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Business ecosystem-oriented business model in the digital era

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Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Business Ecosystem-oriented Business Model in the Digital Era

Abstract

Along with the fast development of digital technologies, innovative business models were booming in the last two decades, which demands further investigation of the growing research trends of business models in the digital era. This research adopts bibliometrics techniques to explore business models in the extant literature, and then uses structured reviews to conduct content analysis which leads to the identification of research trends and propositions. The analysis shows that most of the literature could be summarized into a 4V-BM framework covering value proposition, value creation, value delivery and value capture. Moreover, it reveals and verifies three trending areas that focus on dynamics, digitalization, and business ecosystem. Based on these findings, this research proposes a concept of ecosystem-oriented business mode which reflect the three trending features. The research findings offer insights to entrepreneurs and ecosystem organizations regarding the current business model in digital transformation and its potential economic impact.

Keywords Business model; Business ecosystem; Business ecosystem-oriented business model

1 Introduction

Along with the fast development of emerging technologies in particular digital technologies, it facilitates the booming of innovative business models (BM) in the last two decades. There is already much literature on business models, however, there is still scarce research addressing business models in the digital era. For one thing, the speed of technology iteration has changed the basic forms of the production processes, business models, and organizational forms, and even overturned the fundamental assumptions of some innovation theories (Nambisan, 2017). For another, an appropriate BM will create synergy effects through the further integration between technology and innovation, and then expand its strategic influence (Baden-Fuller and Haefliger, 2013). To understand the ongoing development of business models along with the technology advancement, this research aims to investigate the current trends in this area particularly after 2000 when digital technologies started to play critical roles in the development and evolution of business models.

Up to now, scholars have started to focus on this area, however, there is still no consensus on its common definition as well as the components of BM in the context of industry 4.0 (Zanella *et al.*, 2014). In light of this gap, there are literature made solid attempts to incorporate BM with the business ecosystem (BE) theory which gives more emphasis on a wider business community consisting of various stakeholders (Moore, 1993) involved in the BM innovation. However, due to the incomplete definition and constructs of BM (Teece 2010; Palmaccio *et al.*, 2020), the issue of how existing BM theory is evolved and innovated along with the BE, especially considering external environment change in the digital era needs further study (Alkaraan, 2022a) from a holistic perspective.

To get a better understanding of BM in the digital era, this study concludes the existing BMs into the 4V-BM framework following the bibliometric results, and proposes business ecosystem-oriented business model (EBM) by structured reviews, especially reflecting the three growing trends in BM research as *dynamics, digitalization, and business ecosystem*, which are uncharted territories in current literature. This study shed light on the development of BM and BE theory, contributes to the academic debate about the BM framework and EBM context and makes managerial implications for the organizations in the digitally connected economy, such as high-tech companies, platforms or eco-type enterprises.

2 Current understanding of business ecosystem-oriented business

model in the digital era

Although many scholars support the view that the core of BM is to use appropriate strategy to induce customers to pay for the value produced by firms (Teece, 2010), which reflects the process from value proposition to value capture (Chesbrough, and Rosenbloom, 2002; Osterwalder and Pigneur., 2004), they have not achieved mutual recognition in BM's framework. This study analyzes the article pool from time series and proposes that current BMs could be concluded into one *4V*-BM framework, which covers *value proposition*, *value creation*, *value delivery*, and *value capture* focusing on partners' co-evolution.

Digital transformation will make supply chains and production processes more interconnected, efficient and flexible, allowing mass customization and virtual production. This shift leads to new value propositions for consumers and requires new value creation and delivery activities which will involve more cooperative partners which consist of a business ecosystem and in turn ask for new BM (Rong *et al.*, 2022). There are not yet BMs available confidently supporting this change (Alkaraan, 2021; Lyu, *et al.*, 2022). However, only very few pieces of the literature concentrated on BM research applying the business ecosystem perspective along with those traditional perspectives like the resource-based view (RBV) and innovation theory (Amit and Xu, 2017). For example, open innovation is believed that external sources are necessary for a firm and maintain a superior capability in introducing innovations, which becomes one of the key factors of the business ecosystem (Radicic *et al.*, 2022; Naqshbandi and Jasimuddin, 2022). While following the RBV, scholars have gradually realized that the construction of a business ecosystem can help improve the enterprise's risk-hedge resilience and overall profitability (Rong *et al.*, 2018a). meanwhile, eco-type enterprises are mainly responsible for balancing potential value co-creators who have heterogeneous resources and connecting the focal firm with the supply side and potential value co-creators of the demand side (Amit and Xu, 2017; Rong *et al.*, 2018b).

In all, identifying ecosystem factors contributing to digital-empowered BM remains an important concern, and scholars have urged for further research on BM with a business ecosystem perspective (Alkaraan, 2021, 2022b; Tseng *et al.*, 2022). In this research, therefore, we explore the components needed by a holistic and systematic BM framework and propose the concept of EBM to fill the gap in the existing BM literature.

3 Methodology

This research adopts mixed methods integrating both bibliometrics and structured reviews to conduct a comprehensive analysis of current BM research. The following part is

divided into two categories: bibliometrics and content analysis.

3.1 Research Design

This research uses "business model" and/or "business innovation" as keywords to screen the articles on the WoS (Web of Science) database within the period from 2000 to 2022. There are in total 8380 articles whose titles, abstracts, or keywords are matched with the keywords. We identified 5480 articles from the management, business and economics category, and used the Citespace software to filter the sample with a low citation each year, then identified 845 articles that are highly relevant to this research with the pre-defined selection criteria, including matching with the research scope related to emerging technologies, journal ranked in the ISI Web of Knowledge. After further detailed reading by all team members, the number of the final selected articles is 237 which is used for in-depth content analysis. Figure 1 shows the literature screening process of this research.

