Frequently, investors in early stages of an innovation make their judgements based on heuristics (Gigerenzer et al., 2011) based on a pitch: an idea that is brought forward by an entrepreneur (Sabaj et al., 2020). The success of an investment in this setting depends on how an investor filters out success or failure signals from the pitch. On the entrepreneurs' side, the art of pitching well is bringing forward the necessary elements to convince investors. Therefore, idea evaluation based on a pitch is a communication process where an idea is sent from one side and interpreted by the other side. In communication studies, information theory suggests for the core message to be transferred successfully, any noise in the process needs to be filtered out (Pierce, 2012). Furthermore, the interpretation of the communication on the receivers' side is prone to cognitive biases (Hilbert, 2012).

Historically, innovation has been defined in very different ways (Baregheh et al., 2009). In the last two decades the emphasis has been shifted to the role

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of the business model in capturing value from innovation (cf., Chesbrough and Rosenbloom, 2002). In this view, the business model is considered one of the core success factors of an innovation. Following this approach, evaluation of an innovation from an investors' point of view is tied to evaluation of the business model.

Prior research has gone to great lengths to understand investment decisions to help investors improve the decision and entrepreneurs to generate more successful ideas. Authors have focused on how venture capitalists make investment decisions (Pence, 1982) and what kind of investments are more attractive for which groups of venture capitalists (Klonowski, 2005). Others have investigated the criteria used by venture capitalists to evaluate proposals (MacMillan et al., 1985). A stream in the entrepreneurship literature has studied the entrepreneurs' side of investment deals and investigated "do and don'ts" in convincing potential investors (Clark, 2008). Some authors have explored the qualities of a successful pitch (Komulainen et al., 2020) as well as how to frame and sell an entrepreneurial idea (Dvouletỳ, 2017). Furthermore, the literature has studied how the selection is influenced by the quality of ideas (Boudreau et al., 2016), the use of portfolio approaches and stage gates (Brasil and Eggers, 2019), and several contextual factors—for example, the people pitching the ideas (Brooks et al., 2014), the evaluators of the ideas (Mueller et al., 2018), the presentation of ideas (Lu et al., 2019), the interplay between idea generation and selection (Harvey and Kou, 2013), past and current decisions (Helfat, 1994), and feedback (Wooten and Ulrich, 2017). One of the areas in idea evaluation that, despite its importance, has received less attention is evaluation of an innovation based on its business model.

Scholars have contributed to the early development of business model research by considering the business model concept first (Massa et al., 2017) and then through business model innovation (Foss and Saebi, 2018) steadily progressing to open business models (Brenk, 2020; Montakhabi and Van Der Graaf, 2021). Business models have been studied through the lens of different theories such as transaction cost economics (Zott et al., 2010), dynamic capabilities (Leih et al., 2015), and the resource-based view of the firm (Mangematin et al., 2003), just to name a few. There has also been interest in the application of the business model perspective in a variety of contexts such as innovation (Chesbrough and Rosenbloom, 2002), entrepreneurship (Foss and Saebi, 2016), and performance (Kim and Min, 2015). Despite the popularity of business model discussions in academia and practice (Fullenkamp et al., 2017) we observe little agreement not only on the foundations of business model research such as definitions and construct clarity (Foss and Saebi, 2018), but also the criteria for evaluating (successful) business models. Regardless of the definition in use, the business model in itself is a cognitive tool that is used to communicate what an innovation is, rather than a recipe for success. Therefore, a business model is a form of discourse. This makes it difficult to define and consequently to evaluate. Evaluation of a business model requires knowledge from both the business and communication sides.

Taken as a whole, previous work has generated important insights into evaluation of ideas and investment decisions on innovation projects. However, this overview of contemporary scholarship on idea evaluation reveals a number of fundamental gaps.

First, in order to understand how investment decisions take place and what convinces investors, the storytelling function of business models as a communication tool and associated cognitive biases needs to be incorporated. Nevertheless, these aspects are under-explored in business economics. A frequent approach in communication studies is to look at phenomena as stories, or even more broadly as constructs. In this view, as long as a construct has been talked about, it exists even though it may not be real.

Second, at a theoretical level, the common practice in most previous studies focuses on success cases that consequently end in success-biased theory building. Therefore, data on failures are rarely used. A look at the existing venture capital databases supports this claim as there is no record of rejected ideas in most of the credible venture capital databases. Even though there are a few studies on exploring business model

changes based on false positives and false negatives (e.g., Chesbrough and Rosenbloom, (2002)'s study on Xerox PARC), there is still a considerable gap in the literature on systematically identifying cognitive biases in investment decisions.

Third, on a methodological level, when it comes to studying business models, most of the reasoning is inductive (Klauer and Phye, 2008) and studies are designed on single and multiple case studies. Therefore, many of the insights on business model evaluation remain somewhat context dependent and difficult to implement out of the studied context. Transferability and generalizability (Hellström, 2008) of findings in these kinds of studies are sometimes questionable as well.

To bridge the aforementioned empirical, theoretical, and methodological gaps, this study seeks to investigate the criteria for predicting business model failure in investors' evaluations of business models. To achieve this overarching aim, we systematically identify rejection criteria in evaluating innovations with an emphasis on business models.

Not only will this study examine this very important question, but also use an ambitious theoretical approach and methodology as well as a unique data set. The study deploys discourse analysis techniques from communication studies to use the American Shark Tank TV show as the secondary source of data. A discourse analysis based on open coding is manually conducted on the content of the Shark Tank show. Even though the method is very well founded in communication sciences it is used less frequently in the management context. The data allow us to draw deductive-based conclusions.

The remainder of this paper is structured as follows. First, the methodological approach of the study is explained. This is followed by the summary of findings. Findings are presented by applying the storytelling technique. Then, contributions and novelties of the study are explained. This is followed by the introduction of the limitations of the study. Finally, conclusion and opportunities for further research conclude the paper.

Methodological Approach

This is a qualitative study which utilises secondary data (Johnston, 2017). The American Shark Tank TV show is the source of data in this research. We focused on the cases which did not succeed to get investment in the show. Sharks represent venture capitalists who are investing their own money in their favorite business models pitched by entrepreneurs. This framing lets us have more than a thousand cases to study.

In the majority of cases, there is no consensus between sharks when it comes to successful business models. Even if one shark wants to invest, it is enough to make the case successful in attracting investment. However, for the rejected cases there is consensus among sharks. They may for different reasons but consensually reject a case.

The study investigates the common features which are pointed out by venture capitalists as reasons for not investing in a business. In other words, a business model is uninvestable for venture capitalists if it suffers from the distilled rejection criteria. Nevertheless, every business model which does not have the rejection symptomes gets venture capitalists' money (for several reasons like each venture capitalist has its own interested areas to invest). Data is transcribed, coded, synthesised, narratives are built, and storytelling techniques are applied to present the findings.

We studied four hundred and forty-three rejected pitches from the first twelve years of the show. We followed Gioia's method, transcribed the data, and conducted a thematic analysis to code the data. This led to fifty-four codes in the first order of analysis. Each code represents the main reasons to reject a case. Subsequently, we conducted a second order of analysis and distilled fourteen secondary codes: fourteen things that appeared to turn off the investors.

This is followed by building narratives for each secondary code. We applied the storytelling technique (Boje and Jørgensen, 2020) to build the narratives to present our findings. Narratives are built by using quotes from the show.

Each pitch is evaluated by six venture capitalists. In total twenty-nine venture capitalists were involved

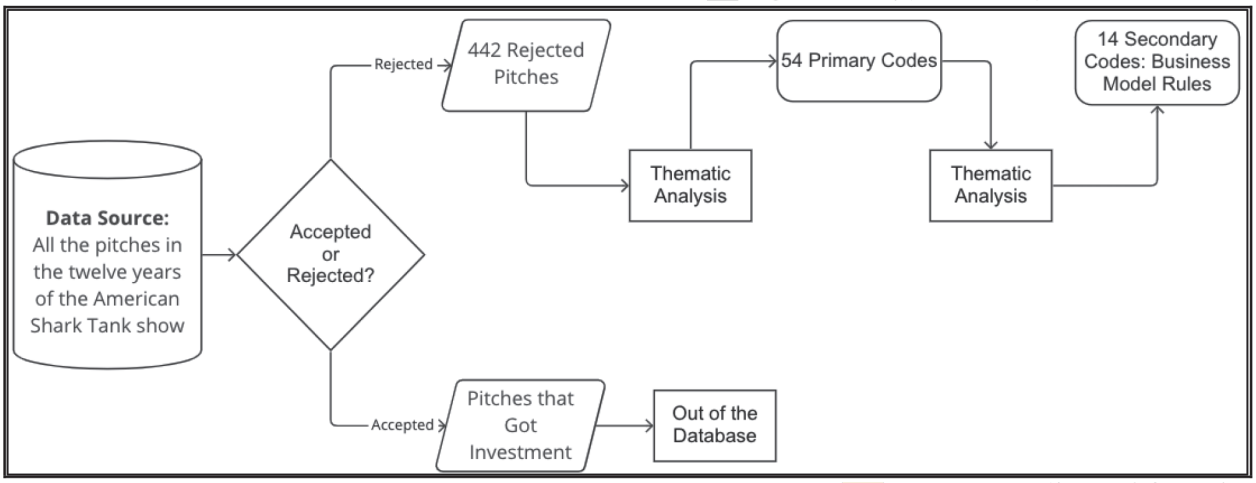

Figure 1: Research design

in the show. We made our cases by assigning each rejected pitch to the applied code _reason for rejection_ and the venture capitalist who used the code. Therefore a case is a combination of i) a venture capitalist, ii) a code, and iii) a pitch. This led to two thousand seven hundred and seventy-one cases. Table 1 shows the statistics of our analyzed data.

Table 1.	
Number of rejected pitches	442
Number of Sharks in each pitch	6
Total number of Sharks in the show	29
Number of codes in the first order of analysis	54
Number of codes in the second order of analysis	14
Total number of cases*	2771

* A case is a combination of a pitch, a shark, and a code from the first order of analysis

Table 1: Statistics of the analyzed data

Figure 1 shows the research design and the steps we followed in this research.

The overarching focus of coding is on the business model (Massa et al., 2017) behind each pitch. A business model is considered as a means for value creation, delivery, and capturing (Teece, 2010). We distinguish entrepreneurs' personalities (Chavez, 2016), venture capitalists' preferences (Carter and Van Auken, 1994), and the quality of the pitch (Kunte et al., 2018) from the business model. Figure 2 distinguishes the different elements in this study.

Summary of Findings

In the following the codes from our initial data analysis are presented. A narrative is built based on the relevant data for each code. For simplicity, we excluded the direct quotes in the presentation of our findings.

- **At what stage is your business model?** Although, it is assumed that businesses go for a venture capitalist at early stages but even in early stages of business there are differences between invention, proof of concept, and a running business. The closer an idea is to a running business, the more trustable entrepreneurs' visions are for a very simple reason; there are numbers to support entrepreneurs' claims. A considerable part of investment is on the entrepreneur and it is almost impossible to judge if the entrepreneur as a part of the idea is investable.

Figure 2: Positioning the study on business models rather than entrepreneur, venture capital, or the pitch

- **Ownership structure (Who owns how much?):** for a venture capitalist it is important to know the ownership structure before and after owning a part of a business. If the ownership of a business is diluted before making a deal and entrepreneurs have lost control of their company, or even if they still have control but will lose control as a result of a venture capitalist's investment, most probably they are not a good option for a venture capitalist's investment. Simply, if the entrepreneur is a part of investment, how can someone invest in a business that has already lost the entrepreneur's control?
- **Is it a business or your hobby?** The entrepreneur believes it is a business and is doing it for a couple of years, not making money, and still continue doing, it is not a business, it is a hobby. No venture capitalist invests in hobbies, they invest in businesses. If the entrepreneurs are not all they will have a hard time finding a venture capitalist to invest.
- **Ownership profile (second job, conflict of interest, bankruptcy, debt, etc.)?** Most times the idea of bringing in a venture capitalist is based on the fact: *a slice of a watermelon is always bigger than a grape*. As much as the idea is important, the profiles of the owners are also important for venture capitalists. Some things like bankruptcy are dealt with like uranium by a venture capitalist. It implies there wouldn't be any chance to access the banking system in the future. Having a second job as well implies that the entrepreneur will split the attention between a venture capitalist's investment and something else. Carrying a lot of debt also implies a venture capitalist should wait a long time to get the investment back. After all, there shouldn't be a conflict of interest between what the entrepreneur does and what a venture capitalist has invested in their portfolio.
- **Is the business scalable (licensing potential, franchising, etc.)?** If a business is not scalable for any reason, it would be hard to find a venture capitalist to invest. The business should have the potential for growth in order to be able to feed two mouths, entrepreneur's and venture capitalist's. Some signs signal scalability, amongst them are potential for licensing or franchising.
- **Is the business replicable? Does the business have any proprietary assets in its possession?** If a business is easily replicable, why should a venture capitalist pay to buy a part of the business? A convincing answer in a venture capitalist's terminology is: the business has a design or utility patent, or at least has filed and is waiting for the patent. If being the first does not give a specific competitive advantage and there is nothing proprietary in the business, it implies the business will be copied at any time which is not a promising signal for a venture capitalist.
- **Does the business have a fat profit margin?** From the moment a venture capitalist invests in a business, even before making the investment, the question always is: how and when will the venture capitalists get their money back? The business should either increase the value of its shares or has a fat profit margin to be able to share money between shareholders. Having a fat profit margin tempts any venture capitalist to get involved in the business.

- **Which one is the entrepreneur ready to give: royalty or equity?** Although both seem like giving up a right in a business for perpetuity, there is a huge difference between the two. Accepting to pay a royalty assures venture capitalists that they will get their money back but if paying the royalty stays for perpetuity it would look like a liability in case of an acquisition in the future. Paying a royalty especially when a business has a tiny profit margin will suck the blood out of the business.
- **Does the business have a realistic valuation?** Even if everything is right, a wrong valuation might not let a deal with a venture capitalist to be made. It is not easy to value a business in early stages. On the one hand entrepreneurs do not want to sell their businesses for cheap, on the other hand no one wants to pay a premium for a promise in the future. Even if an entrepreneur can sell a business at a high valuation, it is not good in the long run to have a high valuation because it will stop the businesses' growth.
- **Do the entrepreneurs know their competitors?** The entrepreneur should be the one who knows the competition better than anyone else and be able to convince venture capitalists that they have a comprehensive understanding of their competitors, either direct or indirect. Imagine a venture capitalist asking if there is a similar product or service in the market and the entrepreneur answers no and then suddenly a similar product shows up.
- **Is the entrepreneur decisive?** It is also important to be able to process and make decisions fast. Entrepreneurs never have all the information they would like to have but they have to make decisions based on what they have. This is also true for the other side of the deal, it is what venture capitalists also do, they make investment decisions based on the limited information they have. The point is an entrepreneur can not sleep on a decision forever. If entrepreneurs want to play with sharks, and stay alive, they better be fast.
- **What is the growth strategy?** There are different types of venture capitalists. There should be a strategic fit between the requested resource, the business nature, and the growth strategy (retail, online, etc.) and the venture capitalists to whom an entrepreneur goes to. At the end of the day it is not just the venture capitalists who make the decision to choose a business to invest in, entrepreneurs should also select their venture capitalists.
- **Is the business seasonal?** If a business makes money but it is not working all year round, it would not be an appealing investment for most venture capitalists. If the business has a product which can only be sold in a specific period of time, the business is also carrying a lot of risks; if the business losees that window during the year, it will lose any potential earnings for that year.
- **Does the business have a serious liability aspect?** No venture capitalist looks for liability nightmares. If a business entails health claims, especially if it still does not have scientific evidence, FDA approval, intervenes with the national financial system, etc., then the business will be looked at as a liability nightmare in the venture capitalist's investment portfolio. As long as a business is small, nobody cares about its liabilities but the moment the business starts to grow, it will be visible on the radar. No venture capitalist wants to be the deepest pocket for the liabilities which a risky business carries.

