

A Review of Research on the Impact of Digital Capabilities on Business Model Innovation

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Abstract. As a specific dynamic capability of enterprises in the digital environment, digital capability can help enterprises quickly respond to environmental changes and develop new products, creatively improve management processes and reconfigure the resource structure of enterprises, thus driving them to carry out innovative activities. Whether an enterprise can successfully develop digital products and innovate business models is highly dependent on its own digital capability, which is a key factor for enterprises to survive and compete in the digital environment and a micro-foundation for business model innovation. This paper systematically reviews the literature on digital capabilities and business model innovation, clarifies the development status of digital capabilities and business model innovation in terms of their connotations, antecedent variables and outcome variables, and proposes future research directions.

Keywords: Digital Capabilities; Business Models; Business Model Innovation.

1. Introduction

With the rapid development of digital technologies such as cloud computing, big data, blockchain and artificial intelligence and their related digital industries, digital has become an important element for business development and innovation and entrepreneurship. Digital transformation and digital entrepreneurship are constantly leading the development of new industries, driving social system changes and driving economic growth^[1]. Digital elements are gradually integrated into the development strategies of countries all over the world, such as France's Digital Economy Strategy released in 2008, the U.S.'s Technology and Policies to Support Data-Driven Innovation, Germany's increased investment to promote the application of digital technologies in Industry 4.0, life sciences and healthcare, and the EU's The EU has proposed a new approach to "digital technology standards and compatibility" and has clearly set out a policy vision for digital entrepreneurship in Europe 2020. In China, General Secretary Xi Jinping proposed in 2017 the digital entrepreneurship strategy of "accelerating the improvement of digital infrastructure, promoting the integration and open sharing of data resources, and accelerating the construction of Digital China".

In recent years, the connotation and form of entrepreneurship have changed rapidly, and new start-ups based on digital entrepreneurship have emerged like a spring. Many new start-ups have broken the limits of time and space through digital technology, broken through the shackles of previously successful traditional business models, overturned existing market rules with new business models, achieved rapid value-addition, and presented unparalleled high growth. For example, Alibaba, Tencent, Jingdong, Meituan, Xiaomi and other enterprises have created a new mode of digital entrepreneurship, leading the new application of digital technologies such as big data and artificial intelligence, bringing a new round of digital storm and becoming a new engine to promote the rapid growth of the digital economy; SpaceX, Changguang Satellite and other enterprises have successfully realized the commercialization of satellite technology, promoting the deep integration of highly sophisticated technology industry and digital technology, creating a new era of satellite information and data. integration, creating a new form of satellite information data commercial services. However, some enterprises such as LeTV, Hammer Technology, and ofo bicycle sharing are short-lived in the competition. A key question arises: In the face of the historical opportunities and major challenges brought by the digital revolution, why can some start-ups successfully break through the traditional time and space constraints of entrepreneurship to write a miracle of entrepreneurship, and what are the important factors that contribute to the success and rapid growth of these start-ups?

In fact, it is easy to find from the existing successful new business cases that most of the successful start-ups have strong digital capabilities and have created unique business models through change and innovation to ensure that internal digital capabilities match the external digital environment, thus achieving sustainable growth. For start-ups, the digital connections created by digital technologies break down the boundaries between internal and external organizations and create a lot of digital opportunities for cross-border operations, but companies also have to face disruptive innovations and alternative competition from different fields all the time^{[2][6]}. Digital capabilities, on the other hand, provide the basis for start-ups to adapt their corporate goals, organizational structures and internal management styles to the changing digital environment in the face of competition^[5]. In other words, digital transformation requires companies to constantly adjust their strategy formulation, resource allocation and production organization according to the digital technology paradigm, and start-ups need to rely on digital capabilities to integrate internal and external digital technologies, digital resources and digital opportunities with each other, and make adaptive adjustments to their strategic goal formulation, internal management style and business model innovation direction to adapt to the changes in the digital environment. Therefore, digital capability is not only a key ability to support the continuous dynamic matching of start-ups with the digital environment^{[3][4]}, but also an important driving force for business model innovation, which is crucial to the survival and development of start-ups. Therefore, this paper systematically reviews and analyzes the literature related to the connotation, antecedent variables, and outcome variables of digital capabilities and business model innovation, and on this basis explores possible directions for future research.