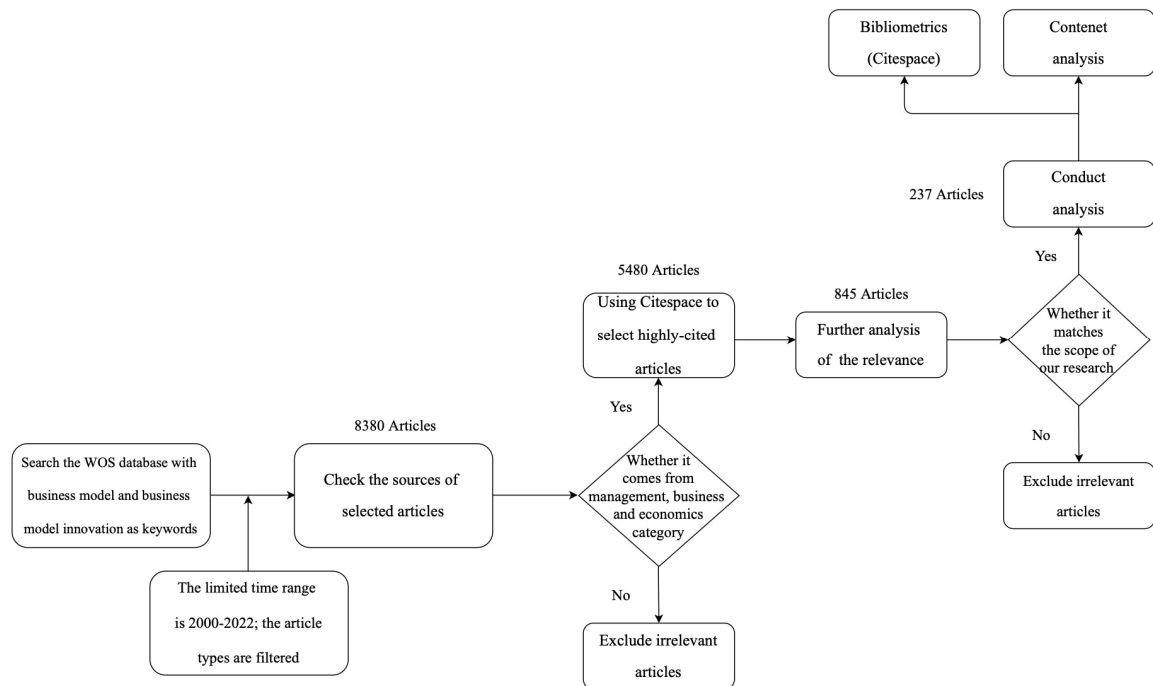


Fig. 1 Literature screening process

3.2 Bibliometric software

Citespace software was adopted to conduct the bibliometric analysis. It allows the analysis and visualization of trends and patterns in a research area (Chen, 2017), and the main goal of this tool is to facilitate the analysis of emerging trends in a knowledge domain. That is appropriately matched with our research purpose to understand the trends of business model research.

3.3 Descriptive Statistics

Based on the results by Citespace software, Table 1 and Figure 2 presents the number of articles published each year in each journal from 2000 to 2022, and the impact factor for each journal is highlighted in the second column following the 2021 index indicators of the Journal Citation Reports (JCR). The results indicated that there is an obvious increase in publication on BM research, and the number of articles published in the top 5 journals (accounting for 41.9% of the total number) is far more than in other journals.

Table 2 describes the title of the top 10 cited articles. The article impact index AIF was proposed by Carvalho *et al.* (2013), It is calculated as follows:

$$\text{AIF} = \text{Citation} * (\text{JCR}+1)$$

3.4 Content Analysis

As bibliometric reviews do not deal with theories, methods, and constructs as much as they usually do with authors, citations and co-citations, etc. (Paul and Criado, 2020), we also use structured review method to do content analysis that we analyze the BM literature by providing critical discussions on a specific research theme integrating extant literature, synthesizing prior studies, identifying knowledge gaps, and developing new BM theoretical frameworks.

Table 1 Statistics on the number of articles published in journals each year (2000-2022)

Journal	JCR	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Industrial Marketing Management	6.69		1		1	2	1	4	4		3	2	7	1	7	2	2	1	10	1	1	8	1		59
Long Range Planning	8.53											19	1	2	5	1		2	1	8	3	1			43
Strategic Management Journal	8.641	2	2		2	2	2	2	2	3	1	3	3	2	2		1	1	1	2					33
MIS Quarterly	8.513	1			2	4	4	3	3		1	1	4	3	1		3		2						32
Journal of Business Research	7.55						1	1			1		2		2	2		5	2		3	4	4	1	28
Research Policy	9.473				1		1	3		1	2	2	1	1	1	7				2	1				23
Harvard Business Review	5.7		1	1	2		1	3		2	2		2	3	1	2	1	1							22
Journal of Marketing	9.43			2	1	1	4	1	3	3	2		4					1							22
Academy of Management Journal	7.417	1	1			2	1	2	2	1	2	1			3		1	1		1		1			20
Organization Science	5.152	1	1	1	1	1	2	1	2		3		1	1	1					1	1				18
Journal of Product Innovation Management	7		1	1		2	1	1			2					2		3	1	1		1			16
Technovation	5.729							1	1	2	1		2	2		2		1	1	1		1		1	16
Entrepreneurship Theory and Practice	10.08							2		1	3		3	1		1	1		2		1				15
Academy of Management Review	12.64	1		1				2	1	1	1	2	1	1	1	1		1							14
Journal of Cleaner Production	9.297														3	1	1	1	3	3	2				14
Information System Research	2.457		1	2	1	1		1			1	5					1								13
Journal of the Academy of Marketing Science	5.888		1	2	1					4				2			1	2							13

Technological Forecasting and Social Change	10.884					1						1	1	4	1	4	1	13
International Journal of Production Economics	7.885	1						1			1	2	1	4		2		12
Journal of Management Studies	7.388			2	2	1	1		4					1			1	12
R&D Management	5.962				3		1	1			4		2	1				12
International Journal of Operations and Production Management	8.69						2		2	1	1	1		1	1		2	11
Journal of Business Venturing	12.065	2		1	1		1	1	1		1	2						10
Journal of International Business Studies	11.382			1			1	1			1	1	1	2		1	1	10
Journal of Management	13.508			1			1	2	3	1				2				10
Management Science	7.772	1			6	1		1			1							10
MIT Sloan Management Review	3.155		1		1	2	1	1	2	1								9
Strategic Entrepreneurship Journal	9.45					1					1		5	1	1			9

Note: Sorted by total number of publications.