In presenting the findings we avoid using a predefined framework (e.g., Business Model Canvas or using the three categories of value creation, delivery and capturing as framing devices)(Sort and Kristiansen, 2021) for one main reason. Following a deductive approach and analyzing an extensive number of cases lets us to capture elements that do not fit into the existing frameworks. For example, the Business Model Canvas does not capture seasonality nor the scalability aspects of a business. Hence, following a predefined model would have limited our findings to the boundaries of the selected model. Therefore, adhering the chosen methodology from the communication sciences we opt for open coding without a predefined framework.

Contribution and Novelty

In answering the research question, the study advances our understanding of the ways to better

evaluate and generate more successful ideas. This is achieveed by firstly deducing the reasons (related to the business models) of rejection of an idea from investors' perspective that can also be examined failure cases in attracting venture capital investment from the entrepreneurs' perspective. To do so, the study deploys a novel approach in which the content of the American Shark Tank TV show is creatively used as the secondary source of data as well as the methods from communication studies that are applied to answer the question that mostly belong in management research. In doing so, the study takes a risky and (arguably) novel approach that deviates from mainstream research in management studies that rely on success cases in theory building. The novel theoretical, methodological, and empirical contributions of the study are:

At the **conceptual-theoretical level**, the study contributes to the business model literature, which so far has mostly ignored investment decision-making and how errors one way or the other in funding a venture might lead to false conclusions on business model success factors and thus the merits of an innovation. At a **methodological level**, the study **bridges between business model research and communication sciences** by deploying methods from media studies that are rarely used in management studies. Discourse analysis and open coding without following a predefined theoretical framework is a widely adopted approach in communication sciences in general and in media studies in particular. Furthermore, such an approach has implications for future applications of this research to use Artificial Intelligence (AI) in order to evaluate crowdsourcing pitches over the Internet. In the medium term, this may allow us to employ AI for theory building in management studies. At an **empirical level**, the study advances knowledge on generation and evaluation of more successful innovations. This can be used to build a screening tool based on the reasons for acceptance and rejection of investment decisions. This will help managers enhance their decisions regarding investments on innovations, i.e., "How to avoid bad deals?" and "How to identify good deals?" The tool will be a checklist consisting of the obvious and non-obvious reasons for rejecting or accepting a proposal that we can distill. The tool can also be used by entrepreneurs to self-evaluate their investment proposals.

Limitations and Remedies

Several limitations pertain to using the show as the context of this study (e.g., the bridge between a TV show and real life, representativeness of venture capitals as the sample, screenings to make the show attractive, etc.). Nevertheless, there are two main reasons to choose the American Shark Tank TV show as the context of this study. First, this is a very iconic phenomenon that has influenced business model thinking over one and a half decades and is now running in more than 20 countries, providing a uniquely rich amount of data on the breadth of innovation evaluation by investors. Secondly, pitching business models for attracting investment is basically an American format. Historically, Silicon Valley has been the place where pitching as a way of communication has been used to evaluate new ideas by investors. Therefore, there is no better way to investigate this format than to look at how entrepreneurs pitch and how investors interpret those pitches.
Using the content of a TV show in scientific studies is not new. For example "Card Sharks" (Gertner, 1993), "Jeopardy!" (Metrick, 1995), "Illinois Instant Riches" (Hersch and McDougall, 1997), "Lingo", "Hoosier Millionaire" (Fullenkamp et al., 2003), "Who Wants to be a Millionaire?" (Lanot et al., 2006), and "Deal or No Deal" (Post et al., 2008). Several studies have been conducted on the Shark Tank show (e.g., Lavanchy et al., 2022 and Sanchez-Ruiz et al., 2021). What has not been done before is focusing on the business model aspect of evaluations.

Conclusions and Future Research

This study presents common reasons for rejecting a pitch by venture capitalists based on the results of using the American Shark Tank TV show. By identifying the criteria of rejected business models the paper highlights what mistakes should be avoided in an entrepreneur's business model. To date, the literature on business models are mostly focused on single of multiple case studies based on primary data. Here a controversial method in communication science

is applied to use secondary data for business model studying. By building narratives based on codes and applying storytelling techniques, it elaborates what and why should be avoided in a business model to attract venture capitalists' investment. Furthermore, the paper draws practical implications for venture capitalists to consider in their evaluation.

The study uses the American Shark Tank TV show as the source of data. One interesting venue for future research is to conduct the same research on other available versions of the show (British, Australian, Mexican, and Indian shows to name a few) and compare the results (Hewitt-Taylor, 2001) to see if the findings are universally applicable or context dependent.

In later stages of this research the findings can be used together with machine learning to evaluate the quality of a business model. This is similar to the credit evaluation systems in banks. A big enough sample size can provide the minimum required data for this purpose. Shark Tank is a unique setting which eliminates the contextual effects caused by researchers.

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Performance Indicators for Business Models: The Current State of Research

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Abstract

Organizations need to evaluate new and existing business models to innovate their business logic and remain competitive. One way to carry out this evaluation is through business model performance indicators. Performance indicators for business models can support organizations in quantifying their business model objectives, monitoring business model performance during and after implementation, and benchmarking their business model against competitors. However, the current literature lacks a complete picture of performance indicators that can be used to evaluate business models and monitor their performance. Therefore, we conducted a semi-systematic literature review to analyze which performance indicators are referred to in the academic literature related to business models. We provide an overview of the current state of research on this topic and discuss possible directions for further research.

Introduction

To stay competitive in today's dynamic business environment, organizations increasingly focus on innovating the way they do business. In this regard, the business model functions as a useful conceptual tool to represent, analyze, and innovate an organization's business logic (Osterwalder, Pigneur and Tucci, 2005). As a result, the business model concept has gained increasing interest in both academia and practice (Johnson, Christensen and Kagermann, 2008; Fielt, 2014; Wirtz *et al.*, 2016; Massa, Tucci and Afuah, 2017). In this study, we consider business models as "*the design or architecture of the value creation, delivery, and capture mechanisms*" of an organization (Teece, 2010, p. 172).

Although organizations need to rethink and adapt their business model continuously, business model

Keywords: Business Models, Performance Indicators, Literature Review

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innovation is a major challenge for most organizations (Frankenberger *et al.*, 2013). They are faced with several challenges throughout the innovation process, including identifying change drivers and managing the implementation of the new business model through pilots and experimentation (Frankenberger *et al.*, 2013). To reduce uncertainty during the innovation process, organizations need to evaluate new and existing business models (Gilsing *et al.*, 2022). One possible way to carry out this evaluation is through performance measurement, for which organizations can use business model performance indicators (Heikkilä *et al.*, 2016; Gilsing *et al.*, 2021).

Performance indicators are measurable constructs that enable organizations to monitor the extent to which their objectives are fulfilled (Lebas and Euske, 2007). In the context of business models, organizations need to use performance indicators to formulate measurable objectives related to the expected performance of a new business model (Heikkilä *et al.*, 2014; Gilsing *et al.*, 2021). Moreover, organizations can use business model performance indicators to monitor the performance of an organization's business model during and after its implementation (di Valentin *et al.*, 2013) or benchmark the business model performance of the organization against that of competitors (Afuah and Tucci, 2003; Montemari, Chiucchi and Nielsen, 2019).

While existing literature focuses mainly on developing methods and frameworks for representing business models, less attention has been paid to identifying performance indicators for monitoring business model performance (Burkhart *et al.*, 2011; Nielsen *et al.*, 2018). A few studies present catalogs of performance indicators to support organizations in selecting and defining indicators for their business models. However, these catalogs mainly cater to a specific domain or context, such as electronic business (Dubosson-Torbay, Osterwalder and Pigneur, 2002) and networked organizations (Heikkilä *et al.*, 2016). To the best of our knowledge, no structured review of business model performance indicators currently exists in the literature.

The main objective of this paper is to review business model performance indicators referred to in the academic literature to depict the current state of research and discuss future research directions in this field. To fulfill this objective, we conducted a semi-systematic literature review following the guidelines of Snyder (2019) and classified the identified indicators. We contribute to the existing body of knowledge by providing an overview of performance indicators for business models and categorizing them into a catalog consisting of relevant business model dimensions. The catalog can support organizations that are in the process of selecting and concretizing performance indicators for their business models to adopt and tailor these indicators for their specific business context and needs.

The remainder of this paper is structured as follows. First, we describe the methodological approach used to identify performance indicators in the literature. Next, we present our key insights regarding the categorization and frequency of the identified indicators. Finally, we discuss the key insights about the review and present our conclusions and possible directions for further research in the last section.

Methodological approach

We conducted a semi-systematic literature review following the guidelines of Snyder (2019). Accordingly, our review process comprised four main steps: design, conduct, analyze, and structure and write (Snyder, 2019). First, we defined the objective of our review (as depicted in Section 1) and established a review protocol that all authors followed during the literature search and selection process. To find relevant studies, we specified the following search string: *"business model*" AND ("performance indicator*" OR "performance measure*" OR "performance metric*" OR "KPI*")*. We included the terms (key) performance indicator, measure, and metric in the search string as these are often used interchangeably in the literature (Neely, Gregory and Platts, 2005). In this paper, we adopt the definition of Lebas and Euske (2007) and use the term 'performance indicator', as it is most commonly used in the performance measurement literature (Neely, Gregory and Platts, 2005). In addition, we decided only to include studies that (1) adopt a non-trivial definition of business

models, in line with our interpretation as outlined in Section 1, (2) present clearly defined business model performance indicators, measures, or metrics, and (3) are published in academic venues, such as journals, conference proceedings, or academic book chapters.

We conducted our search in the following digital libraries that publish research studies on business models: Web of Science, Scopus, and AIS eLibrary. Next, we performed a title, abstract, and keyword search using the specified search string in the selected libraries. This search resulted in an initial set of 879 studies published between 1988 and December 2021. In the next step, we excluded 236 duplicates from the initial set and conducted a title, abstract, and keyword screen on the remaining studies. We excluded 423 studies based on this initial screening, after which we read the full text of the remaining 220 papers. Finally, we selected 18 studies that were relevant based on our inclusion criteria. We used Google Scholar to snowball back and forth on the selected studies, which allowed us to find an additional 13 relevant studies. As a result, our final set consists of 31 publications (15 journal articles, 12 conference papers, and 4 book chapters) that present performance indicators for business models. The initial results of this literature review have been reported in Van de Ven et al. (2022). Appendix I presents the selected publications resulting from the literature review.

Next, we performed several review iterations on the selected papers to extract and categorize the indicators. This iterative process resulted in an unstructured set of 951 performance indicators, including duplicates. When specified in the paper, we also extracted the way in which the indicators were operationalized, for example, through a qualitative question or mathematical formula. Qualitative questions are used to measure performance in a subjective way (e.g., on a Likert scale), while mathematical formulas are used to calculate performance indicators objectively based on quantitative data. 16 of the 31 selected studies did not present a clear operationalization for the proposed indicators.

In the next step, we defined the initial conceptual dimensions of the catalog. Since the Business Model Canvas (BMC) (Osterwalder and Pigneur, 2010) is the most widely used framework to represent business models in both research and practice (Massa, Tucci and Afuah, 2017), the nine building blocks of the BMC were selected as the initial catalog dimensions: Value Propositions, Customer Relationships, Customer Segments, Channels, Key Activities, Key Resources, Key Partners, Revenues Streams, and Cost Structure (Osterwalder and Pigneur, 2010). Moreover, we adopted the term 'business model pillar' (Osterwalder, Pigneur and Tucci, 2005) to describe the meta-dimensions of the catalog, and categorized the initial nine BMC dimensions into the business model pillars 'Frontstage', 'Backstage', and 'Profit Formula' (Osterwalder *et al.*, 2020). The Frontstage pillar (Osterwalder *et al.*, 2020) includes performance indicators related to the value proposition that the organization offers to its customers (i.e., products and services), the relationships that the organization establishes and maintains with customers, the different customer segments and their characteristics, and the channels used to deliver the value proposition (i.e., communication, distribution, and sales). Next, the indicators categorized in the Backstage pillar (Osterwalder *et al.*, 2020) are concerned with the performance of key activities performed by the focal organization to deliver value to the customer, the resources required to perform these activities, and the network of partners that the organization relies on. The third pillar, the Profit formula (Osterwalder *et al.*, 2020), contains indicators related to the value capture mechanisms of the business model, including its revenue streams resulting from the delivery of the value proposition, and costs associated with performing activities, acquiring resources, and collaborating with partners.

Subsequently, we iteratively categorized the identified indicators in the selected business model dimensions. In this step, we merged similar indicators and rephrased them into more general terms. Examples of two specific indicators are '(website-related) conversion rate' (Heikkilä *et al.*, 2016) and 'premium conversion rate' (Nielsen, Lund and Thomsen, 2017). These two indicators were merged into the more general indicator 'conversion rate'. The authors frequently met to align on the tentative categorization of the indicators. We discovered that several

indicators presented in the literature were related to the profitability of business models during this iterative process of categorization and synthesis. To account for profit-related indicators mentioned in the literature, we added the new dimension 'Profitability' to the Profit Formula pillar. We also identified indicators related to market performance (for example, shareholder expectations) and the environmental sustainability and societal impact of business models. We added these categories as two distinct dimensions to the catalog, 'Market' and 'Sustainability & Society', respectively, and categorized them in a new pillar called 'Environment'. The Environment pillar includes indicators related to a business model's 'contextual logic' (Lüdeke-Freund *et al.*, 2017), which refers to the larger stakeholder environment in which the business model is embedded.

During this phase, we also adapted and refined the operationalizations of the indicators. We attempted to define the operationalizations as close as possible to the original definition and context of the selected publications. If an indicator's operationalization was not provided in the original publication, we looked for appropriate definitions in the literature and discussed them to reach an agreement.

Our final step was to reorder and refine the indicators in the catalog until all authors agreed on the final form. This required several meetings until an agreement about the synthesis and categorization of the indicators was reached.

Key Insights

To analyze the business model performance indicators referred to in the academic literature, we extracted the performance indicators related to business models from selected publications and categorized them. The final catalog consists of 215 performance indicators for business models, including an operationalization for each indicator. An excerpt of the catalog is presented in Appendix II. The indicators are categorized along four pillars and 12 dimensions relevant to business models (Table 1).

Figure 1 presents the number of identified indicators per business model pillar and dimension. It shows that the majority of indicators are related to the *Profit formula* pillar of business models (73 indicators), while the *Frontstage* pillar (69 indicators) and *Backstage* pillar (51 indicators) also cover many indicators. According to these numbers, the majority of indicators in the literature are aimed at these three original pillars of the Business Model Canvas (Osterwalder *et al.*, 2020). However, we discovered only 22 indicators related to the *Environment* pillar of business models. As such, performance indicators related to the environment of business models appear to be overlooked in the current literature.

Furthermore, the number of identified performance indicators varies greatly across business model dimensions. Figure 1 shows that the Cost Structure dimension has the highest number of indicators (N=31). This number could be explained by the fact that costs are important in evaluating the business case of new business models (Turetken *et al.*, 2019) and controlling the performance of an existing business model (Wirtz, 2020). The Channel performance dimension accounts for the second-highest number of indicators, with a total of 28 performance indicators, and is part of the Frontstage pillar, which has the second-highest number of indicators. These numbers align with the argument by Wirtz et al. (2016) that an organization's customer interface design is critical to the success of a business model. At the same time, only a few indicators were discovered related to the environmental and societal context of business models (six indicators, respectively), despite the growing interest in evaluating these contextual dimensions of business model performance (Schaltegger, Hansen and Lüdeke-Freund, 2016; Lüdeke-Freund *et al.*, 2017; Turetken *et al.*, 2019; Ortuño and Dentchev, 2021).