2. Digital Competency Related Research

2.1 The Connotation of Digital Competence

In recent years, with the booming development of digital technologies such as big data, machine learning, artificial intelligence, Internet of Things, cloud computing, and blockchain, digital capabilities have received more and more attention from scholars. In the field of management and entrepreneurship research, digital capability is a key element for organizations to gain sustainable competitive advantage in the digital era, a digital dynamic capability for enterprises to quickly adopt response strategies according to environmental changes, which is extremely important for the survival and development of start-ups as well as the transformation and development of traditional enterprises.

The theoretical development of digital capabilities is not a "castle in the air", its connotation and concept originated from scholars' research on information technology capabilities and dynamic capabilities of enterprises. According to Westerman et al. (2012)^[12], digital capabilities are the basis for changing customer experience, optimizing operational processes, and updating business models. development and application capabilities for information technology, but also analytical capabilities to derive value from big data. Levallet and Chan's (2018)^[10] study points out that digital capabilities of enterprises encompass flexible information technology capabilities as well as information management capabilities, with flexible information technology capabilities being the ability of organizations to focus on scalable, adaptable, and modular digital technology investments and applications, and information management capabilities being an organization's ability to dynamically manage information through the processes of collecting, processing, storing, creating, generating, and distributing it. Khin and Ho (2019)^[5] define digital capabilities as a specific dynamic capability of start-ups in a digital environment. Companies with digital capabilities are the ones that are more willing to adopt digital technologies and are able to work on transforming digital technologies into digital new products. The study defines digital capabilities as an organization's ability to the process of developing digital new products by applying digital technology and managing expertise. Through a study of platform-based enterprises using Internet infrastructure to build a digital ecology, Zhuang, Caiyun et al. (2020)^[8] concluded that digital capabilities of enterprises are mainly expressed as Internet capabilities in networked contexts. The study by Zhu Xiumei et al. (2020)^[3] pointed out that the digital capability of start-ups is the comprehensive ability of entrepreneurs to set strategies,

identify opportunities, reconfigure resources, and drive digital entrepreneurial activities. The relevant concepts of digital capabilities are shown in Table 1.

In summary, scholars have put forward different understandings of the connotation of digital capabilities according to their own research objectives and perspectives, but the existing literature generally agrees that digital capabilities are not only a kind of ability to apply digital technology, but also a dynamic capability that combines internal and external technologies, resources, opportunities and capabilities to adapt to changes in the digital environment.

Table 1. Concepts related to digital capabilities

Literature source	related notion
Westerman et al., 2012	Digital capability is the basis for enterprises to change customer experience, optimize operation processes and update business models, including the ability to develop and apply information technology and the ability to analyze the value obtained from big data.
Levallet and Chan, 2018	Digital capability is the enterprise's flexible information technology capability and architecture and information management capability.
Khin and Ho, 2019	Digital capability is the ability of enterprises to apply digital technology and management expertise in the process of developing new digital products.
Zhuang et al., 2020	Digital capability is the ability of an enterprise to achieve its goals by using the infrastructure, resources and platforms related to the Internet.
Zhu et al., 2020	Digital capability is the comprehensive ability that leaders or teams have to gain insight into digital entrepreneurial situation, identify digital opportunities, capture digital strategic resources and lead digital transformation and entrepreneurial activities.

2.2 Antecedent Variables of Digital Capability

From the available literature, although digital competency has received increasing attention from scholars, there are still relatively few relevant studies, and the antecedent variables of digital competency mainly include digital literacy, digital technology, and digital tools.