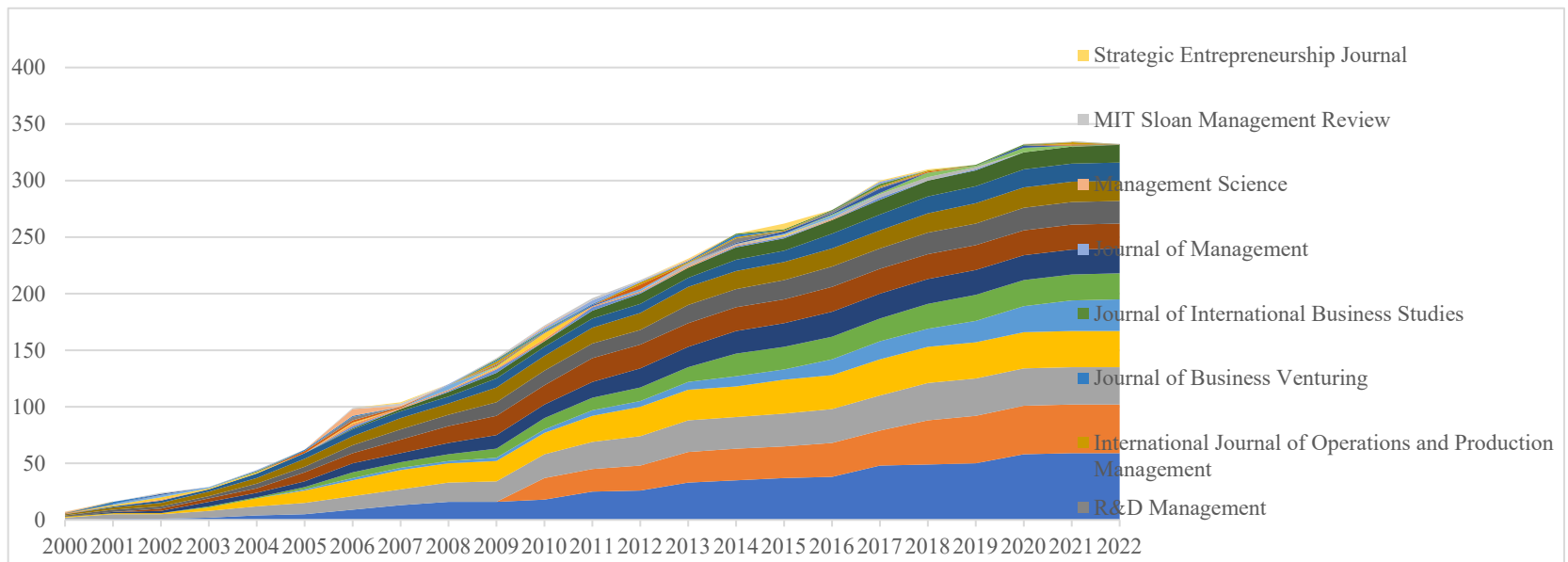


Fig. 2 Top journals with more publications on business models

Table 2 Statistics of Cited Information of Highly Cited Articles (2000-2022)

Title	Journal	Citations	Citation Rate (%)	JCR (Newest)	A _{IF}
The Business Model: Recent Developments and Future Research	Journal of Management	1222	8.06%	13.508	16506.8
Business Models, Business Strategy and Innovation	Long Range Planning	1826	12.04%	8.53	15575.8
Value creation in e-business	Strategic Management Journal	1692	11.16%	8.641	14620.6
Business Model Design: An Activity System Perspective	Long Range Planning	826	5.45%	8.53	7045.8
The entrepreneur's business model: toward a unified perspective	Journal of Business Research	783	5.16%	7.55	5911.7
Business models for sustainable innovation: state-of-the-art and steps towards a research agenda	Journal of Cleaner Production	597	3.94%	9.297	5550.3
From Strategy to Business Models and onto Tactics	Long Range Planning	630	4.16%	8.53	5373.9
Internet of Things in the 5G Era: Enablers, Architecture, and Business Models	IEEE Journal on Selected Areas in Communications	426	2.81%	11.42	4864.9
The fit between product market strategy and business model: Implications for firm performance	Strategic Management Journal	554	3.65%	8.641	4787.1
The role of the business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies	Industrial and Corporate Change	1391	9.17%	3.04	4228.6

Note: Sorted by the article impact factor.

4 Bibliometric analysis

Within the current literature bank, it is interesting to know the most productive authors, networks, their articles and current research hotspots to better understand the research trend on BMs.

4.1 Authors' Co-citation Network

As presented in Figure 3a, shows a network of cited authors with a citation frequency of at least 10. The more obvious the font displays, the more prominent the circle is, which indicates that the cited author's position in the academic circle is more important, and the author's research article is cited by more people. The colour transition from grey tones to red tones represents time varies from past to now. From Figure 3(a), it is worth noting that many BE scholars have paid increasing attention to the area of BM in the past ten years, such as Adner R., Jacobides MG, Rong K., Moore J.F., Gawer A. and others.

To further analyze the trending of the scholar network, Figure 3(b) shows the network of cited authors after 2010 whose cited frequency is greater than 30. Compared to Figure 3a, in addition to the centre network of the cited authors, it is easy to note scholars in the business ecosystem field have gradually appeared in the cited circle of business model research, and the frequency of citations has reflected an upward trend, indicating that business model research scope has changed with the advancement of science and technology.