A few performance indicators were frequently referred to in the business model literature. The most used performance indicators for business models are 'Product or service quality' (part of the Value proposition dimension) and 'Customer satisfaction' (Customer relationships dimension), which both appeared in 14 studies. The second-most used performance indicators are 'Perceived customer benefit' and 'Satisfaction of customer needs', both part of the Value proposition dimension, which were mentioned in 13 studies.

Table 1.

Business model pillars	Business model dimensions	Focus of performance indicators
Frontstage	Value proposition performance	Product and service performance, perceived customer value, price-related performance
	Customer relationship performance	Customer acquisition, customer satisfaction, and relationship-building performance
	Customer segment performance	Performance of different customer segments, customer characteristics, and behavioral performance
	Channel performance	Communication, distribution, and sales channel performance, including the performance of marketing and post-purchase customer support
Backstage	Key activity performance	Development, production, service provision performance
	Key resource performance	Performance related to physical assets, financial resources, intellectual resources, human resources
	Key partner performance	Performance of the partner network related to relationships, outsourcing, knowledge sharing
Profit formula	Revenue stream performance	Financial performance regarding sales and recurring fees
	Cost structure performance	Fixed and variable costs incurred by the company to deliver the value proposition
	Profitability performance	Value capture performance related to profit margins
Environment	Market performance	Strategic positioning and shareholder-related performance
	Sustainability & Societal performance	Environmental sustainability performance, societal impact, and non-economic environmental or societal costs and benefits

Table 1: Business model dimensions and corresponding pillars.

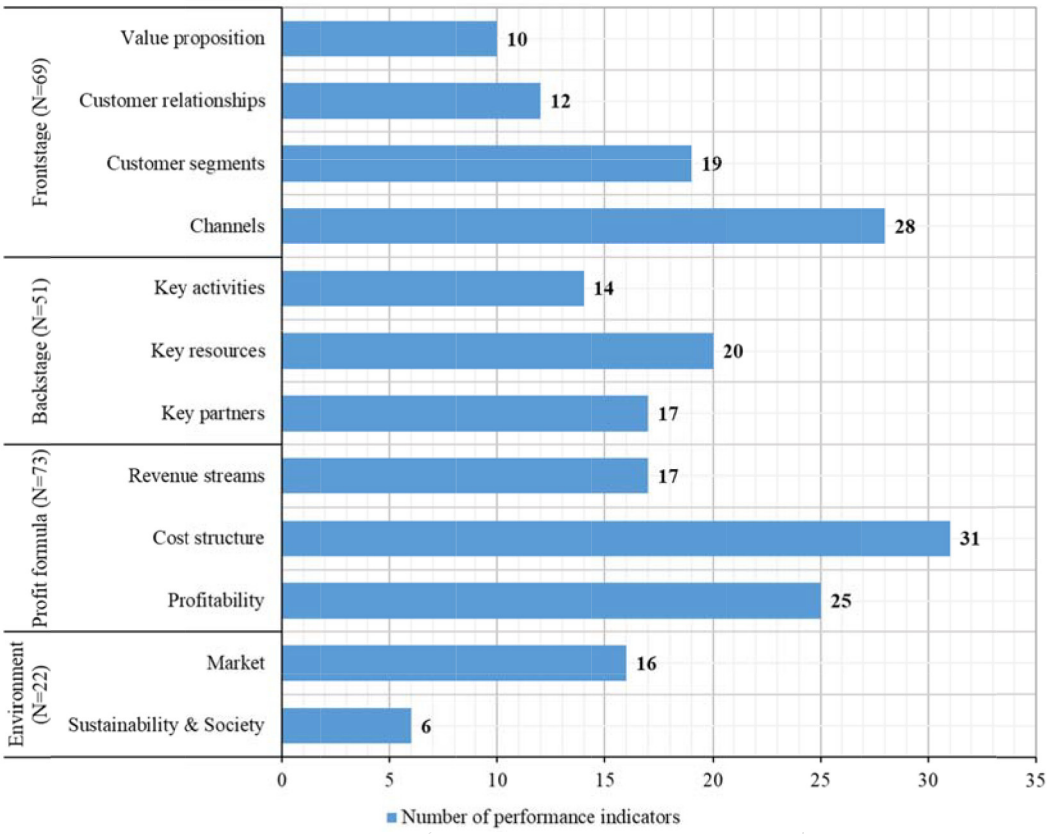

Figure 1: Number of performance indicators per business model pillar and dimension

Discussion and Conclusions

This paper reviews the academic literature to analyze the performance indicators related to business models. To this end, we conducted a semi-systematic literature review, resulting in a sample of 31 relevant studies. Based on the identified indicators in the selected literature, we developed a catalog consisting of 215 performance indicators, categorized into four business model pillars (Frontstage, Backstage, Profit formula, and Environment) and 12 dimensions relevant to business model performance (Value proposition, Customer relationships, Customer segments, Channels, Key activities, Key Resources, Key partners, Revenue streams, Cost structure, Profitability, Market, and Sustainability and Society).

A number of performance indicator catalogs for business models are presented in the literature (e.g., Dubosson-Torbay, Osterwalder and Pigneur, 2002; Heikkilä et al., 2016). However, we discovered that more than half of the identified studies in our review did not present a clear operationalization (i.e., question or formula) to measure and calculate the suggested indicators. Thus, existing research often fails to provide specific guidance for concretely measuring business model performance indicators. We aim to go beyond the state-of-the-art by providing a catalog of 215 business model performance indicators, including an operationalization for each indicator. Our research thereby responds to the multiple calls in the literature to investigate performance indicators for monitoring business model performance (Burkhart *et al.*, 2011; Nielsen *et al.*, 2018).

Business professionals who aim to select and specify performance indicators for the business models of their organization can use the catalog. The indicators can be modified to fit a particular organization and business context. The additional key contribution of our work compared to existing catalogs is that we provide an explicit operationalization for most of the indicators that can be used to measure the performance of existing or novel business models. It can serve as a starting point for selecting

indicators for each dimension of an organization's business model, which can be further concretized based on its specific context and needs.

As with any research endeavor, our work is subject to limitations. First, as the catalog developed in this study is still conceptual, future research should focus on empirically evaluating the structure of the catalog. Researchers can apply the catalog to improve and validate its applicability in different business settings. Secondly, during the review process, we found that authors of existing studies use and interpret the terms performance indicator, measure, and metric in different ways. Because we interpreted these different terms as synonyms in this study, there may have been some subjectivity involved in the process of reviewing papers and categorizing the identified indicators. We mitigated this by actively involving different authors of this paper in all research steps and by iteratively developing the categorization and synthesis of indicators.

Based on our findings, we outline several possible future research directions. First, our research showed that the Profit formula pillar of business models has received the greatest attention in terms of the number of performance indicators. The other business model pillars (i.e., Frontstage, Backstage, and Environment) need greater focus by researchers in order to identify relevant indicators and formalize their operationalizations. Second, we found that existing studies contain very few indicators dedicated to the environmental sustainability and societal performance of business models. Therefore, future research can investigate what indicators are relevant to these emerging dimensions related to the contextual logic of business models, which are quickly becoming important (Schaltegger, Hansen and Lüdeke-Freund, 2016; Lüdeke-Freund *et al.*, 2017; Turetken and Grefen, 2017; Ortuño and Dentchev, 2021). Third, researchers can evaluate the validity and utility of the catalog by conducting empirical case studies with business model professionals in various business settings. Fourth, future research can investigate how the catalog can be used during different phases of the business model innovation and management process (Wirtz, 2020; Taran, Boer and Nielsen, 2021; Lara Machado *et al.*, 2022) and how the performance indicators are possibly evolving during the development of the business model over time (Heikkilä *et al.*, 2016).

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Appendix I - Selected Publications Resulting from the Literature Review

ID	Year	Authors	Title	Source title	Type
1	2003	Afuah A., Tucci C.	Internet Business Models and Strategies	McGraw-Hill	Book chapter
2	2018	Augenstein D., Fleig C.	Towards increased business model comprehension - Principles for an advanced business model tool	ECIS 2018 Proceedings	Conference paper
3	2017	Batocchio A., Minatogawa V.L.F., Anholon R.	Proposal for a method for business model performance assessment: Toward an experimentation tool for business model innovation	Journal of Technology Management and Innovation	Article
4	2003	Bouwman H.	Designing metrics for business models describing mobile services delivered by networked organizations	Workshop on concepts, metrics & visualization, at the 16th Bled Conf.	Conference paper
5	2004	Bouwman H., Van den Ham E.	Business models and e-metrics, a state of the art	E-Life after the Dot.com Bust	Book chapter
6	2012a	Di Valentin C., Emrich A., Werth D., Loos P.	Conceiving Adaptability for Business Models: A Literature-based Approach	CONF-IRM 2012 Proceedings	Conference paper
7	2012b	Di Valentin C., Werthe D., Loos P., Weiblen T.	Quantifying the Quality of Business Models	Int. Conference in Human-Oriented and Personalized Mechanisms, Technologies and Services.	Conference paper
8	2017	Díaz-Díaz, R., Muñoz, L., Péréz-Gonzalez, D.	The Business Model Evaluation Tool for Smart Cities: Application to SmartSantander Use Cases	Energies	Article

ID	Year	Authors	Title	Source title	Type
9	2002	Dubosson-Torbay M., Osterwalder A., Pigneur Y.	E-business model design, classification, and measurements	Thunderbird International Business Review	Article
10	2021	Gilsing R., Wilbik A., Grefen P., Turetken O., Ozkan B., Adali O.E., Berkers F.	Defining business model key performance indicators using intentional linguistic summaries	Software and Systems Modeling	Article
11	2010	Heikkilä J., Tyväinen P., Heikkilä, M.	Designing for performance - a technique for business model estimation	Proceedings of EBRF 2010	Conference paper
12	2016	Heikkilä M., Bouwman H., Heikkilä J., Solaimani S., Janssen W.	Business model metrics: an open repository	Information Systems and e-Business Management	Article
13	2014	Heikkilä M., Solaimani S., Soudunsari A., Hakanen M., Kuivaniemi L., Suoranta M.	Performance estimation of networked business models: case study on a Finnish eHealth Service Project	Journal of Business Models	Article
14	2008	Johnson M.W., Christensen C.M., Kagermann H.	Reinventing Your Business Model	Harvard Business Review	Article
15	2013	Kastalli I.V., Van Looy B., Neely A.	Steering manufacturing firms towards service business model innovation	California Management Review	Article
16	2007	Khoshalhan F., Kaldi A.	Skills brokerage performance measurement through BSC	Int. Conf. on Computer and Information Technology	Conference paper
17	2010	Kijl B., Boersma, D.	Developing a business model engineering & experimentation tool–the quest for scalable 'lollapalooza confluence patterns'	AMCIS 2010 Proceedings	Conference paper

ID	Year	Authors	Title	Source title	Type
18	2021	Kostin, K.B., Steinbiss, K., Petrinovic, O.	Determining the KPIs of the German engineering industry based on the evaluation of contemporary business models	Strategic Management	Article
19	2016	Kriegel J., Auinger K., Reckwitz L., Schmitt-Rüth S., Weissenberger S., Tuttle-Weidinger L.	AAL service performance measurement cube - key criteria for AAL new service development	Proceedings of eHealth2016	Conference paper
20	2017	Lüdeke-Freund, F., Freudenreich, B., Saviuc, I., Schaltegger, S., Stock, M.	Sustainability-Oriented Business Model Assessment—A Conceptual Foundation	Analytics, Innovation, and Excellence-Driven Enterprise Sustainability	Book chapter
21	2020	Minatogawa V.L.F., Franco M.M.V., Rampasso I.S., Anholon R., Quadros R., Durán O., Batocchio A.	Operationalizing business model innovation through big data analytics for sustainable organizations	Sustainability	Article
22	2019	Montemari, M., Chiucchi, M.S., Nielsen, C.	Designing Performance Measurement Systems Using Business Models	Journal of Business Models	Article
23	2018	Mourtzis D., Papatheodorou A.-M., Fotia S.	Development of a key performance indicator assessment methodology and software tool for product-service system evaluation and decision-making support	Journal of Computing and Information Science in Engineering	Article
24	2017	Nielsen C., Lund M., Thomsen P.	Killing the balanced scorecard to improve internal disclosure	Journal of Intellectual Capital	Article

ID	Year	Authors	Title	Source title	Type
25	2001	Palanisamy, R.	Evolving internet business model for electronic commerce using flexible systems methodology	Global Journal of Flexible Systems Management	Article
26	2015	Rodríguez-Rodríguez R., Alfaro-Saiz J.-J., Verdecho M.-J.	A performance-based scenario methodology to assess collaborative networks business model dynamicity	Working Conference on Virtual Enterprises	Conference paper
27	2022	Stalmachova K., Chinoracky R., Strenitzerova M.	Changes in Business Models Caused by Digital Transformation and the COVID-19 Pandemic and Possibilities of Their Measurement—Case Study	Sustainability	Article
28	2021	Udo Y., Ishino Y.	Two-Stage Lean Startup Model for Subscription Business	KES International Conference	Conference paper
29	2020	Wirtz B.W.	Business model management: Design - instruments - success factors	Springer	Book chapter
30	2014	Yu C.-C.	Developing value-centric business models for mobile government	EGOV 2014	Conference paper
31	2006	Yu C.-C.	A hybrid modeling approach for strategy optimization of E-business values	BLED 2006 Proceedings	Conference paper

Appendix II - Catalog of performance indicators for business models (excerpt)

Business model pillars	Business model dimensions	Performance indicators	Operationalization
Frontstage	Value proposition	Perceived customer benefit	Extent to which the product or service is better than current alternatives of competitors (qualitative scale from high to low) which can be measured based on various dimensions (e.g., security, protection of privacy, skills or learning provided, comfort, ease of use of the service, brand image, trust) and scales (e.g., Customer Effort Score, CSE)
		Satisfaction of customer needs	• Extent to which the product or service meets the requirements or needs of the customer (qualitative scale from high to low) • Number of customer requirements satisfied divided by total number of requirements requested by the customer (e.g., performance according to service-level agreement) • Number of additional and value added services offered on top of the main product or service offering
		Product diversification	• Number of different products or services, • Number of different product or service categories • Percentage of specific type of products (e.g., fresh products) of total product portfolio
	Customer relationships	Conversion rate	Number of conversions of free customers to paying customers divided by total number of interactions per time period
		Customer satisfaction	• Customer Satisfaction Index (CSI) • Satisfaction barometer

Business model pillars	Business model dimensions	Performance indicators	Operationalization
Frontstage	Customer relationships	Recommendation ratio or willingness to refer	• Net Promotor Score (NPS) (i.e., willingness of customers to recommend the service to their friends) • Number of referrals divided by total number of customers per time period
	Customer segments	Profitable customers	Number of customers that are profitable divided by total number of customers
		Online customers	Number of customers who order products or service online / Total number of customers
		Average order size or customer expenditure	• Average amount of money a customer spends in one transaction • Average amount spend by a customer per purchase multiplied by the purchase frequency over a certain time period
	Channels	Website performance	• Average number of page-views over a certain time period • Number of click-throughs on the website divided by the number of times the website is shown to the customer • Ease of finding and navigating through the website (qualitative scale from high to low) • Average time to load a web page • Maximum number of users logged in at the same time on the website
		On-time delivery	• Number of on-time deliveries divided by total number of deliveries • Percentage of late deliveries