Specifically, Wang You-mi et al. (2013) emphasized the importance of digital literacy in fostering digital competency, which enables entrepreneurs to quickly and effectively discover and access, evaluate, integrate, and communicate digital information, and actively promote the formation and development of individual digital competency, and digital literacy is the foundation of digital competency. Nambisan's (2017)^[6] study proposed that digital technology is the key for companies to enhance and strengthen their digital capabilities, digital technology stimulates the digital attributes of traditional entrepreneurial elements, and the process of empowering entrepreneurial activities facilitates companies to continuously cultivate and strengthen their digital capabilities, thus creating entrepreneurial models that are more in line with the development of the times. The study by Yang Li et al. (2020) argues that the application of digital tools based on digital technologies such as social media, open source software, and crowdfunding platforms not only enhances entrepreneurs' digital capabilities, but also reduces barriers to invention and new venture value creation.

2.3 Outcome Variables for Digital Capabilities

From the available literature, the outcome variables of digital competencies include improvisation management process, digital opportunity development, digital innovation, firm performance, and strategic flexibility. Specifically, Levallet and Chan (2018)^[10] studied that digital capabilities are particularly important in limited management improvisation situations, where digital capabilities facilitate leaders to respond quickly to high uncertainty and unexpected events, helping them to improve their management processes quickly and creatively. Pergelova et al. (2019)^[14] argued that a

firm's digital capabilities determine its own strategic direction, and In turn, it affects whether companies can apply digital technologies well and whether they can effectively identify and develop digital opportunities. Zhu Xiumei et al. (2020)^[3] point out that digital capabilities are the foundation of digital entrepreneurship and the key capabilities that determine how firms develop and exploit digital opportunities, and the study argues that digital opportunities arise from the interaction between digital technologies and digital capabilities. Through a study of 105 ICT SMEs in Malaysia, Khin and Ho (2019)^[5] explored the relationship between digital capabilities, digital orientation, digital innovation, and firm The relationship between performance, the study found that digital capabilities can promote digital entrepreneurial activities of firms, while digital capabilities can also enhance firm performance. A study by Caiyun Zhuang et al. (2020)^[8] concluded that digital capabilities of start-ups can have an impact on the strategy of platform-based firms and the way information and other resources are shared, thus enhancing the strategic flexibility of firms.

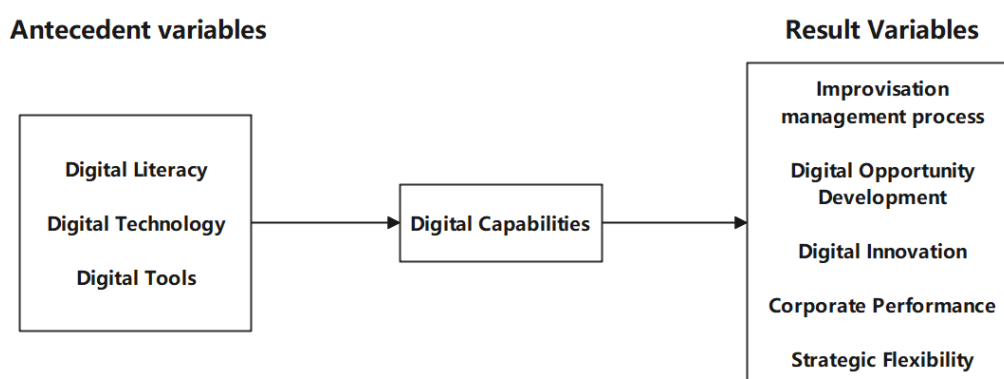


Fig. 1 Antecedent variables, outcome variables of digital capabilities

3. Business Model Innovation Related Research

Numerous disruptive and revolutionary new business models have emerged in the digital age, and more and more scholars are focusing on the important role of business model innovation. Business model innovation is a kind of disruptive innovation. The process of business model innovation enables companies to maximize economic value guided by market logic and thus rapidly establish competitive advantage. The definition and evaluation of business model and its innovation process have become important topics in the field of strategy, innovation and entrepreneurship. Scholars and entrepreneurs agree that both mature and start-up companies should go beyond mere product, service or process innovation, activate more internal company values, drive business model innovation and gradually create an innovation system that is difficult to be imitated by competitors. Therefore, business model innovation is an important innovation activity for enterprises, and it is important to sort out and clarify the business model and the connotation of business model innovation to reveal the process of business model innovation.