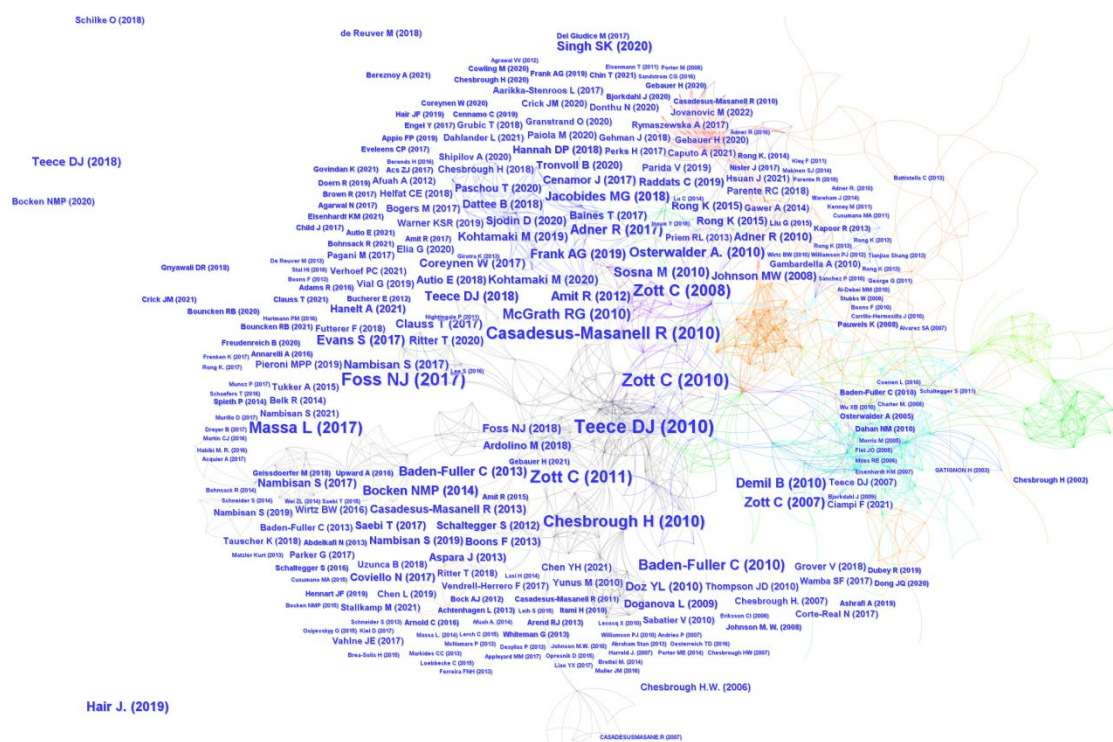


Fig. 3(a) Authors' Co-citation Network (Frequency exceeds 10)

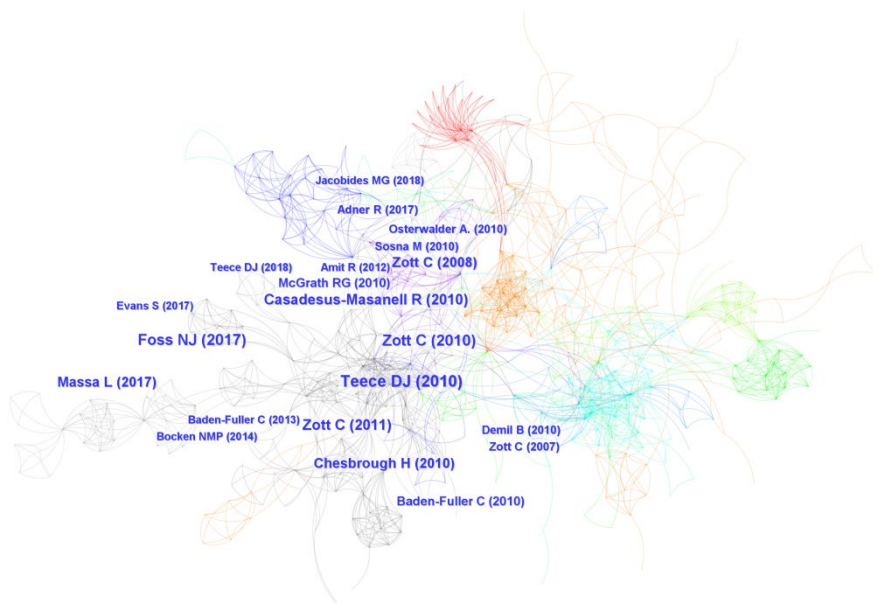


Fig. 3(b) Authors' Co-citation Network (Frequency exceeds 30 after 2010)

4.2 Current research hotspots

To capture the research hotspots in the last 20 years, we use Citespace software to conduct the keyword network analysis and visualize the results. Firstly, the keyword frequency limit was set as 1, which means if the frequency exceeds 1, it will appear in the keyword network. The keyword network sorted by centrality is shown in Figure 4(a). Secondly, we raised the threshold of the frequency of keywords to 30, then we got results as shown in Figure 4(b). These two figures indicated that *business ecosystem*, *capabilities*, *innovation*, *strategy*, *performance* and *value creation* occupy a central position in the research of BM, indicating that these are the hotspots of current BM research which gives us the hint to dig the article pool.



Fig. 4(a) Keyword Network (Frequency exceeds 1)



Fig. 4(b) Keyword Network (Frequency exceeds 30)

5 The current business model research

We find that the current literature lies in two main subject areas and could be summarized into a 4V framework.

5.1 The main subject areas of current BM research

After analysing the article pool, the results show that current literature could be grouped into two main subject areas including *strategic management* and *innovation management*.

5.1.1 Business model and strategy

BM concept is closely related to strategic management theories. As one of the branches of strategic management, the comparative advantage theory (Osterwalder and Pigneur, 2010; demil and LeCocq, 2010) treats firm performance and market as important factors to strategy, hence it uses information flow and management systems to explain the whole process starting from value proposition (Amit and Zott, 2001; Casadesus-masanell and Zhu, 2013), and makes competitive strategy to make the innovative enterprises continuously obtain and maintain competitive advantages over their competitors (Chesbrough and Rosenbloom, 2002). Among these, one of the focuses is the ability, such as dynamic capability (Teece, 2010), creative bricolage ability (McDonald and Eisenhardt, 2019), design management ability (Baden-Fuller and Haefliger, 2013) and adaptability (Amit and Zott, 2011). Dynamic capability theory extends and develops the resource-based view and knowledge-based view. According to the definition of Teece (2010), dynamic capability refers to the ability to integrate, construct, and redesign the firms' internal and external competitive resources to adapt to the rapidly changing environment, so it is often called capabilities' ability.

While value creation is the core of all BMs, enterprises usually obtain value by seizing new business opportunities, new markets, or new revenue sources (Bocken *et al.*, 2014). Hence, it is well-agreed among scholars that BM and strategies have overlapping parts but not identical concepts. BM enabled by strategic theory will help enterprises to gain constant competitive advantage. In a BM, value creation, strategy and customer market are all aimed at obtaining competitive advantage, while strategy is the most important part (Wirtz *et al.*, 2016).