Business model pillars	Business model dimensions	Performance indicators	Operationalization
Frontstage	Channels	Sales performance	• Number of companies contacted by the commercial department over a certain time period • Number of deals closed with companies by the commercial department over a certain time period • Time to first proposal • Average sales per sales person (monetary value) • Number of sales orders received but not completed yet)
Backstage	Key activities	Process throughput	Number of completed cases per time period (e.g., customer complaints)
		Product or service development speed or time-to-market	• Average time from idea to prototype (i.e., development time of new product or service concept) • Time from product development to product or service placement on the market (i.e., product or service launch)
		Production performance	• Time to produce a single product (i.e., completion time) • Number of products that are built-to-order per time period
	Key resources	System architecture or Information Technology (IT) infrastructure performance	• 24-7 availability and downtime • Response time (e.g., API response) • Number of help desk calls per time period • Number of disaster recoveries per time period • Mean time between failures • Data security or integrity • Number of applications • Extensibility of applications • Percentage of service providers' data base visits • Percentage of cross-system collaboration (i.e., interoperability of systems)

Business model pillars	Business model dimensions	Performance indicators	Operationalization
Backstage	Key resources	Internal collaboration performance	• Number of units and departments involved in the business model • Number of organizational layers involved • Number of different roles and responsibilities
		Workforce size	• Number of employees • Number of Full-time equivalent (FTE) employed
	Key partners	Partner network control or coordination	• Type of coordination (Middle, high, none) • Centrality of specific actors in value exchange
		Vertical integration of activities	• Degree of co- or outsourcing of activities (e.g., logistics, manufacturing) • Owned activities compared to outsourced activities
		Partner collaboration and innovation	• Number of new projects started with partners per time period • Percentage of cross-unit or organizational collaboration • Improvement of the degree of collaborative innovation per time period
Profit formula	Revenue streams	Volume or value of traded goods	• Number of products and/or services sold per time period • Value per product multiplied by total number of products traded per time period"
		Sales growth	Net sales of the prior period minus net sales of the current period, divided by net sales of the prior period
		(Premium) subscription revenue	Revenue from customers through recurring (premium) fees multiplied by number of time period intervals (often regular intervals, e.g., weekly, monthly, or annually)

Business model pillars	Business model dimensions	Performance indicators	Operationalization
Profit formula	Cost structure	Personnel costs	Average costs per working hour, total salary costs
		Operating expenses (OPEX)	Direct costs of goods sold and other operating expenses over a certain period of time
		Sales and marketing expenses	• Total expenses made to market and sell products and services • Total costs of sales (e.g., distribution costs, marketing costs, wages, commissions)"
	Profitability	Return on investment (ROI)	Profit divided by total capital (i.e., efficiency of the total capital)
		Net profit margin	Revenue minus cost, divided by revenue
		Earnings Before Interest and Taxes (EBIT)	Annual net profit plus or minus taxes and interest (operating profit excluding tax and interest)
Environment	Market	Positioning	Extent to which business model is affected by competitive forces from (qualitative scale from high to low): rivalry, customers, complementors, suppliers, potential new entry, substitutes (Porter's Five Forces)
		Earnings per share (EPS)	Net income minus preferred dividends, divided by outstanding shares
		Shareholder value	Total (monetary) value delivered to the equity owners of a company due to management's ability to increase sales, earnings, and free cash flow

Business model pillars	Business model dimensions	Performance indicators	Operationalization
Environment	Sustainability & Society	Unit energy consumption	All energy consumed in a production cycle divided by production quantity
		Wastage degree	Scrap quantity divided by planned scrap quantity
		Non-economic benefits	Non-economic aspects of the business model that are beneficial to society and the environment (e.g., development goals related to knowledge development, innovation productivity, creativity, social cohesion)

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Sustainable Trajectories for Business Model Innovation: Insights from Visual Thinking

Emelie Havemo[1]

Abstract

This paper introduces a visual approach to sustainable business model innovation that helps business model designers conceptualise how sustainability can be integrated in business models. Drawings are used to illustrate four sustainable trajectories for business model innovation. The visualisation of trajectories helps to open the "black box" of sustainable value creation by enabling different understandings of value creation from a business model perspective. The paper also introduces and exemplifies the concept of "multi-lens" thinking for sustainable business model innovation, which entails combining insights from several perspectives.

Introduction

Business models describe how an organisation creates value. Given the increasing focus on sustainability concerns, new approaches to doing business are necessary to ensure that business models support planetary and social value as well as financial value (Bocken *et al.*, 2014). Business model innovation is thus a critical activity that supports sustainable development going forward. Business model redesign is particularly important when it comes to making fundamental changes to business models to achieve sustainable outcomes (Guldmann, Bocken and Brezet, 2019).

Visualisation can be used to systematise the design process by providing a shared picture for the designers to work on together (Spence, 2014). In addition, visual thinking has the power to engage an audience through holistic and immediate impressions of key information (Meyer *et al.*, 2013). This makes visualisations particularly useful in collaborative settings where they illustrate and facilitate a shared

Keywords: sustainability, business model innovation, design, visual thinking, trajectories, toolbox

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understanding among participants (Sibbet, 2008). Accordingly, prior studies have recognised the immense potential of visualisation for business model innovation activities (Täuscher and Abdelkafi, 2017; Havemo, 2018; Massa and Hacklin, 2021). For example, visual tools can be used to clarify design goals and guide dialogues among key stakeholders in each stage of the business model innovation process (Guldmann, Bocken and Brezet, 2019). Incumbent firms in particular may benefit from visual enhancements as they face the cognitive challenge of overcoming current business model logics and reducing path dependency during the design phase of business model innovation (Daood, Calluso and Giustiniano, 2021; Massa and Hacklin, 2021). To accomplish this, it is important to identify and question the current cognitive model and identify relevant alternatives.

However, at present, the visual perspective on business models is fragmented, as evidenced by the wide range of different approaches to business model visualisation currently used (Täuscher and Abdelkafi, 2017; Henike, Kamprath and Hölzle, 2020). There is thus an opportunity to contribute to the visualisation perspective on business models.

Another challenge associated with sustainable business model innovation is that many of the current design methodologies do not specifically include sustainability (Evans *et al.*, 2017). Some recent studies do include tools and frameworks for sustainable design (e.g., Guldmann, Bocken and Brezet, 2019; Vladimirova, 2019), but given the scarcity of such models there is still a gap when it comes to harnessing the potential of visual principles to improve sustainable business model innovation.

Against this background, the aim of this paper is to draw on visual theory to develop tools to improve the sustainable business model innovation process. This is achieved through a framework of sustainable trajectories for business model innovation. A cognitive view on business models is adopted since this is often linked to the visual perspective (Massa and Hacklin, 2021). According to this view, business model innovation is the activity of (re)imagining the firm's value creation logics by following visual design principles to update the cognitive map of the business model.

The paper is organised as follows. First, the methodological approach is described, which involved using visual theory and linking it to the sustainable business model literature. Next, the key insights are introduced, focusing on how to use visual thinking to support sustainable business model innovation. Finally, the concluding section describes the theoretical contribution, namely the opening of the "black box" of sustainable value creation (Lüdeke-Freund et al., 2020) by visualising different business model value creation trajectories, and the practical contribution of guidelines for visual business model design and a multi-lens design approach to combine sustainable trajectories.

Methodological Approach

The paper adds to the typology of value creation logics in business model visualisations found in my previous article (Havemo, 2018). In that paper, over 200 business model diagrams from firms' annual reports and websites were analysed to identify patterns and styles of communication. I found that business model illustrations could be sorted into four basic value creation logics based on how they visually depicted value, where each logic presented a different cognitive lens describing the business model. As a result, a visualisation logic may guide interpretations and discussions of the business model according to the cognitive potentials and limitations of that particular visual illustration. For example, a visualisation showing activities and links (the transactive logic) will centre discussions around the network of exchanges and relationships between actors and activities, whereas a process illustration will emphasise the inputs and outputs of a value creation process.

Because mental and visual models guide how we think and interact with others (Tversky, 1997; Sibbet, 2008), they can be used to support the business model design process. The methodological approach in this paper was therefore to use the visual value creation logics described in Havemo (2018) as

a starting point to develop four sustainable trajectories for business model innovation. The first step was to conduct a literature survey of sustainable business models to identify theoretical concepts and approaches linked to each visual logic. Next, empirical examples (for example, H&M's circular business strategy) were used together with visual theory to populate each trajectory with content. For example, the visual grammar described by Kress and van Leeuwen (2006) was used to determine the design affordances of different types of diagrams, such as classification and process diagrams. This grammar was combined with the work of Barbara Tversky (1997), which describes different visual modes such as "spatial metaphors" and the communicative role of shapes and lines in diagrams, to develop the illustrations of the trajectories according to visual design recommendations. Finally, a second literature search was conducted to find case studies in the literature that illustrate the thinking within each trajectory.

Key Insights: Sustainable Business Model Trajectories

To imagine what it takes to be more sustainable, the concept of pathways has been used to identify steps that support increased business model sustainability in prior research. For instance, Endregat and Pennink (2021) describe pathways for managing business model complexity and Bocken et al. (2014) outline eight archetypes of sustainable value creation and value capture (e.g., maximising resource efficiency and encourage sufficiency) that can lead to higher sustainability performance of the business model. Drawing on concepts like pathways and archetypes, this paper develops four trajectories for sustainable business model innovation based on visual thinking.

The four logics of value creation (from Havemo, 2018) and the resulting sustainable trajectories are shown in Figure 1 in the top and bottom row, respectively. The illustrations of business models are examples of types based on the findings by Havemo (2018). The trajectories are also summarised in Table 1, which names advantages and disadvantages of each logic and lists examples of related cases.

Classification trajectories

Classification diagrams conceive of the business model as a set of components that are crucial for value creation. This logic is common among practitioners' business model diagrams (Havemo, 2018) as it conveys key dimensions of value creation (for example, business units, products, or activities) in a clear manner. Using the classification visualisation as the basis of sustainable innovation invites questions about the role of the existing components and whether any elements should be added or removed to increase sustainability. A theoretical proposition in line with this idea is the sustainable canvas adapted from the original Business Model Canvas to include people and planet as part of the value proposition (Bocken, Schuit and Kraaijenhagen, 2018). The classification design is, however, limited to the static nature of these diagrams (Kress and van Leeuwen, 2006), such that changes will focus mainly on the presence or absence of elements rather than the role of links, relationships, and transformations.

An example of a classification-based approach is the business model innovation displayed by the owner of a sustainable pizzeria, as described by Franceschelli et al. (2018). The business model of "Pizza" was developed by changing the components of the "traditional" pizzeria business model by including, for example, bike or e-scooter delivery (instead of car), the use of electric ovens, biodegradable cutlery (instead of plastic), and locally sourced and "zero kilometre" ingredients to ensure a low environmental impact as well as high quality products (as opposed to a low-cost model). Each change from the traditional restaurant model involved exchanging a component for a sustainable alternative. The innovation process thus included the activity of defining the characteristics of an original business model and making replacements in line with sustainable goals.

Transactive trajectories

The transactive logic stipulates that value is created through interaction between, or within, firms (Havemo, 2018). This corresponds to a network perspective on the business model, for example, the activity systems view that conceptualises the business model as the sum of activities carried out by the firm and its network (Zott and Amit, 2010; Massa and

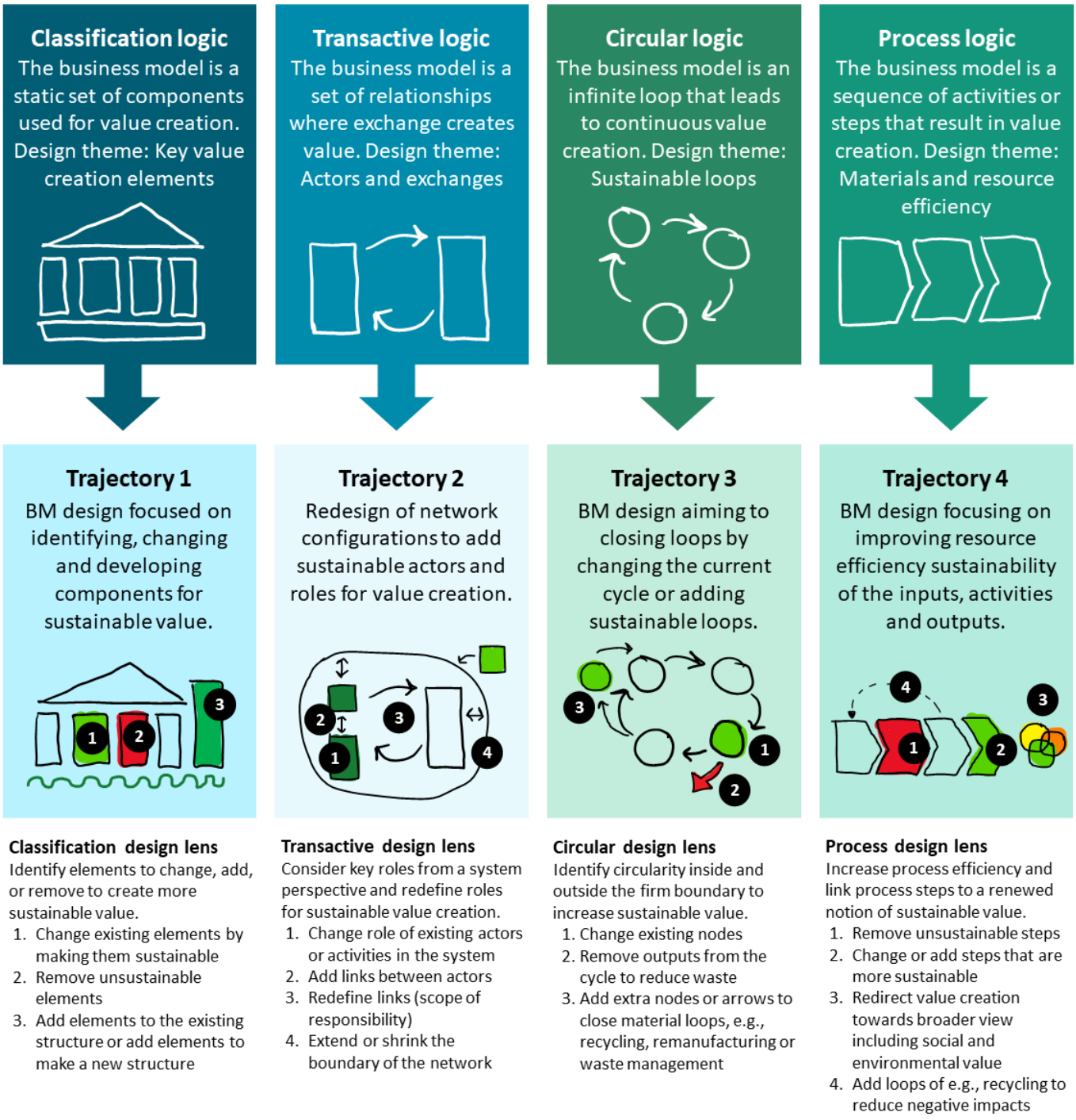

Figure 1: Framework of sustainable business model trajectories

Hacklin, 2021). From a visual perspective, changing a transactive logic involves adding new nodes (e.g., actors) to a network, changing links between nodes, or reorganising nodes as insiders or outsiders. Relatedly, the sustainability literature emphasises that the boundary of control needs to be expanded to support strong sustainability where firms take more responsibility (Antonini and Larrinaga, 2017); this could be visually illustrated by the extending or shrinking of the line marking the boundary of the business model network.