3.1 The Connotation of Business Model

The academic community still has not reached a consensus on the concept and connotation of business model, resulting in business model innovation becoming a term of "common agreement and disagreement". The selection and design of business model is the key to the exploration and development of business opportunities and the foundation of business model innovation, so the concept and connotation of business model should be clarified first.

According to Teece (2010)^[11], a business model is a way of designing a company around value creation, with the aim of achieving customer value and gaining profit. Casadesus and Ricart (2010)^[23] define business model as a customer-oriented value proposition, the essence of which is a decision

logic to create value for customers. Demil and Lecocq (2011) ^[24] argue that the business model of a company is the process of creating value, integrating resources, enhancing capabilities, delivering the value proposition and reaping the benefits. The study by Priem et al. (2013) states that business model is a way of behavior centered on achieving customer value, which includes making value proposition, generating customer value, providing customer value and realizing customer value. Achtenhagen et al. (2013) argue that business model is a business structure and market analysis mechanism designed by a firm to achieve organizational profit. Angeli and Jaiswal (2016) define business model as a template for firms to conduct transactional activities with customers, partners, and suppliers, and a mechanism for firms to link markets and analyze them. Foss and Saebi (2017) ^[25], on the other hand, argue that business model is a system for firms, customers, and stakeholders to interact, containing perceived needs to satisfy the market, norms for activities, and the way activities are. Cao et al. (2018) ^[26] argue that the design and execution of a business model is the process by which a firm provides value, accesses resources and creates value, and is the core logic by which a firm creates value for consumers as well as partners.

Table 2. Related concepts of business model

Literature source	related notion
Teece, 2010	A design method around the creation of enterprise value.
Baden-Fuller and Morgan, 2010	The process of creating and distributing value in enterprises.
Casadesus and Ricart, 2010	The essence of a customer-oriented value proposition is a decision logic to create value for customers.
Demil and Lecocq, 2011	The process of creating value, integrating resources, improving ability, transmitting value proposition and gaining profits.
Priem et al., 2013	Behavior mode with the realization of customer value as the core.
Achtenhagen et al., 2013	A business structure and market analysis mechanism designed by enterprises to realize organizational profits.
Angeli and Jaiswal, 2016	The template for trading activities with corporate customers, partners and suppliers is also the mechanism for enterprises to connect and analyze the market.
Foss and Saebi, 2017	A system in which enterprises, customers and stakeholders interact.
Cao et al., 2018	The core logic of creating value for enterprise consumers and partners.

3.2 The Connotation of Business Model Innovation

Business model innovation triggered by the development of digital technology can help companies quickly commercialize their digital products and core products. Especially for start-ups, maintaining business model innovation is the only way to break through industry barriers and resource constraints and maintain sustainable development of the enterprise. The research on business model innovation has become an important topic in the field of entrepreneurship, and there are more and more research results and richer research perspectives.

(1) Strategic Perspective

By revealing the process of creating value through business model, Hamel (1998) proposed that business model innovation is essentially a process of creating new value to establish a competitive advantage, and considered business model innovation as a kind of strategic innovation. On this basis, scholars have carried out research on business model innovation from the perspective of strategy. Schlegelmilch and Chini (2003)'s study argued that business model innovation is an innovation of corporate strategy, an innovation process in which companies guide the design and practice of business models through strategy, and in this innovation process, companies achieve value growth and rapid growth ^[21]. Bock et al. (2010) consider business model innovation as a specific innovation process at the strategic level of the firm and the process of exploitation of new opportunities by the

firm. Cucculelli and Bettinelli (2015) point out that business model innovation is the process of transformative innovation of the firm in the strategic direction of the existing business logic and the process of development and creation of new opportunities.