5.1.2 Business model and innovation

Business model innovation (BMI) is a critical factor in business success, BM and technological innovation jointly promote the evolution of BM (Casadesus-masanell and Ricart, 2010). Firms are increasingly aware of the need to integrate their internal R&D efforts and of the importance of managing their outbound flows of knowledge and technology (Chesbrough 2006). BMI consists of creating, diversifying, acquiring, or transforming a BM as a response to internal and external incentives (Foss & Saebi, 2017; Geissdoerfer *et al.*, 2018a). External environmental change and institutional differences are important drivers of BMI (Garrity and Martin, 2018; Yi *et al.*, 2020). Along with the changes in the internal or external environment, BM may need to be adjusted, innovated, or even completely changed (Morris *et al.*, 2005). As a result, the

dynamic characteristics of these factors determine dynamic development as the essential characteristic of BMs. Chesbrough (2006) proposed the concept of open innovation (OI) which focus on how firms' interactions with the external environment affect their innovation activities. OI could be defined as a distributed innovation process that uses financial and non-financial indicators to align with the organisation's business model, and it is normally based on purposively managed knowledge flows across organisational boundaries (Chesbrough and Bogers 2014). There are three processes of OI, i.e. the outside-in process, the inside-out process and coupled process (Gassmann and Enkel 2004). The outside-in process focuses on increasing a firm's innovativeness by integrating pan-community (suppliers, customers and other external knowledge sourcing defined by Rong *et al.*, 2018b) participants' resources. While the inside-out process encompasses the external use of firms' internal knowledge. The coupled process refers to networking with complementary firms, such as strategic alliances, which is the core concept of a business ecosystem (Adner and Euchner,2014).

Recent studies have shown the positive external incentives of digital technologies in BMI, such as the Internet of Things (IoT), big data, blockchain, cloud computing and data analytics-powered artificial intelligence(AI) (Nandi *et al.*,2020; Iansiti and Lakhani, 2020a, 2020b; Chaudhuri *et al.*,2022), which have great potential to reduce production cost and improve financial revenue (Alkaraan *et al.*,2022). While firms make use of sensors, digital networks, and algorithms to optimize their BMs, it helps to connect the supply side and demand side closely. For example, modern products usually are connected to the organization that created them by a mobile app, like an app in the iPhone and Tesla *et al.*, which can help the organization to receive feedback from customer interface and then optimize their products or service to improve the user experience in real-time (Verganti *et al.*, 2022). These instant two-way interactions characterize an increasing range of goods and services. As AI brings data and algorithms to the core of the innovation processes, it profoundly changes the practice of design and innovation in some firms, such as Netflix and Airbnb, based on a digital operating model (Iansiti and Lakhani, 2020a, 2020b), which gives more emphasis on algorithms and data analytics. In this process, scholars hold the view that With the weakening organization boundaries, more enterprises are needed to accomplish a comprehensive business vision. That's also why scholars are increasingly put attention to the theory of organizational or institutional innovation, stakeholders (Verganti *et al.*, 2022), platforms (Hou, 2020), and business ecosystem (Moore, 2013; Rong, *et al.*, 2022).

5.2 Business model – the 4V framework

As depicted in the above review, we find that even though scholars illustrate BM from different perspectives, it can be concluded into one framework, say, *4V* (see Table 3). Stepped into the first decade of the 21st century, scholars hold the view that the essence of BM is *value proposition*, and the process of *value delivery* from the company to its targeted customers (Teece, 2010). The concept of linking activities together based on transactions that *create value* by exploiting business opportunities as a system of activities connecting internal parts and crossing the boundaries of a company (Chesbrough, 2007).

After 2010, along with the coming of the digital era, more and more BMs' research paid to focus on strategic management and corporate innovation (Chesbrough, 2010; Baden-Fuller,

2010). BM is considered a mechanism for transferring the core *value proposition* to the consumers and gaining its corresponding benefits (*value capture*) (Mair, 2007). Hence, it is more emphasized the dynamic capabilities of a firm as well as its evolutionary capabilities (Demil and Lecocq, 2010). In terms of dynamic capabilities, it includes three major processes, namely, sensing opportunities, seizing them by mobilizing resources, and continuously innovating organizational mechanisms and BMs to enjoy the benefits of technology change (Velu and Stiles, 2013).

By now, scholars have constructed several BM frameworks around the process of *value delivery*. Based on Richardson (2008), Bocken *et al.* (2014) proposed a BM including three parts: *value proposition*, *value creation* and *delivery/consolidation*, and *value capture*. Velu (2016) proposed that a dynamic BM should emphasize its dynamic evolutionary ability and take the different stakeholders into account. Therefore, BM should incorporate a value network that depicts the stakeholders of the focal firm to ensure effective *value delivery*.

Finally, *value capture* is an important guarantee for a good BM to continue. It depicts how the focal firm, and the stakeholders generate revenue and profit, which determines the sources of revenue and economics of their business (Bocken *et al.*, 2014). In Wirtz's integrated BM (2016), the revenue model and financial model are important components of the business, which depict the firms' revenue streams and cost structure. The financial model reflects the appropriate distribution of economic costs and benefits among business participants (Osterwalder *et al.*, 2005), and illustrates the company's ecological and social impact (Boons, 2013).

Table 3 Business Models and 4V Framework

	Value Proposition	Value Creation	Value Delivery	Value capture
Chesbrough and Rosenbloom, (2000)	Value Proposition	Market Segment	Structure of the Value Chain, estimate the cost structure and profit potential	Position in the Value Chain, Formulate the competitive strategy
Zott and AMIT (2001)	Transaction Component	Architectural Configuration	Transaction Component	
Afuah and Tucci (2003)	Customer Value Scope	Connected Activities, Value Configuration	Capabilities, Sustainability (team-up strategy)	Cost Structure, Pricing, Revenue Source
Morris <i>et al.</i> (2005)	value proposition customer, internal processes/competencies, personal/investor factors	competitive strategy		economic model
Osterwalder; Pigneur and Tucci. (2005)	Value Proposition Target Customer	Distribution Channel, Relationship	Value Configuration, Core, Competency, Partner, Network	Cost Structure Revenue Model
Lecocq, Demil and Warnier (2006)	Value Propositions	Competences, Resources	internal and external Organization	
Richardson (2008)	value proposition (The offering; The target customer; The basic strategy)	value creation and delivery system (Resources and capabilities; Organization: the value chain, activity system, and business processes; Position in the value network)		Value capture (Revenue sources; The economics of the business)
Johnson, Christensen and Kagermann (2008)	customer value proposition	key resources	key resources	a profit formula
Teece (2010)	Create value for customers		Entice payment	Convert payment to profits
Yunus <i>et al.</i> (2010)	Value Proposition (Stakeholder; Product/service)	value constellation (Internal value chain; External value chain) Economic Profit Equation (full recovery)	Social Profit Equation (Social profit; Environmental profit)	