Several studies stress the importance of collaboration for sustainability, which from the transactive

perspective can be supported by changing how actors are linked in the business model's network. For example, Brennan and Tennant (2018) describe business model network innovation in a case study of a commodities supply chain in the UK. The initial configuration of the business model network was strictly market-based, where a brewery accessed their resources through a maltster and its supply chain, buying products through yearly spot contracts. The brewery then conducted a reconfiguration at the network level by changing the links between actors to include direct links with each tier of its supply chain, which influenced the actors' sustainability responsibility through new pathways for learning and innovation. This illustrates the trajectory of changing links between existing actors to increase the influence regarding sustainability concerns in the firm's business model, a change which can be illustrated visually by adding new lines that link actors in the network.

Circular trajectories

The circular trajectory reflects the lifecycle thinking of circular business models, whereby value is created through a circular process with the aim of narrowing or closing resource loops (Bocken, Schuit and Kraaijenhagen, 2018). For example, prior studies have used the cycle logic to illustrate causal loops between decisions and outcomes (Casadesus-Masanell and Ricart, 2010). Visually, changes can be illustrated based on the concept of directionality. According to Tversky (1997), directionality is the sense of transformation or change conveyed through the order of elements (left-to-right) and the use of arrows to indicate a direction of change. Thus, the circular diagram lends itself to visualising recycling or remanufacturing by adding new activities to the current loops or by adding new arrows to indicate the closing of loops. What this logic fails to illustrate clearly, however, is the role of specific actors and the inputs and outputs that are inevitably part of a resource loop. This could be addressed by adding inputs and outputs to each step of the loop, although this runs the risk of increasing the visual complexity to the point that it lowers the usefulness of the illustration.

An example of business model redesign guided by life-cycle thinking is the case of Norwegian office chair manufacturer HÅG (Høgevold, 2011). HÅG's sustainability journey began in the 1990s when they started to reframe the business model in terms of a lifecycle logic, which guided the firm's design process. For instance, concepts like cradle-to-cradle were adopted when adding recycled materials to the production loop in order to reduce the product's negative environmental impacts over its entire lifespan.

Process trajectories

The process logic identifies the value chain as the focal point of value creation, which is tied to an understanding of the firm as a rationally organised and bureaucratic entity (as opposed to the nature-oriented view of the circular logic). Treating the business model as a process visually emphasises the value proposition (input), value creation (process steps) and value delivery (output) as a set of sequentially organised elements. Process visualisation therefore supports design discussions focusing on inputs and outputs, i.e., the key material flows and outcomes of the business model, which are crucial topics from a resource efficiency perspective.

The office chair case (see above) contains several examples of a process-oriented redesign of a manufacturing business model. Since life-cycle analyses showed that it was largely the supply chain that contributed to the firm's product's environmental impact, the conceptualisation of the process was expanded to include inputs from the supply chain in order to show the total impact of the firm's business model. This illustrates how process-oriented thinking invites questions regarding the flows of the supply chain as well as the roles of suppliers and customers in the business model process.

Combining lenses

Most firms use only one business model visualisation logic at a time (Havemo, 2018). However, it has been suggested that multiple design principles can be combined to achieve a fruitful design process (Täuscher and Abdelkafi, 2017), especially when it comes to sustainable business models (Young and Gerard, 2021). For example, the office chair case (HÅG) shows that business model innovation can be guided by both circular and process thinking, which suggests synergistic outcomes from using these perspectives together. Accordingly, it would be possible to treat

Table 1.

	Classification	Transactive	Circular	Process
Focal point	*Key value creation elements*	*Actors and exchanges*	*Sustainable loops*	*Materials and resource efficiency*
Goal of the visual design process	Identify elements to change, add, or remove to create more sustainable value.	Consider key roles from a system perspective and redefine roles for value creation.	Identify circularity inside and outside the firm boundary to increase sustainable value.	Increase process efficiency and link process steps to a renewed notion of sustainable value.
Advantages	Simple to use when identifying key BM elements.	Highlights actors' co-creation and collaboration.	Emphasises circular thinking and closing loops.	Shows material flows (inputs and outputs).
Disadvantages	Static; does not illustrate the process of value creation.	Hides the sustainability impact of each actor's activities.	Ignores inputs and outputs.	Ignores the role of network actors and circular loops.
Illustrative case	*Pizzeria case* (Franceschelli, Santoro and Candelo, 2018)	*Brewery case* (Brennan and Tennant, 2018)	*Office chair case* (HÅG) – lifecycle perspective (Høgevold, 2011)	*Office chair case* (HÅG) – supply chain perspective (Høgevold, 2011)

Table 1: Design trajectories for sustainable business models

the visual trajectories as complementary 'design lenses' in order to cast light on different aspects during the business model innovation process. Such a multi-lens approach could cycle through each of the design lenses, either iteratively or sequentially. An example of a sequential design process is shown in Figure 2.

A first step is to use the process lens to describe the intended outputs of the value creation process. Here, designers need to define the purpose of the business model that takes sustainable value into account, as discussed by, for example, Bocken et al. (2014). Second, the classification logic guides designers to think about which elements are needed to deliver more sustainable value. Inspired by the Pizzeria case, a favourable design outcome could involve identifying which existing practices to replace in order to enable more sustainable value creation across all the elements of the business model. Third, the cycle perspective invites consideration of whether there are any loops to close to reduce waste, which in turn feeds into transactive-oriented considerations about the key business model

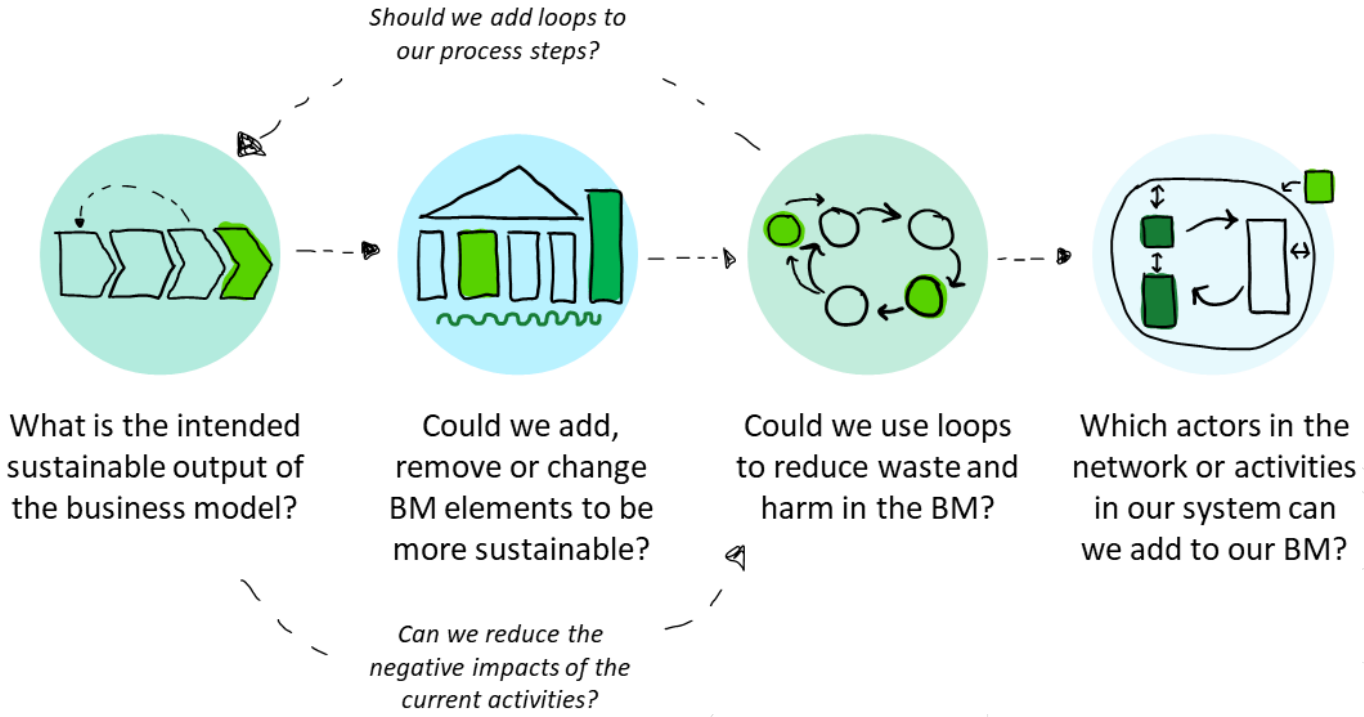

Figure 2: The sustainable trajectories used as business model (BM) design lenses

actors, what links between them are needed inside the activity system to enable the sustainable loops, and whether the firm boundary needs to shrink or expand to enable sustainable value creation. Taken together, these questions support the combination of multiple perspectives in the business model innovation process.

Conclusions

By conceptualising how sustainability can be integrated into the business model through four different sustainable trajectories that guide the innovation process, this paper contributes to the literature on sustainable business models and business model innovation. The paper also provides a novel visualisation to the growing list of sustainable business model visualisations, such as the Circular Business Experiment Cycle (Bocken, Schuit and Kraaijenhagen, 2018) and the sustainable value proposition model (Vladimirova, 2019). A further contribution is the multi-lens perspective, that is, the combined use of multiple business model logics to support sustainable business model innovation. Since sustainability is a complex matter involving numerous business model changes, multi-lens methodologies are potentially important tools to manage complexities and consider multiple, sometimes conflicting, perspectives in the design process.

Moreover, the four trajectories illustrate that value creation can be understood in fundamentally different ways, as each logic frames value differently and emphasises different focal points, such as actors, loops, resources, and outputs. This in turn affords different interpretations of the key design goals in the sustainable business model innovation process. Thus, the paper responds to the concern that sustainable value creation is often treated as a "black box" in the literature (Lüdeke-Freund *et al.*, 2020) by extending and nuancing sustainable value creation through visual drawings that illustrate different interpretations of value creation.

The practical contribution of the paper is the "toolbox" of visual business model trajectories. Firms can use this toolbox to identify the current value creation logic of their business model and then use the sustainable trajectory of this logic as a design lens to discuss avenues for innovation. A second option is to employ all the business model lenses interactively

or sequentially during the innovation process to identify multiple opportunities for designing a sustainable business model.

The practical toolbox can be used at any level of the organisation where the current and future state of the business model are discussed. For instance, Doganova and Eyquem-Renault (2009) describe business modelling involving visualisations as a way to represent a new venture's future value creation potential to key investors. Although business model design is often linked to the domain of decision makers – indeed, it has been suggested that it can be useful to start with a small team of key roles in the early stages of business model innovation and to gradually engage more stakeholders (Bocken, Schuit and Kraaijenhagen, 2018) – there is a potential to extend the scope of business model design by using visualisations to support dialogue with a range of internal and external stakeholders during the design process.

In terms of limitations, the sustainable trajectories are theoretically derived based on visual theory and the sustainable business model literature but not yet empirically verified. Although empirical examples were mapped according to the trajectories, it is conceivable that firms would not follow the trajectories as strictly as the current framework suggests. There is therefore an opportunity for future studies to use case-based approaches to dive deeper into each of the trajectories to identify critical success factors as well as find additional trajectories. Finally, there is an opportunity to conduct action research to develop new visual business model innovation methodologies for sustainability based on these, and other, sustainable trajectories.

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Complementors' Coopetition-Based Business Models in Multi-Platform Ecosystems

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Abstract

Multi-platform ecosystems (MPEs) are comprised of multiple platforms integrated to create and capture value together. The collective value creation and capture within MPEs gives rise to coopetion, which impacts the business model configurations for both incumbents and entrants that provide complementary offerings. Previous platform research has predominantly focused on incumbent platforms. This research focuses on the question of how entrant platforms configure their busi ness models to endorse coopetition with incumbents in the MPEs in the highly regulated healthcare sector. Our findings indicate that entrant platforms configure their business models to integrate into MPEs and need to flexibly align with the complementarity requirements set by the incumbents, combine inter- and intra-platform collaborative dynamics in their business models, and build on coopetition with incumbents.

Introduction

Digital platforms have become a prominent component of the digital economy (Cusumano et al., 2020; Hein et al., 2019; Rietveld et al., 2019), including in healthcare. The increased adoption of digital health technologies globally brings new challenges for digital platforms operating in the healthcare domain. These challenges affect incumbent platforms, which must keep up with rapidly changing requirements and newness threats from the entrant platforms. Meanwhile, entrant platforms lack sufficient resources to meet the regulatory requirements and sustain enough revenue streams to develop their

Keywords: Multi-platform ecosystems, Coopetition, Complementarity

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platforms (Aerts et al., 2023). Entrant platforms need extensive resources to get their technologies accredited by hospitals and establish trust mechanisms with them, as healthcare is a highly regulated domain. Incumbent and entrant platforms need to configure their business models to find new value creation mechanisms outside their ecosystem boundaries and start collaborating with their competitors. In turn, these dynamics drive the competing platforms to collaborate and integrate their technologies into Multi-platform Ecosystems (MPEs) for collective value co-creation and co-capture (Mohamed et al., 2023).

Coopetition aggregates all actors in the MPEs in the creation of shared value, and it affects the actors' choice of competition outside the borders of the MPEs. From the strategic perspective, integration into the MPEs grants the incumbent platforms the autonomy to decide the governance mechanisms for the whole ecosystem, which triggers governance tensions between ecosystem actors in the later phases of integration (O'Mahony and Karp, 2020). The alignment of multi-layered relations between incumbent and entrant (complementing) platforms in MPEs is complex and differs from the single multi-sided platform (Mohamed et al., 2023; Zhang and Williamson, 2021). Research on common value co-creation and business model configuration in complex domains like MPEs is lacking. Recent research on platform business models has focused on incumbent platforms, often referred to as platform owners. However, there is scant research on firms' business models offering *complementary* platforms (Ritala et al., 2014) or their business models and coopetition dynamics in multi-platform ecosystems. The extant research considered platform ecosystems as organizations where the leadership role was granted to the owner of the platform's technological hub (Hein et al., 2019; Kretschmer et al., 2020). The platform leader orchestrates the governance mechanisms and designs the roles of admitting new complementors to the platform core (Cusumano and Gawer, 2002; Gawer, 2014). The extant research has examined collaboration-competition dynamics in the platform setting from the platform leader's perspective. However, most of the extant research used publicly available data for the platform companies, which may be considered biased and incomplete because it lacks data from managers and decision makers in the platform firms.

In this study, we consider the managerial influence on the platform decision to configure their business model for establishing coopetition with the competing platforms. In doing so, we use the digital stroke pathway as the context for this study, in which the implementation of cross-integration between multiple platform providers is required. The incumbent platform providers are the platform leaders who orchestrate the governance mechanisms for the overall platform ecosystem. Given the complex entry requirements and regulations in the healthcare domain, entrant platforms are the complementors for the incumbent's offering and collaborate with the incumbent platforms to get access to the healthcare domain.

This study develops the following research question: how do entrants configure their business models to endorse coopetition with incumbents in MPEs? We argue that platforms integrate into MPEs to scale and renew their businesses through coopetition with a large base of stakeholders integrating into MPEs. The paper concludes that entrant platforms configure their business models to endorse inter-platform coopetition and gain approval from incumbent platforms in highly regulated domains like healthcare.