(2) Technological Innovation Perspective

Chesbrough and Rosenbloom (2002)^[18] argue that the development of technology is a necessary prerequisite for firms to engage in business model innovation, but the potential objective value contained in technology needs to be reflected in the form of business model innovation. On this basis, scholars have conducted research on business model innovation from the perspective of technological innovation. Chesbrough (2006) explored the link between core technology and business model innovation in enterprises and argued that business model innovation is an innovation process that incorporates the economic value of core technology and establishes heuristic logic. Doganova and Eyquem-Renault (2009) proposed that business model innovation enables entrepreneurs to explore new markets and opportunities and facilitate the construction of techno-economic networks, and emphasized that the core technology of a company is the basis of business model innovation. Tidd (2012), on the other hand, argued that business model innovation is the process by which companies reconfigure their business models and problem handling rules based on technological development.

(3) Customer Value Creation Perspective

According to Aspara et al. (2010)^[30], business model innovation is the process of creating new customers and creating new markets by actively exploring potential customer needs, thus achieving a jump in customer value and changing the rules of competition. The innovation process of value creation, value delivery and established market structure, business model innovation should be based on the re-understanding and redefinition of customer value. According to Xiang Peng et al. (2014)^[31], business model innovation is an innovation process in which companies design a unique innovation system, reshape the industrial structure and match the potential needs of customers in the process of deeply exploring customer value. Na and Tse (2012) argue that business model innovation is an innovation process that matches different needs of customers through bilateral markets. Xiao, Hongjun and Yang, Zhen (2020)^[17] explored business model innovation in the digital era and concluded that business model innovation in digital entrepreneurship breaks away from the traditional model of focusing on customer value creation and integrates the value demands of multiple entrepreneurial agents in digital platforms and value networks, including the value creation process of the company's employees, suppliers, government, society and the natural environment.

(4) Organizational Management Perspective

Osterwalder's (2005)^[32] study defines business model innovation as the process of designing an organization's operating and profitability models, and this innovation process aims to reconfigure the organization's established structure, innovation system, and management style. Demil and Lecocq (2010)^[24] considered business model innovation as a process of innovation and evolution of management systems based on the restructuring of resource structures based on value propositions that drive the interaction of management elements within the firm, and this process may result in disruptive innovations. On the other hand, considers the business model as a description of the organization's operational management and operational business, elaborates the role of organizational management in achieving goals, and is the embodiment of a series of elements in the organizational operational management process.

Table 3. Business Model Innovation Related Concepts

Literature source	related notion	Research perspective
Hamel, 1998	The process of creating new value to establish differentiated competitive advantage, and it is considered that business model innovation is a strategic innovation.	Strategic perspective
Schlegelmilch and Chini, 2003	Through the innovation process of business model design and practice guided by enterprise strategy, enterprises have achieved value growth and rapid growth in this innovation process.	
Bock et al., 2010	A special innovation process at the strategic level of an enterprise is also a process in which an enterprise develops and utilizes new opportunities.	
Cucculelli and Bettinelli, 2015	The innovative process of the existing business logic in the strategic direction of an enterprise is also the process of developing and creating new opportunities.	
Chesbrough, 2006	An innovative process that integrates the core technical and economic values and establishes heuristic logic.	Technological innovation perspective
Doganova and Eyquem-Renault, 2009	Enable entrepreneurs to explore new markets and opportunities, and promote the construction of technical and economic networks.	
Tidd, 2012	The process of reconstructing business model and problem-solving rules based on technological development of enterprises.	
Aspara et al., 2010	Enterprises actively explore customers' potential needs to create new customers and new markets, so as to realize the leaping growth of customer value and completely change the competition rules.	
Zott et al., 2011	Innovation process of creating new value and reshaping value creation, value transmission and existing market structure.	Customer value creation perspective
Xiang Peng et al., 2014	In the process of deep excavation of customer value, enterprises design unique innovation systems, reshape the industrial structure and match the innovation of customers' potential needs.	
And natse, 2012.	An innovative process of matching different needs of customers through bilateral markets.	
Xiao Hongjun and Yang Town, 2020	The innovation of business model in digital entrepreneurship breaks through the traditional model of focusing on customer value creation, and it also integrates the value demands of multiple entrepreneurs in digital platform and value network.	
Osterwalder, 2005	The design process of the organization's operation mode and profit mode.	Organizational management perspective
Demil and Lecocq, 2010	The process of reconstructing the resource structure based on the enterprise value proposition and driving the interaction of the internal management elements of the enterprise to carry out the innovation and evolution of the management system.	
Massa et al., 2017	Description of the organization, operation management and operation business.	