		of cost and capital)		
Sosna <i>et al.</i> (2010)		transaction content (activity, assets, degree of customization, core capabilities/knowledge)	transaction structure (distribution, revenues, end customer)	transaction governance (Pricing, inventory & supply management, organizational design)
Wirtz <i>et al.</i> (2010)	value proposition (marketable products or services)	Resources value generation	distribution	revenues
Casadesus-Masanel (2012)	Firm logic choice	Operating and creating values		
Baden-Fuller (2013)	customer identification	customer engagement	value delivery	monetization
McGrath R G (2014)	outside-in focus			
Bocken <i>et al.</i> (2014)	value proposition (product and service; customer segments and relationships)	value creation and delivery (key activities; resources; channels; partners; technology)		Value capture (cost structure; revenue streams)
Wirtz, <i>et al.</i> (2015)	Customer, market components (customer model, market model)	value creation components, strategic components		Customer, market components (revenue model)
Velu (2018)	value proposition	value creation	value network	value capture

6 New trends in business model research

One of the key purposes of this research is to explore the development trends of BM research. To reflect the research trending with a longitudinal view, we use Citespace software to visualize the authors and then keywords with a timeline which helps to show the growing trends for future research. Then we analyse the contents of BM trending areas.

6.1 Trending clusters

Firstly, we visualized authors with a timeline as shown in Figure 5. It is found that there are 14 important trending clusters in the article pool, which reflects what those highly cited authors and their articles are focused on in the last 22 years. First of all, those 11 clusters fall into the two subject areas discussed in the above section, strategy (#1,2,3,5,6,7,10,13) and innovation (#4,8,9,10,11,12). However, some clusters (#1,4,6,7,10,13,14) could be put into both areas, this reflects the growing trend of the multi-discipline nature of BM research.

Moreover, we found that article numbers and their citations within the two clusters (#3,7) are quite stable in particular before 2015. These are focused on classical areas of BM research, either product- or service-centric ones. Similar clusters include #5 on value co-creation, #9 and 10 on BM innovation as a traditional classical area, and #11 on open innovation diffusion. Beyond #9 and #10, #8 extended to focus on sharing economy and sustainable consumption in terms of BM innovation. It seems these are already in a mature stage and with decreasing publications in those topic areas.

Different from that, after 2015 there are five growing clusters as indicated in Figure 5, including #1,2,4,6,13,14. While #1 has a focus on co-evolution, #2 on dynamics capability, #4,14 highlight digital transformation and data analytic capability, #13 are more focused on business ecosystem issues such as nurturing and integration.

Since much of the research in #4,8,14 are related to digital technologies, data industry, big data, and data analytics, we could group them into one cluster on digitalization. Moreover, we

could group #1,2 into one theme focusing on dynamics of BM. Furthermore, #6,13 could be grouped as a theme of business ecosystem. As a result, this research identified three growing trends of BM research focusing on *dynamic*, *digitalization*, and *business ecosystem*. From Figure 5, it is very clear that there is a growing number of cited authors on lines #2,4,6,8,13,14. It reflects the current trend that more and more researchers paid growing attention to these three areas in recent years, in particular after around 2015 when digitalization boomed with the fast development of emerging technologies.

Secondly, to further verify the results, we continued to visualize the keywords to show the trending clusters, the results are presented in Figure 6. We still got the same results with three trending clusters: *dynamic* (#3,5,6,7), *digitalization* (#4,6,8,9), and *business ecosystem* (#7,9,10). More interesting thing is that those three trends are not stand-alone, but they are interlinked. In the below sections, these three trending clusters will be discussed in detail.

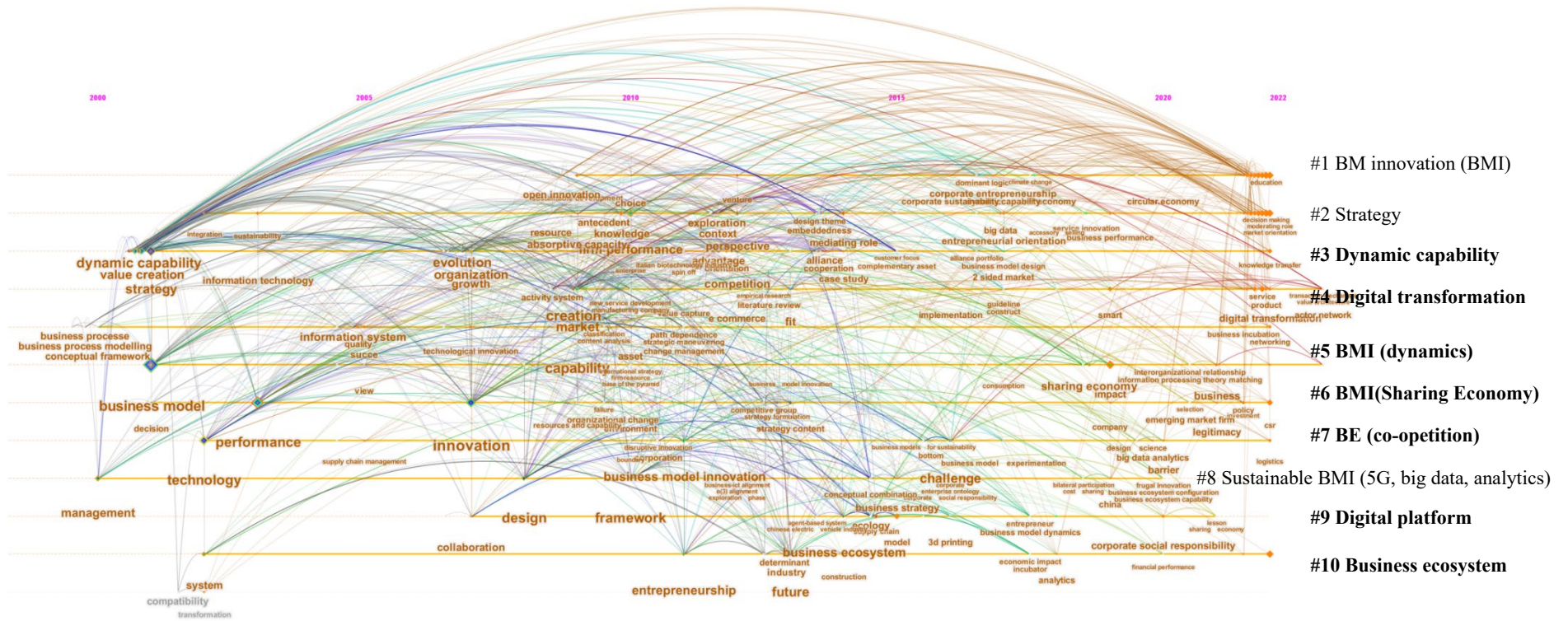


Fig. 6 The timeline of the clusters in BM (keyword)