Approach

Definition of key concepts

Platform business models

At the single multi-sided platform level, the business model creates value by facilitating the exchange between the demand side (end-users) and the supply side (producers) (Gawer, 2014). The network effect influences the dynamics of platform business models when users on the demand side grow to an extent that motivates complementors to join the supply side of the platform to add their complementary innovations and generate greater value for the platform (Tiwana et al., 2010). The platform leader decides on the degree of platform openness through governance mechanisms by granting access to complementors on the supply side to the platform

to add their innovations (Tiwana, 2013). Depending on the degree of openness set by the governance mechanisms, when it becomes publicly known how to integrate complementary offerings to the leading platform, new complementors will be encouraged to join the platform and provide complementary offerings to the it (Cusumano and Gawer, 2002).

As a starting point for building up the conceptual framework for MPE's thinking, the extant research has examined the emergence of the digital platform from the single-sided platform perspective. The supply-side platform operates to fulfil the demand created by the end-users on the demand-side platform. The demand side aggregates the end-user group, and the supply side aggregates the platform complementors, and in some cases, it aggregates the third-party complementors. The digital multi-sided platform aggregates both demand-side and supply-side platforms around both sides. (Tiwana et al., 2010; Cusumano and Gawer, 2002). The direct network effect occurs when the platform becomes favourable to many users on the demand side. The more it aggregates complementors on the supply side, the more it provides a complementary offering that matches the core of the central platform (Economides, 1996; Tiwana et al., 2010).

Yet unlike industrial/product-oriented platforms, digital multi-sided platforms establish complex ecosystem dynamics (Cusumano et al., 2020; Tiwana, 2013). The governance mechanisms determine the role of each complementor in the platform ecosystem, specifying who does what, and what types of innovation are needed, specifically when these innovations take place in the complementary modules (Boudreau, 2010). Furthermore, when it becomes publicly known how to integrate complementary modules to the leading platform, new complementors will be encouraged to join the platform ecosystem (Cusumano and Gawer, 2002). Moreover, this increases competition in multi-sided markets, introducing challenging new forces for the platform leader to emphasise, adding innovations to the overall platform ecosystem and protecting the technology from imitation (Zeng et al., 2019). As part of coping with the competition that might arise from the complement's side or entrant platforms, the platform ecosystem can evolve as a meta-organisation in which the architecture design of the leading platform's infrastructure can enable the aggregation of platforms around the technological core (Kretschmer et al., 2020).

MPEs include leading and complementary platforms aggregated around the technological core of the leading platform (Kretschmer et al., 2020). The architectural design of the platform ecosystem enables the central platform to provide the technical infrastructure for complementors to create their complementary offerings and expand their business scope (Tiwana, 2013). Further, it enables the central platform to orchestrate the value creation and capture for the entire platform ecosystem (Baldwin, 2012; Yrjölä et al., 2021). The platform ecosystem leverages the capabilities of complementors to add new features that the platform owner does not see (Tiwana et al., 2010; Isckia et al., 2020) and transform the business models of both incumbent and complementor platforms.

Inter-platform coopetition in MPEs

Strategic management scholars define coopetition as the alignment of collaborative dynamics with competitors to achieve a more significant competitive advantage for both parties than a single firm could achieve alone (Ritala and Hurmelinna-Laukkanen, 2009). In the digital platform setting, coopetition occurs when complements align their heterogeneous motives to join the platform ecosystem to use resources efficiently, share costs, risks, and resources for innovation and improve the competitive dynamics

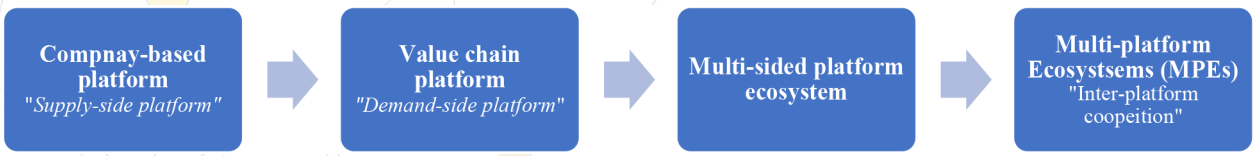

Figure 1. The conceptual development of Multi-platform Ecosystems (MPEs)

of the platform ecosystem. In this sense, the value is captured by involving competitors in the company's business model (Ritala et al., 2014). Although coopetition intensifies data sharing between complementors in MPEs, it can stimulate tensions between complementors when the individual platform's opportunistic behaviour becomes visible (Mohamed et al., 2023; O'Mahony and Karp, 2020).

The value proposition in digital platforms forms around end-user centricity and information exchange between end-users, platform leaders, and complementors (Gawer, 2014). The integration between the platform leader and complementor enables the exchange of the platform leader's internal resources and facilitates complementors in adding complementary innovation and expanding the scope of the platform (Isckia et al., 2020; Zeng et al., 2019). Value creation thus depends on the degree of integration between both sides of the platform. Moreover, it enhances platform leaders to establish a large base of users and complementors to enable the cross-side network effect between these two groups (Tiwana, 2013). Nevertheless, achieving the full integration dynamics between multiple complementors and leaders in multi-platform ecosystems is challenging. In MPEs, incumbent platforms come at the centre of the platform ecosystem and design the integration roles for other complementors involved in them (Cusumano and Gawer, 2002; Rietveld et al., 2019; Teece, 2018). Yet designing and managing complementarity becomes complex when multiple platforms have unequal leadership roles within the same ecosystem (Mohamed et al., 2023).

Research method

We opt for a qualitative case study approach (Yin, 2015) to address the configuration of complementor's business models when integrating into MPEs. We collected the research data through 13 semi-structured interviews with project managers from the selected case companies between June 2020 and November 2021. We followed purposeful sampling in the selection of the case companies (Patton, 1990), where all cases were part of the Stroke-Data consortium in Finland, which aims to co-create a patient solution for stroke prevention, treatment, and rehabilitation. We discussed the following themes during interview rounds: the platform's integration strategy to the MPEs, the type of market opportunities driven by integration into the MPEs, the configuration of the platform's business model, complementarity with other partners, and the platform's future business model and revenue model scenarios. We reached data saturation after the last interview round, and no further data collection could develop additional insights for this study. We anonymised any information that could affect the case company's future strategies. We transcribed all interviews to start the data analysis.

We followed the thematic analysis approach to analyse our data (Braun and Clarke, 2006) and started the analysis with an in-depth reading of interview transcripts and highlighting the relevant themes for our study. We categorised the common themes into three categories, following Zott and Amit's (2010) business model design elements of content, structure, and governance to analyse how the platform conducts business and delivers value to its customers. The content refers to the activities performed by the focal platform; the structure describes how various activities can be linked and what sequence is needed; and governance refers to who does what.

Key insights

Using Zott and Amit's (2010) business model design elements, we identified what kind of adjustments entrant (complementing) platforms make to their business model to endorse coopetition and meet the integration requirements imposed by the incumbents in MPEs. We consider the choice of our analysis approach justified, because the selected platforms configure their business models to integrate the external capabilities (i.e. coopetition with incumbents) with internal resources in support of innovation strategies (i.e. integration into MPEs). Further, the business model determines a firm's bargaining power, which

means that the greater the value the focal firm has, the greater the bargaining power it will have, i.e. bargaining power between incumbents and entrants' platforms integrating into MPEs.

In the analysis of our case study, we identified the content, structure, and governance of the complementing "entrant" and incumbent platforms. We found that complementing entrant platforms configured their business model to best align with the coopetition requirements set by the incumbents to achieve market entry into the healthcare domain. The licensing requirements to admit a new device is rather complex, and the initial cost required to run the piloting study to get a licensed medical device is beyond the resources of the newly born entrant firms.

Our findings indicate that incumbents design the governance mechanisms in MPEs to control the platform's central technological hub. In other words, incumbents facilitate the coordination and data-monetisation activities between complementors in MPEs. Whilst complementors agree to the governance mechanisms that define platform-to-platform openness strategies, coopetition dynamics within and outside MPEs are difficult to identify by the complementors due to their limited financial resources and uncertainty about new markets. The key findings of our analysis are presented in Table 1.

Table 1.

Complementors' Business Model		Incumbent Platform Business Model	Business Model configuration in MPEs
Platform B	**1. Content** The platform *applies cross-collaboration with all platforms integrating into MPEs*. The current usage of the platform focuses on the rehabilitation and prevention sides of the stroke treatment journey. The *coopetition with all platforms is a renewed opportunity* to expand into the treatment parts of the stroke. **2. Structure** A big data platform integrates and monetises sleep and rest periods *with other platforms* integrating into the stroke-data MPEs. **3. Governance** *Coopetition with incumbents and other new entrant platforms* to develop secondary prevention solutions for strokes. Through the *partnership with other new entrants,* the company supplies platform E with their sensors to help build the AI-oriented platform.	**Platform A** **1. Content** The platform offers a preventive solution for medical care professionals and patients and *regulatory experts* to certify medical devices/solutions. **2. Structure** The platform is integrated into MPEs to *expand the business scope through collaboration with new entrants* and develop an initial prototype for Software as a medical device for clinical decision making through data integrations with other platforms. **3. Governance** Platform-to-platform openness to developing software as a medical device that supports healthcare professionals in clinical decision making. Also, personalised support for patients alongside their *treatment journey.*	**1. Complementor business models** Enable the establishment of collaborative relationships between competing firms as new entrants arrive with a radical innovation that may disrupt the market dominance for incumbents. The resource limitations and higher levels of market uncertainty are the drivers for new entrants to establish coopetition-based business models with incumbent platforms. **2. 'Complementors' joint business models** Relieve some of the integration conflicts between complementors and platform leaders. Deciding who designs the governance mechanisms and how to share data is related to platform-to-platform openness from the beginning of integration.

Table 1. Complementors' business model configuration in the MPEs[1]

[1] The italic font refers to coopetition in the business model elements.

Table 1.

Complementors' Business Model		Incumbent Platform Business Model	Business Model configuration in MPEs
Platform C	**1. Content** Platform specialising in business intelligence, data reporting, warehousing and planning. **2. Structure** Established *collaboration with platform E* to build the rehabilitation platform. **3. Governance** The platform unifies the stream analytics generated from the business analytics platform to the platform D concept and meets the integration requirements for MPEs.	**Platform G** **1. Content** AI-based analytics platform to measure ECG. **2. Structure** *Coopetition with new entrants* to further develop the AI-driven analytics platform. **3. Governance** The platform applies *platform-to-platform openness* as a data source for all platforms integrating into the MPEs. The platform sensor monitors the patient status either from home or the hospital environment.	**3. Approval of the complementors' business models for entry and the creation of new market opportunities** Coopetition with incumbents helps gain approval to "entrants'" business models in complex domains. Entrants can find their place in MPEs through collaboration and sharing the high costs of R&D. In parallel, coopetition-based business models enable incumbents to keep control of the propensity for sudden competition from entrant firms.
Platform D	**1. Content** Empathic building platform specialising in data visualisation from *all possible data collection points.* **2. Structure** *Collaboration with platform C* for data visualisation and all other platforms to integrate solutions around the empathic building platform. **3. Governance** Platform integration into all points on the digital care pathway for stroke prevention, treatment, and rehabilitation.		**4. Coopetition-based business model as an international market approach for complementor platforms** Resource limitations, market uncertainty, and competition drive new entrants to configure their business model based on the mechanisms set by incumbent firms. Otherwise, they cannot establish collaborative dynamics with well-established incumbents. Coopetition will guarantee entrant platforms a fair share of the business when expanding internationally.
Platform E	**1. Content** AI platform developed based on the *integration phases and complementors* needs in the MPEs. **2. Structure** The platform operates in the Finnish market *and collaborates with platform A to access other Nordic countries.* **3. Governance** The platform applies *platform-to-platform openness* through a *partnership* with Platform A		

Table 1. Complementors' business model configuration in the MPEs (*Continued*)

Table 1.			
Complementors' Business Model		**Incumbent Platform Business Model**	**Business Model configuration in MPEs**
Platform F	**1. Content** The platform develops its sensors to continuously monitor people at risk of stroke or stroke reoccurrence. **2. Structure** *Collaboration with the incumbent* platforms to *gain access to the Asian market.* **3. Governance** The platform seeks the *approval of the incumbent platforms A and G* to use their sensors in stroke rehabilitation and prevention.		

Table 1. Complementors' business model configuration in the MPEs (*Continued*)

Discussion and conclusion

Our motivation for this study was to understand how entrant platforms configured their business models to endorse coopetition with incumbent platforms when integrating into MPEs. This paper enriches our understanding of the inter-platform coopetition when platforms shift from the single multi-sided platform ecosystem to multi-platform ecosystems. We emphasised healthcare as a complex, rapidly changing, and highly regulated domain that facilitated the competing platforms to engage in collaborative dynamics as the central part of their value creation and capture in healthcare. From the entrant platforms' perspective, they lacked sufficient resources to meet the entry requirements set by healthcare. At the same time, incumbents collaborated with entrants as a strategic approach to overcoming possible competition in the future. We analysed the business model configuration for both entrant and incumbent platforms, with a particular emphasis on the entrant platforms during their integration into MPEs – i.e. the ecosystem of multiple platforms working together to create a shared value for the whole platform ecosystem. The extant studies have examined MPEs as a multi-layered system using modular design as a critical element for managing interdependencies between modules and bringing active cooperative dynamics to the ecosystem (e.g. Yrjölä et al., 2021). Tensions of managing modularity in multi-layered systems arise from battles for market dominance between different modules. The platform leader designs the modular business model to guarantee equal opportunities for all modules involved in the multi-layered system.

Four significant findings have emerged from our analysis. First, we argue that in the complex and highly regulated domains like healthcare, platforms need to configure their business models to integrate into the MPEs. Incumbent platforms take the platform leader role and design the governance mechanisms for the whole ecosystem to guarantee market dominance and overcome sudden competition by complementors. This finding resonates with the platform leadership strategies in the single multi-sided platform setting, where the platform leader decides the level of platform openness that enables complementary innovations to expand the scope of the platform (Den Hartigh et al., 2016). Further, we conclude that resource limitation and higher levels of market uncertainty drive entrant platforms to configure their business models for coopetition with regulated incumbents.

Second, we argue that complementors configure their business models when integrating MPEs to best align with the *complementarity requirements* set by incumbents, especially in complex domains like healthcare, where the integration and optimisation requirements for admitting new technologies and creating trust are complex. Our findings extend Kretschmer et al.'s (2020) view on the hierarchy and establishment of the incumbents that place a considerable hurdle for the platforms to enter specific markets unless the platform leader grants complementors the flexibility and autonomy to design their offerings.

Third, we find that *complementor platforms must be flexible* when configuring their coopetition-based business model with incumbents to gain their approval to verify the overlapping goals and decide the size of market share from the cooperative relations. Our view is consistent with Kretschmer et al.'s (2020) study on meta-organisation features, where control of the platform is granted to the central technological hub to facilitate the coordination between the existing and new complements, as entrants integrate into MPEs to increase their opportunities in the ecosystem (Isckia et al., 2020). This finding highlights that MPEs grow when they become open and attract many complementors to integrate into the ecosystem. Nevertheless, this raises cooperative tensions between complementors concerning future collaborations that may influence some complementors' future market strategies (Zhu and Iansiti, 2007).

In MPEs, the dynamics of the ecosystem evolve, as many platforms decide to integrate their complementary technology or open their technical core for other platforms to build their offerings upon. The complementarity does not limit the layered setting. Instead, some platforms can simultaneously have the complementor and owner roles, which means integrating into MPEs *combines inter- and intra-platform collaborative dynamics*. We conclude that the coopetition in MPEs conceptualizes two elements: (I) the number of complementors is bigger than the number of platform owners, and (II) the platform owner decides the openness of the platform infrastructure to attract complementors who add complementary innovations and increase the value of the platforms.