3.3 Antecedent Variables of Business Model Innovation

From the available literature, the main antecedent variables that influence business model innovation in firms include management perceptions, executive competencies, organizational activities, leader traits, technological innovation, and market opportunities.

Cavalcante et al. (2011)^[23] argued that business model innovation begins with the perceptions of the firm's leaders and teams, and the leaders' and teams' perceptions of the environment influence the

firm's interpretation of external competition and achieve business model innovation through decision adjustments to gain competitive advantage. A study by Winterhalter et al. (2015) argued that the leadership competencies of firm managers determine the Itami and Noshino (2010) found that firms can learn from and absorb the experience of successful business models through organizational learning activities, and continuously adjust and improve their business models in practice to achieve business model innovation. Guo et al. (2016) explored the relationship between firms' opportunity identification and entrepreneurial patchwork activities and the results show that opportunity identification and entrepreneurial pastiche can positively promote business model innovation. The study by Zhang and Zhou (2017)^[34] explored the impact of leader traits on business model innovation, and the results demonstrated that the initiative of executives can enable them to proactively identify new opportunities of value, which can fundamentally change and innovate existing business models. Kley et al. (2011) argued that technological changes have driven dramatic changes in the market environment, and firms must engage in business model innovation to respond to Kley et al. (2011) argue that technological change has led to dramatic changes in the market environment, and firms must innovate their business models to cope with the changes in the external environment in order to achieve sustainable development. Wu and Zhao Ziyi (2017) suggest that the market opportunities in the market where the company is located drive the business model innovation, especially when the company tries to enter the emerging market it needs to think about how to deliver the value created to the customers, and more importantly, how to grasp the market opportunities in response to the customers' needs, and then design and create a business model that meets the needs.

3.4 Resulting Variables of Business Model Innovation

From the existing literature, the research on the impact outcomes of business model innovation is mainly related to firm performance, organizational learning, manufacturing service transformation, and the legitimacy of start-ups.

Chesbrough and Rosenbloom's (2002) study analyzed the relationship between business model design and innovation and firm performance in Xerox and its related companies from the inherent attributes of business models, and explored the positive relationship between business model innovation and performance. Hu's (2014) study explored the key role of business model innovation for Chinese manufacturing firms, and the study concluded that business model innovation can effectively stimulate organizational learning behavior, which in turn promotes the technological innovation performance of firms. Based on a study of Chinese firms, Liu (2016)^[35] showed that mature manufacturing firms can undergo digital as well as service transformation through business model innovation. A study by Xingwu Luo et al. (2017)^[36] concluded that business model innovation can effectively enhance the legitimacy of start-ups.