6.1.1 Business model and dynamics

As shown in Figure 6, dynamic appeared as a growing trend in BM research. It is not only shown in cluster #3 but also listed in other clusters. For example, #5 is listed as BM dynamics, while #6 value co-creation and BM alignment, and co-opetition in #7. Dynamic has become an important growing trend in BM research.

As the competitive market environment becomes increasingly unstable and unpredictable (Dubey *et al.*, 2018), firms need to continuously explore new markets and seek new resources and opportunities to enhance their efficiency and profits (Wu *et al.*, 2017). As discussed above, scholars hold the view that the innovation of BM presents dynamic characteristics. The term "dynamic" refers to the situation that the technology and market are rapidly changing, which acted as feedback influencing enterprise business operations (Teece *et al.*, 2018). One of the most noteworthy dynamic capabilities is the ambidexterity capability (Gibson and Birkinshaw, 2004), which means pursuing flexibility and efficiency within the firm or entire supply chain (Blome *et al.*, 2013; Im and Rai 2008). Ambidexterity is defined as a firm's efforts to harness and employ its current resources to establish new sustainable supply chain capabilities and improve its performance (Partanen *et al.*, 2020), which employs exploitation and exploration to achieve long-term BM success (Tseng *et al.*, 2022). Exploitation focuses on current internal knowledge and resources, while exploration focuses on learning new knowledge, discovering new capabilities, and investigating new ways of doing business (Levinthal & March, 1993; Cenamor *et al.*, 2019). An organization's ability to pursue two separate activities (i.e., exploration and exploitation) at the same time is termed organisational ambidexterity (Shamim *et al.*, 2020). It is generally agreed that ambidexterity entails sustaining firms' competitive advantages by considering present and future performance (Kristal *et al.*, 2010; Lee and Rha, 2016; Tseng *et al.*, 2022). As data is one of the crucial productivity factors and strategic resources in the digital era, scholars noticed that ambidexterity requires firms not only to be both agile and resilient to the external environment, but also to be intelligent to improve their data management abilities through employees' exploitative and exploratory actions (Aslam *et al.*, 2018; Chaudhuri *et al.*, 2022). Thus, the dynamic nature of future BMs requires a firm's supply chain can quickly meet both short-term demand changes (agility) and long-term market changes (adaptability) (Shamim *et al.*, 2020), which should also take their cooperative partner's interactive behavior into account (Venugopal *et al.*, 2020). This essential requirement has not been addressed in the traditional single supply chain BM.

Based on the above discussion, the following proposition is derived.

Proposition 1: The future BM requires dynamic extension capability, which implies the enterprises should use their ambidexterity capability to continuously realize technological innovation and partner expansion to achieve effective flexibility and efficiency.

6.1.2 Business model and digitalization

It is clear more and more scholars are conducting BM research with a consideration of emerging technologies, like cluster #8 digital technologies used in sharing economy innovation and cluster #14 Data analytic capability as presented in Figure 5. The link between cluster #4,5,6,7,9 in Figure 6 also proves that BMI research is linked with the concepts of digitalization, digital platform, and sharing economy.

Since the emergence of digital technology in the 1990s, there have been several technology iterations, and the digital revolution has disrupted traditional ways of production and consumption (Palmaccio *et al.*, 2020). Digital technologies have led to the emergence of many platforms, which changed our lifestyle by bringing convenience to consumers while impacting traditional forms of business organization (Iansiti and Levien, 2004). Examples of popular platforms include Amazon in the E-commerce industry, and Airbnb in the accommodation industry. These platforms optimize their products/services to targeted consumers, personalize the user experience and improve their products through a data-centric operating model by making intensive use of algorithms and AI (Iansiti and Lakhani, 2020b). For example, Didi's food-delivery business, Meituan began to enter the ride-hailing business and Alibaba's map business, which proves that digital networks make business inherently easier to scale up (Zhu and Iansiti, 2019). These emerging technologies have enabled more products to be bundled with other products, and provide new propositions to consumers in new forms, thus enabling changes in BMs (Velu, 2018).

It is also necessary to be constructed a core ecosystem that provides complementary resources to support and capture more value (Jacobides, 2018). In the digitally connected economy, the long-term success of a product or service depends heavily on the resilience of its ecosystem, and five fundamental properties of networks determine the resilience of a platform: network effects, clustering, risk of disintermediation, vulnerability to multi-homing, and bridging to multiple networks (Zhu and Iansiti, 2019). The dividend effects of the digital revolution go far beyond technology transfer, it fundamentally reshaped the business supply chain management by increasing business efficiency and human resource (Rong, 2010). Tseng *et al.* (2022) propose that sustainable supply chain management is a type of information flow management which facilitate cooperation and collaboration among stakeholders. AI brings data and algorithms to the design and learning processes (Iansiti and Lakhani, 2020b), which profoundly changes the practice of design into automated learning loops and reinforces the three Design Thinking principles: being people-centred, abductive, and iterative. With the rapid development of outsourcing strategies in the last two decades, multinational enterprises are focusing on building infrastructure platforms and re-configuring their operational strategies. More and more enterprises are shifting from the traditional BM of buying at a low price and selling high with incomplete information, to the digital platform with more transparent

information to enjoy more profits by taking advantage of the digital dividend network effect (Guo *et al.*, 2017).

Based on the above discussion, the following proposition is derived.

Proposition 2: Future BMs should use appropriate digital technologies to consider ways to strengthen network effects, and enhance the cooperation within the business ecosystem consisting of partners and consumers to mitigate the risk of disintermediation.