Fourth, this study concludes that the *complementors' business models build on coopetition to benefit incumbent and new entrants integrating into MPEs*. Platform-to-platform openness and governance mechanisms are the wheels for admitting new complementors to MPEs. Nevertheless, platform leaders decide the governance mechanisms in MPEs, and they develop through multiple transitions. Platform leadership activity varies between centralise-d and decentralised control over the complementors who integrate into the MPEs. The transitions in leadership roles are generated from the platform leader strategy to maintain the same level of market dominance by not admitting platforms that might turn into sudden competitors in integrations' later stages.

Finally, this case study has analysed complementors' approaches to configuring their business models as part of their renewal strategy. Further research could investigate the specifics of business models as the coopetition relationship emerges. In particular, an examination of the conditions in which the tensions of coopetition occur when new entrants have business opportunities outside the scope of MPEs that may intensify the competition between new entrants and incumbents would be valuable. Further, we encourage additional empirically grounded studies in different domains (instead of the healthcare domain used in this study) to investigate how the integration requirements and drivers may be formed in other settings.

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The Role of Digital Technologies in a Data-driven Circular Business Model: A Systematic Literature Review

Malahat Ghoreishi[1,2]

Abstract

The Circular Economy (CE) has been identified as a promising solution for reducing emissions, waste, and achieving sustainable development goals while offering economic values for companies. However, the move towards CE requires managers and decision-makers to rethink and redesign their Business Models (BMs) incrementally or radically. In order to achieve proper decisions on resource usage, product designs, material flows, and recirculation of materials, data plays a significant role in CE. Accessible data is considered as an essential enabler of circular solutions and at the heart of circular business models. In this regard, digital transformation can offer innovative tools for efficient execution and sharing of data to help companies generating new business models and to increase their competitive advantages. This study explores different data-driven BMs enabled by digital technologies in CE.

Introduction

The move towards Circular Economy (CE) requires systemic change in how companies create and deliver value to customers (value proposition) and how they can capture and generate revenue (value capture) (Bocken et al., 2016). Therefore, innovating Business Models (BMs) are the fundamentals of the CE concept (Centobelli et al., 2020). Bocken and Ritala (2021) defined two strategic choices in developing circular BM initiatives as innovation and resource strategies. While resource strategy focuses on narrowing, slowing, closing, and regenerating resource and energy loops (Geissdoerfer et al., 2018), innovation strategy focuses on firm-driven internal processes (closed innovation) and collaboration with external partners and stakeholders (open innovation). The value creation in circular BMs for narrowing the loops happens by delivering

Keywords: Circular economy, data-driven business model, digital technologies

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value to customers through efficient design and production, reducing the extraction of virgin materials and resources (Li et al., 2010). In slowing the loops, circular BMs aim to create value by extending products' life by designing products that can have more than one use cycle and are more durable, upgraded, repairable, and easy to disassemble recyclable (Zhu et al., 2010). Finally, BMs for closing the loops generate value through recycling and recovering materials for reuse in new production processes (Bocken and Ritala, 2021). Processes such as resource optimisation, manufacturing products, extending the lifetime of products, offering new use cycles, and improving material flow, include high-volume data, which, if implemented efficiently, can enhance circularity (Ingemarsdotter et al., 2020). Data can create value when transferred to information, which can be integrated with other data sources and interpreted as knowledge. When knowledge is further enriched and developed, it forms wisdom (Kristoffersen et al., 2020). A data-driven CE gives companies more opportunities to develop innovative BMs, create networks and partnerships, as well as expanding ecosystems (Kauppila, 2022). Transparent data on material and components enables measuring the impact of production and operations on material, creating pure and high-quality feedstock by preventing toxic, contaminant and non-renewable material, as well as reducing the cost of material extraction and usage (Blomsma et al., 2020). Hence, it helps companies to make more efficient and accurate decisions on material and process choices to achieve CE goals. In addition, accurate data on material flow internally and across the whole value chain can ensure proper recycling opportunities at the end of product's life while enhancing the recovery processes of materials (Sitra, 2021). Accordingly, data for circular BMs can be categorised as follows: data on product design and production, data on use phase and customer behaviour, data on product and service lifetime, data on system performance, and data on material flows. Implementing such data in circular value creation develops BMs such as servitisation-based models, product as a service model, sharing economy models, collaborative consumption models, product life extension models, and resource recovery models (Luoma et al., 2021).

As shown in Figure. 1, data is at the core of the CE model, which can be collected, stored, measured and analysed by digital technologies such as big data, Artificial Intelligence (AI), Blockchain and the Internet of Things (IoT), also known as Industry 4.0

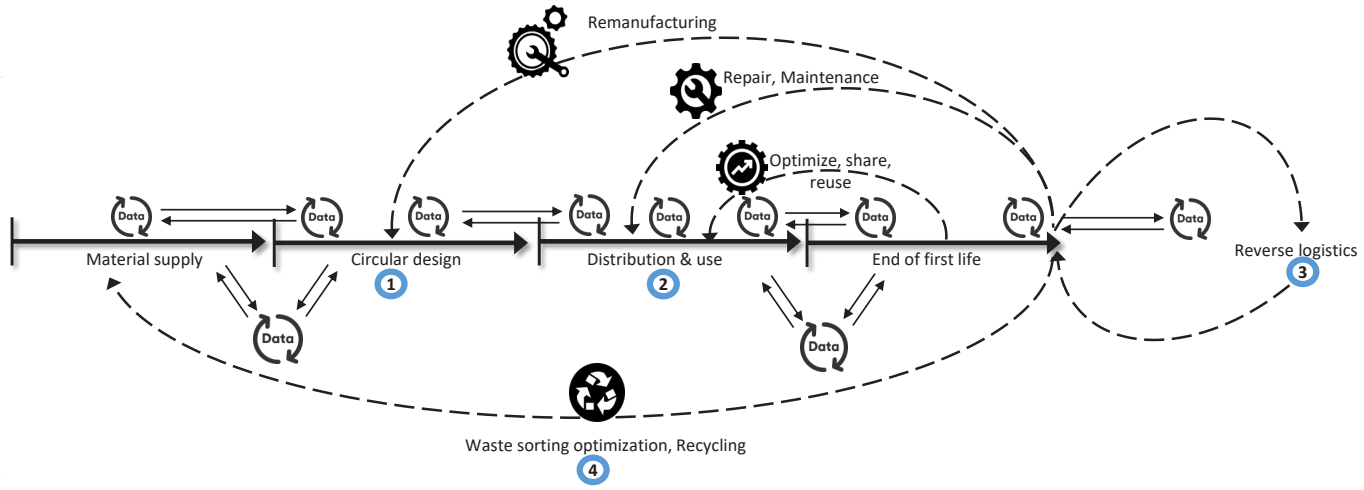

Figure 1: Role of data and digital technologies in CE (based on Ghoreishi et al., 2022)

(Ghoreishi et al., 2022). Digital technologies are revolutionising BMs in CE by:

- enabling tracking and tracing products and materials to develop product-as-a-service system which reduces product ownership while increasing reuse, repair and refurbishment opportunities (Alcayaga et al., 2019);
- enabling data sharing within the whole supply chain that improves retaining of value from products and materials (de Sousa Jabbour et al., 2019);
- enabling higher efficiency and circularity in manufacturing products and material processes (Ranta et al., 2021);
- enabling platforms that connect companies and customers, support development of service and dematerialisation, and facilitate industrial symbiosis (Täuscher and Laudien, 2018);
- enabling shared databases for sharing waste information and reusing waste as a resource (Radamaekers et al., 2011).

Although research on the role of data in CE has recently gained the attention of practitioners and researchers (Luoma et al., 2021), only limited studies were conducted on the role of digital technologies in data-driven circular BMs (Ranta, 2021). Therefore, the research questions of this study are as follows:

RQ1. What are the existing data-driven business models in CE?
RQ2. What is the role of digital technologies in data-driven circular BMs?

Methodological approach

To answer the research question and to understand the existing literature on the role of digital technologies on data-driven circular BMs, a systematic literature review was conducted in this study (Xiao and Watson, 2019). Scopus and EBSCO Business Source Complete were the selected academic databases. The search was conducted using the main terms 'circular business model', 'digitalization', and 'data-driven business model'. The set of keywords for each term was selected based on the domain literature (Table 1). The search terms were selected in the title, abstract, keywords, or subject, with 'data' chosen as any part of the text. In addition, the search was limited to articles and reviews published in peer-reviewed journals, English language, between January 2000 and March 2022 (1.1.2000-31.03.2022).

Table 1.

Terms	Keywords
Circular business model	(circular*) AND "business model*" OR "Value creat*")
Digitalization	(digitali*ation OR "digital technolog*" OR "digiti*ation" OR "digital transformation" OR "big data" OR "IT" OR "Industry 4.0" OR "Internet of Things" OR "IoT" OR "remote control" OR "remote monitoring" OR "RFID" OR "Artificial Intelligence" OR "data analytics" OR "predective analytics" OR "machine learning" OR " automat* robots" OR "smart robots" OR "smart data" OR " digital manufacturing")
Data-driven business model	(data OR "data collection" OR "data gathering" OR "data analysis" OR "data analytics" OR "data mining")

Table 1: Keywords used in the search settings

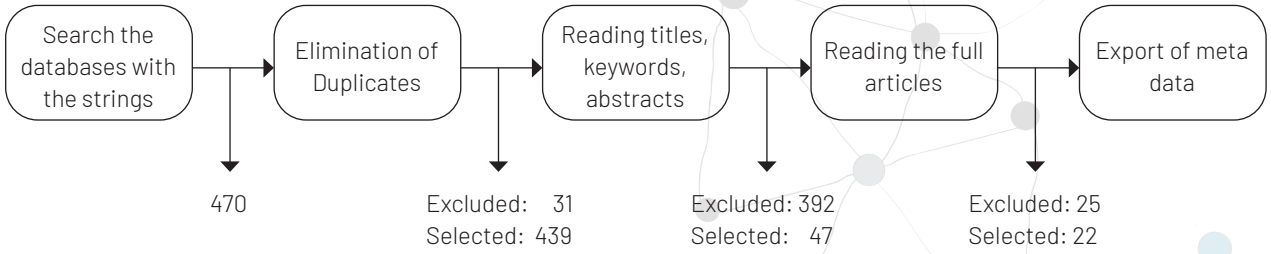

Figure 2: Research design for the literature review.

After removing duplicates, the screening process was continued by reading titles, keywords, and abstracts. To ensure the final sample, the articles should 1) include the concepts of circular BMs and circular value creation, 2) address the digital technologies and CE, 3) address the utilisation of data in circular BMs by digital technologies. Accordingly, the articles that did not meet these criteria were excluded. Furthermore, the author read the full articles for a more accurate decision, specifically the results sections. The literature search process is shown in Figure 2, based on which 47 articles were selected for full article screening. After reading the full text of each article carefully, the irrelevant articles were excluded and resulted in 22 selected articles for a systematic review regarding the theoretical, conceptual and empirical contribution to answering the RQs of this study.

Furthermore, the relevant data was collected manually and documented systematically in an Excel sheet. The aspects of the articles related to the role of data in circular BMs and value creation by digital technologies were assessed and identified. The main terms of circular BMs, the definition of the BMs, the role of data in circular BMs and the description of how digital technologies enable data for circularity in these BMs were identified and coded after the data analysis. This way, the contents of articles were classified and compared to form a systematic finding.

Results of the literature review

The role of digital technologies as an enabler of circular strategies, ReSOLVE strategies, and circular BMs has been discussed in various research and studies since 2017 (Alcayaga et al., 2019; Blomsma et al., 2020). However, according to the results of this study, the vital role of data, how data creates value in circular BMs through digital technologies, has only been argued by limited researchers since 2018. The results from the systematic literature review indicate the increasing trend in research on this topic, with three publications in 2018, two publications in 2019, three publications in 2020, seven publications in 2021, and seven publications by the Spring of 2022 (Figure 3).

Moreover, the journals with the highest publications are respectively as follows: Sustainability open access Journal with six publications, four publications in Business Strategy and the Environment Journal, two publications in Journal of Cleaner Production and two publications in Journal of Resources, conservation and Recycling, and the rest were published in various Journals (Figure 4).

According to the results, as illustrated in Figure 5, IoT is the most discussed digital technologies in different research due to the capability of IoT sensors and links in connecting physical products and online services. Therefore, it can enable tracking, tracing and transferring of real-time data, which results in saving resources, optimisation of processes, transportation and material flows, as well as minimizing unnecessary expenses on material extraction throughout the entire network of supply chains (Ivanov et al., 2022; Chauhan et al., 2022; Ranta et al., 2021; Ingemarsdotter et al., 2020).

Furthermore, Data-based services are a rising trend aiming at increasing transparency and creating new value from supply chain data. According to the results, 13 publications discussed the "Product-service System (PSS)" BM in the concept of CE and highlighted the significant role of digital technologies, specifically IoT. Servitisation and PSS model provides services and performance instead of products,

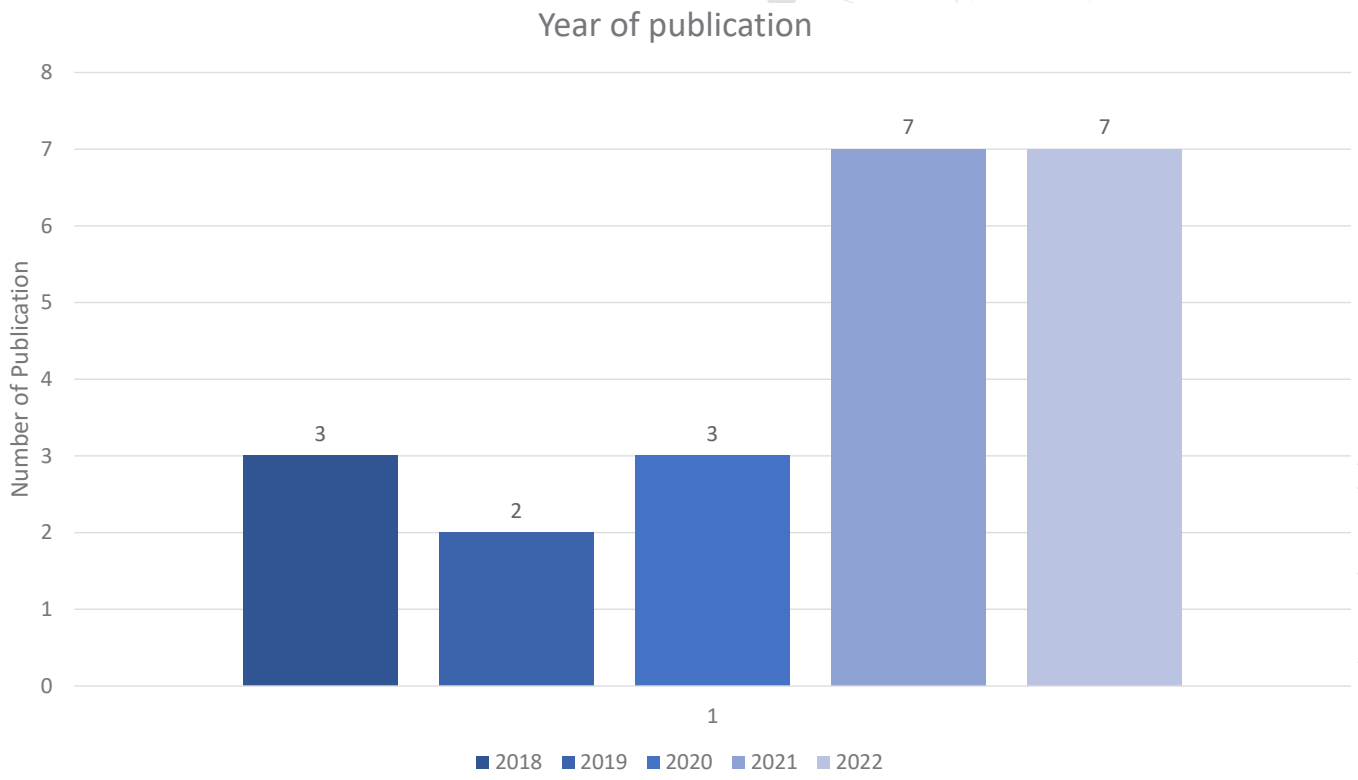

Figure 3:

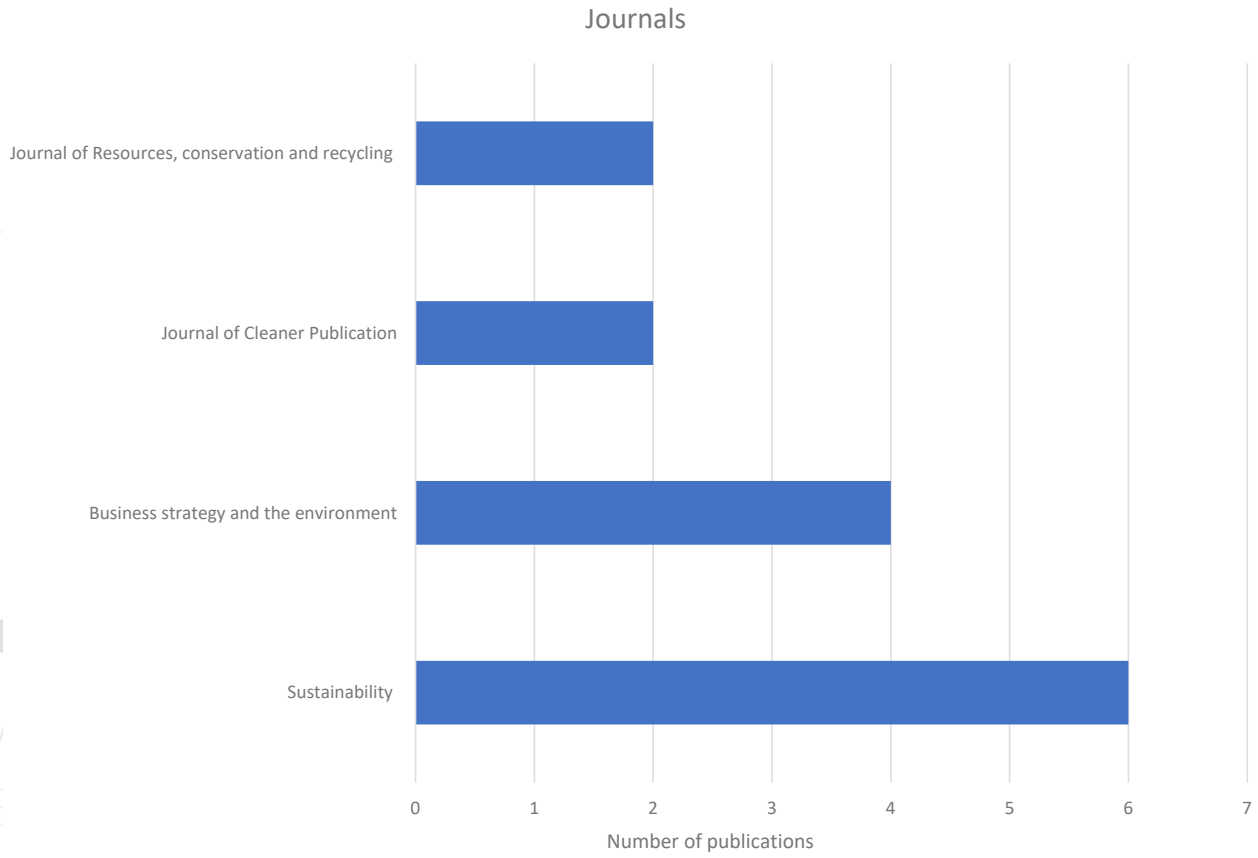

Figure 4:

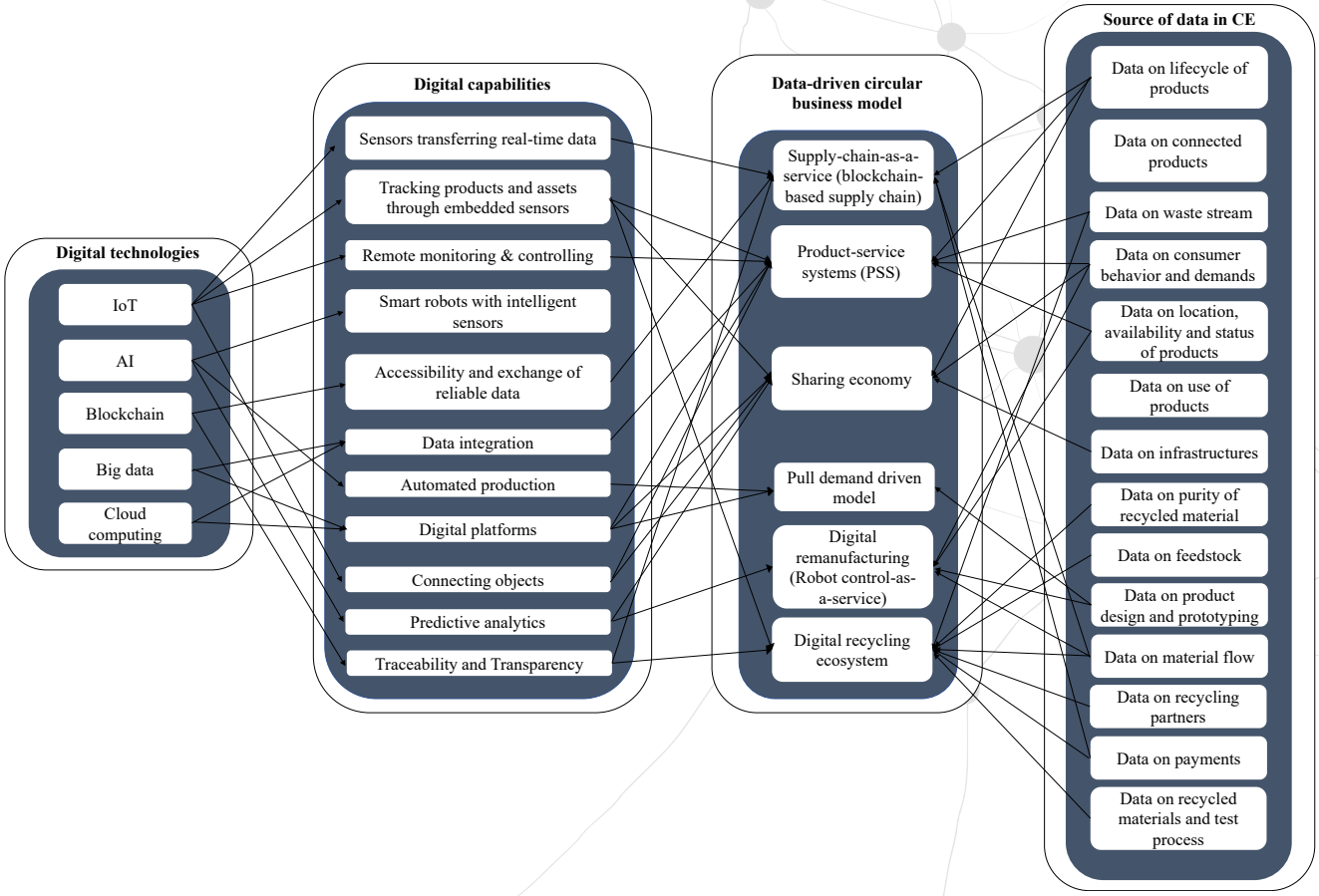

Figure 5. Data-driven BMs, source of data and digital technologies

which increases resource and material optimisation. Various authors emphasized the role of data in extending the life of products for creating value and developing service-based BMs. In this regard, data enables repair, reuse, maintenance services and recycling while helping companies to optimize product design. The second vital circular BM highlighted by the authors was "Blockchain-based supply chain", with the important role of Blockchain technology in creating a transparent and trustable data transaction throughout the entire supply chain. Many authors mentioned that the tight connections between Blockchain and IoT sensors, create a trustworthy environment for different actors within the supply chains and enable safe and visible transactions without the need for a third party. "Sharing Economy", "Digital remanufacturing", "Digital Recycling Ecosystem", and "Pull demand-driven model" were respectively the most discussed circular BMs, highlighting the role of digital platforms and cloud-based technologies. Table 2 below includes an overview of the data-driven BMs in CE identified through the literature review.

Discussions and Conclusions

The findings of this paper offer a greater understanding of the role of data in CE and why data is crucial in developing circular BMs. The existing data-driven BMs have been identified and why data is important in circular BMs has been discussed through this research. Data is the source of value in various decision-making processes in CE and enables material and process optimisation. Precise and accurate data supports the best choices and decisions in changing supply chains, ecosystems, and networks dynamically. The results from the systematic review show the increasing trends in this topic and the increasing potential for more emperical studies in future. There is huge potential for research in identifying the benefits of data by utilizing digital technologies

Table 2.

Data-driven Circular BM	Definition of circular BM	Role of Data	Industry 4.0 Technologies	Reference examples
Supply-chain-as-a-service (cloud-based enabled supply chain) , Blockchain-based supply chain	Supply chain-as-a-service enables major principles of resilience and viability. Main resilience strategies such as multi-sourcing, collaboration, visibility, and flexible re-routing. Viability is the ability of a supply chain to survive in a changing environment through a redesign of structures and replanning of performance with long-term impacts.	Data on each stage of product's life enhances transparency and visibility in the supply chains which is highly important for efficiency, resilience and sustainability while tracing performances. Data from connected products, plants and systems enables operation optimization and create better quality products.	Tightly connected IoT sensors and platforms to Blockchain technology allow contracting in the platform context and creating improvements in performance through transferring real-time data, visibility and trust. Blockchain registers each transactions of products and materials throughout the value chain, thus enabling access and exchanging of reliable data without the need for third party operators. AI and big data analytics can enable visibility and outsourcing in pricing and revenue decisions.	Ivanov et al., 2022, Huynh 2021
Product-service systems (PSS)	The PSS business model offers products entirely as a service or supportive services in addition to products such as maintenance contracts. Support services that can improve and extend lifecycle of the products through reuse, recycling, and remanufacturing operations. PSS enables resource efficiency.	Data on lifecycle of products helps in prolonging life of products. data on waste stream, data on consumer behavior. Data on location, availability and status of products. Data on product facilitates decision making.	IoT enables tracking of the products during and after use, enables durability in products, connects objects and enables service-based model. Utilizing data enables remote monitoring and controlling of products. Big data, and cloud computing enable digital platforms that manage operational activities and services. Blockchain enhances the sorting process. Cloud technologies integrate and show data to the company and consumer, enabling the potential for offering context-specific maintenance services.	Chauhan et al., 2022, Huynh 2021, langley 2022, Subramoniam et al., 2021, Cetin et al., 2021, Okorie 2020, Ranta et al., 2021., Ingemarsdotter et al., 2020., Rossi et al., 2020., Lieder et al., 2020, Garcia et al 2018, Bressanell et al., 2018, Lindström et al 2018

Table 2.

Data-driven Circular BM	Definition of circular BM	Role of Data	Industry 4.0 Technologies	Reference examples
Sharing Economy (SE)	Sharing economy business model aims to optimize resource consumption through collaborative consumption (sharing, exchangin, and renting resources leads to reduction in resource and energy usage). Improving operation mangement. Enables sharing access to assets and resources instead of owning assests.	Data on entire lifecyle of product, data on consumer behavior, data on use of products, data on products and systems demand, data on infrastructures.	Big data platforms, Embedded sensors and IoT enabling data collection for products and services. Installing sensors on assets enables tracking and monitoring the condition of products, allowing predictive maintenance. Artificial intelligence enables new product development, preventive maintenance services .	Vecchio et al., 2021, Massaro eta l., 2020
Digital recycling ecosystem (extended blockchain service)	Reducing waste and carbon footprint across the supply chain.Creating a closed-loop supply chain by innovating products from post-consumer materials which are fully certified through a traceable and transparent supply chain.	Data on purity of recycled material for customers' trust. Accurate data on payments for waste collectors and other partners. Data on recycling partners' capacities. Data for choosing the right feedstock and how to use it for which end product. Data for handling types of feedstock. Data for test process of the content of recycled materials.	Blockchain secures transparent process and cost of the entire value chain. Blockchain system enables tracing post consumer recycled materials to their source. Private Blockchain with a customized token system enables setting transparent rules as well as a tokenizer reward system.	Chaudhuri et al., 2022
Pull demand-driven model	Facilitating a radical shift in the entire production-consumption paradigm of supply and demand as well as upstream/downstream businesses. The pull demand-driven business model reforms the linear model to a more collaborative and integrative circular process. This model increases the speed from design to delivery, producing more personalized products and more flexible for small-scale production.	Real-time data helps to solve two main problems: overproduction and underuse. Data on design and prototyping help in prodcut development and production phases, making involve all the stakeholders from the first stage.	Digital plaforms enable communication and interaction between end-users and designers and business partners. AI enables automated production which reduces labour costs while increasing higher acuracy in production.	Huynh 2021

Table 2.

Data-driven Circular BM	Definition of circular BM	Role of Data	Industry 4.0 Technologies	Reference examples
Digital re-manufacturing business model (Power-by-the-Hour, Robot control-as-a-service)	Provides remanufacturing companies the capacity to gain access to the customer base and to enable rapid respond to the changes in demands, reducing resource consumption while increases competitiveness. Integration of digital remanufacturing is crucial for product development, process development, production, and after sales in CE. Improves real-time inventory management.	Data on different parts' condition enables high quality remanufacturing. Historical data enhances decision-making to qualify or separate the returned products. Data on product design (design for disassembly, design for repair, design for upgrade…) enhances taking consideration parameters for better remanufacturing. Data on material flow and returns improves design processes, lack of information results in enhanced processing of the product. Data on customers' behavior and demand reduces response time to drive changes.	IoT enables tracking the parts to ensure availability of replacement parts. Sensors enables tracking part performances and facilitating predictive analytics such as predictive maintenance. Transferring real-time data on returned product defects and demands helps plant managers to schedule operations. A cloud-based service supports the development of distribution process planning in decentralized dynamic remanufacturing environment. Smart robotic remanufacturing using intelligent sensing and real-time adaptation.	Subramoniam et al., 2021, Kerin and Pham 2019

in supply chains, ecosystems and various value creation strategies in CE with the focus on different industries such as textile and fashion which have more complex supply chain.

This research is limited to understanding the role of data and digital technologies in circular BMs. Hence, the study only examined the papers that included the term "data" and excluded articles that only focused on digital circular BMs and not mentioned data utilization. Moreover, the concepts "circular BMs" and "digital technologies" are showing strong and fast development recently, especially from the data-driven perspectives. Future research will benefit from a comprehensive study on the role of data on different CE strategies, process and product designs. Moreover, a deeper understanding of the role of data as a driver of circular BM innovation and configuration, the role of data in enhancing collaborative ecosystems, and the role of data in creating and capturing value in the circular supply chain are required through studies of different cases. Finally, although the role of IoT has been identified considerable as an enabler of data-driven BMs in CE, there is still potential to explore the capabilities of AI, analytics and blockchain technologies in this field.

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