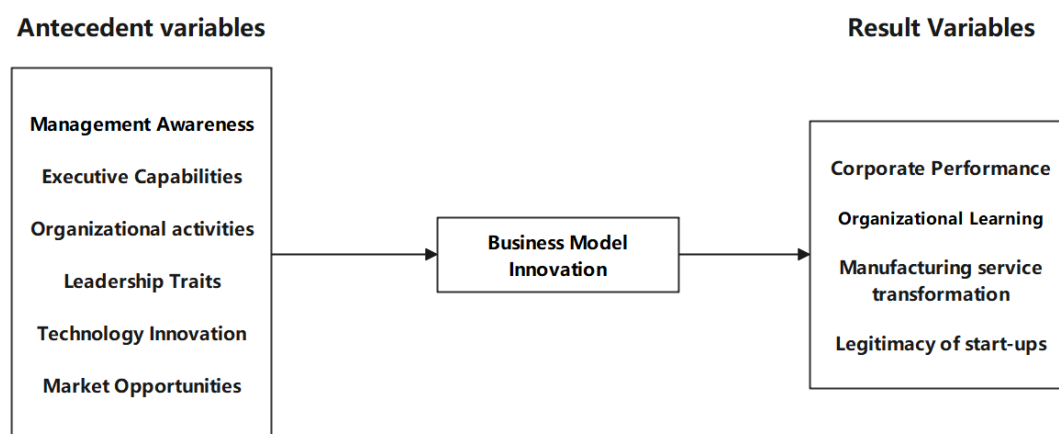


Fig. 2 Antecedent and outcome variables of business model innovation

4. The Impact of Digital Capabilities on Business Model Innovation

Innovation theory suggests that business model innovation is triggered by the direction of technology and enabled by the underlying capabilities of the firm. Nambisan (2016)^[13] states that in a digital entrepreneurial environment, the success of a firm's digital product development and business model innovation is highly dependent on the firm's digital capabilities. Khin and Ho (2019)^[5] argue that digital capabilities complement a firm's digital orientation and that only firms with the ability to manage digital capabilities are more inclined to adopt digital technologies and work to transform them into new products, so firms with digital capabilities are better able to stimulate and achieve innovation. Business model innovation is the process of innovation and reinvention of existing business models by start-ups. The development of digital technology provides new sources of creativity for business models, while digital capability is the foundation for companies to carry out business model innovation and the driving force for business model innovation. At the same time, the rapidly changing digital environment also requires enterprises to continuously scan the digital environment through digital capabilities to discover new digital opportunities, and to reconfigure, integrate and transform existing resources to realize the creation of digital opportunities. In summary, digital capabilities have an important impact on business model innovation.

5. Future Research Outlook

By combing through the literature related to digital capabilities and business model innovation, possible directions for future research can be obtained on the basis of.

(1) Future research directions for digital capabilities.

First, future research can further explore the connotation and characteristics of digital capabilities, improve the measurement of digital capabilities, and explore the differentiated expression of digital capabilities in heterogeneous start-ups based on different digital types of start-ups, so as to reveal the dynamic impact of digital capabilities and the mechanism of action more comprehensively.

Secondly, the literature has explored and discussed the process of digital capabilities affecting organizational management process, digital innovation activities and enterprise performance, but the research on the influence mechanism of digital capabilities is not sufficient, and whether and how digital capabilities affect the entrepreneurial process of start-ups has not been explored yet, which greatly hinders the in-depth research and theoretical expansion of digital capabilities.

Finally, both theoretical and empirical studies on digital capabilities have focused on mature market scenarios in developed Western countries and lacked attention to developing countries, especially in the Chinese context. While the practice of digital entrepreneurship in China is growing rapidly, with digital innovations and new market-disrupting business models emerging, theoretical research on digital capabilities of start-ups is lagging far behind the development of practice.

(2) Future research directions for business model innovation

First, empirical research on business model innovation is still relatively scarce, and there are still a lot of empirical research gaps. In the future, empirical research on business model innovation can be conducted. Second, Velu and Jacob (2016) argue that the specific dynamic capabilities of start-ups are particularly important for business model innovation, but the existing literature lacks research on key factors such as digital capabilities of firms in the digital environment for business model innovation. Therefore, the impact of key factors such as digital capabilities of firms on business model innovation in the digital environment can be studied.

(3) Future research directions for digital capability and business model innovation

First, future research can explore the path mechanism of different influencing factors in the relationship between digital capability and business model innovation from more perspectives, or further enrich the research results of digital capability and business model innovation from individual, team and organizational levels as well as cross-level research.

Second, future research can incorporate simulation research and experimental research into the study of digital capability and business model innovation, and make comprehensive use of case

studies, simulation research, empirical research (cross-sectional research and longitudinal research), experimental research and other research methods to explore and enrich the intrinsic relationship between variables and continuously expand and improve the research results.

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