6.1.3 Business model and business ecosystem

Since the concept of BE was first coined by Moore (1993), it has attracted huge attention from academia and practitioner in the last decades. As in cluster #10, keywords like BE configuration, BE capability, and nurturing BE are in a fast-growing stage. Also, in clusters #7,9, we can see that there is growing research among individuals and groups focusing on the core concept of BE, like co-opetition, co-evolution, and collaboration-related research in the BM area.

As mentioned in the above study, the exploratory actions stated in ambidexterity capability, the concept of open innovation and the network effect *et al.*, are all the key factors of BE. One reason for the fast-adopting BE concept in BM research is the increasing awareness of sustainability calls for research on sustainable and innovative BM (Rong *et al.*, 2020, 2022). As global sustainability pressure continues to increase, the rigid demands of sustainability are forcing practitioners as well as scholars to innovate the dynamic capability of BMs with BE perspective which demands various stakeholders get involved in BMI. Another reason is because of the growing platform-based BMs. The shift from a single-polar platform to a more complex multi-homing platform is the essential requirement of the future BM (Rong *et al.*, 2022), which is the key concept of network bridging proposed by Zhu and Iansiti (2019). When platform owners connect with multiple networks, they can build important synergies, and the higher the network interconnectivity of a platform is, the stronger the platform's profitability and defensibility of incumbent platforms will be (Zhu *et al.*, 2021). Therefore, BMs should incorporate multi-stakeholder engagement and provide a broader range of stakeholders with a long-term benefit in monetary or non-monetary form (Geissdoerfer *et al.*, 2018b). Value creation cannot be achieved without the involvement of stakeholders and partners in the ecosystem (Lowitt, 2013; Zott *et al.*, 2011; Yunus *et al.*, 2010).

Meanwhile, value is no longer created only by the firm itself, but also by the external community through formal or informal alliances. In the value proposition and value delivery process, more and more scholars emphasize that the core company in BE should not only create value for itself, but also all stakeholders. It emphasizes the positive externalities to ensure the survival and sustainable development of the firm (Zott and Amit, 2009; Sosna *et al.*, 2010). Some scholars have also added social and environmental factors to Osterwalder's business

canvas, emphasizing the sustainable output of BMs in a framework that incorporates social, environmental, and economic perspectives (Joyce and Paquin, 2016; Cardeal et. al., 2020).

Based on the above analysis, the following proposition is developed.

Proposition 3: Future BM should be a sustainable BM with multiple positive externalities of the business ecosystem to continuously seek new consumer markets and meet consumer needs for sustainable development.

6.1.4 Business ecosystem-oriented business model

To reflect the growing trends of focusing on dynamic, digitalization, and business ecosystem, this research proposed the concept of business ecosystem-oriented BM (EBM). This is in line with the growing awareness of the importance of nurturing BE to facilitate the success of innovative BMs.

The proposed concept of EBM stands the view that the future BM should be based on BE. EBM refers to an integrated BM with multiple different BMs which corresponds to different firms or organizational forms, and these firms constitute the collaborative business community (business ecosystem) that can evolve by the whole community's resource. Different from the ecosystem-level process model that focuses on shaping new BE via BMI (Rong *et al.*, 2020; Zhu and Iansiti, 2021), and the idea of supporting BM development via BE resources (Rong *et al.*, 2022), the proposed concept combines these two ideas to formulate a mutual facilitation mechanism highlighting that BM could be developed/innovated via nurturing BE, and BE itself could be shaped via BMI. This concept emphasizes that EBM is built in the environment of a BE which consists of various supply chains and community partners, and it focuses on the process of coordinating multiple interactive partners to produce and capture the value to achieve the common vision of realizing the evolution of the whole BE.

Based on the above analysis, the following proposition is derived.

Proposition 4: The business ecosystem-oriented BM includes multiple stakeholders and multiple BMs, it could be dynamically expanded, innovated, and upgraded from three dimensions of supply chains, technology, and community partners.

7 Conclusions and future research

This paper critically reviewed the current literature on BM via undertaking a bibliometric analysis and content analysis to identify the current development and the growing research trends in this area. The research findings are believed to contribute to current knowledge and practice in the below ways.

In addition to the supplementation of the two identified main subject areas of strategy and innovation in previous research, the results of this research further highlighted a growing trend of cross-discipline-oriented research in the digital era. It is because of the growing complexities

of adopting advanced digital technologies to achieve BM innovation, which demands cross-disciplinary investigation. Hence, the results of this study also shed light on characteristics of digital technologies driven BM innovation which requires more dynamic and ecosystem-oriented perspectives rather than simply firm-based perspectives widely applied in previous BM research.

The research results add to the body of knowledge by rigorously identifying the main researchers and the three growing trends in BM research which are as follows: (1) focusing on dynamic characteristics to achieve continuous BM innovation driven by digital technologies; (2) emphasizing the adoption of digital technologies and digitalization capabilities to reshape the BM innovation; and (3) highlighting the importance of enhancing relationships with ecosystem partners for sustainable development. These three themes are in line with the boom of digital technologies developed and implemented in a wide range of industries, particularly in the last decade.

The research results have several managerial implications. First, managers need to focus on developing dynamic digitalization capabilities by using digital technologies to drive and facilitate BM innovation, which could create future competitive advantages in the digital era. Second, companies should develop ecosystem-oriented thinking for BM innovation. Either developing a comprehensive business ecosystem involving various stakeholders to support the BM innovation that relies on digital technologies, or forming a BM consisting of several ecosystem-based BM to expand the innovation from a firm level to a business ecosystem level, all could lead to success for the efficiency and innovation of the digital technology-driven BM. Finally, practitioners have to align BM elements across their BMs. All dimensions of the BM under the umbrella of the 4V framework (value proposition, value creation, value delivery, value capture) need to work together with a holistic and dynamic approach.

This research also has some limitations that need to be addressed in future research. One possible limitation that could be addressed in future research is to choose a specific emerging technology to have a comprehensive and in-depth investigation of its BM innovation. Another one that could be addressed is to expand the selection of databases to cover a wider range of journals, which is believed to help to identify emerging themes of BM research. Meanwhile, further comparative studies would be helpful to bring a comprehensive understanding of the digital technology-driven BM innovation in the digital age. With the proposed concept of ecosystem-oriented BM, it is worth conducting in-depth case studies to further develop comprehensive knowledge and understanding of it.

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