

Exploring Entrepreneurial Learning, Digital Business Management, and Business Model Innovation in Internet New Ventures: An Empirical Study

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Abstract. This paper aims to investigate the relationship between entrepreneurial learning, digital business management, and business model innovation in internet startups. Business model innovation plays a significant role in today's digital era, and entrepreneurial learning and digital capabilities are considered key factors influencing business model innovation. By elaborating on related concepts and theoretical foundations, this paper introduces the research contents of business model innovation, entrepreneurial learning, and digital capabilities, including their connotations, impacts, and mechanisms. Based on this, a theoretical model is established, and hypotheses are proposed to study the effects of entrepreneurial learning and digital capabilities on business model innovation, as well as the mediating role of digital capabilities. The research design includes the selection of research subjects, data collection methods, measurement of variables, data analysis, and result validation. Finally, empirical research is conducted to verify the hypotheses, including reliability tests, validity tests, and tests for common method bias. The results of this study are of great significance in understanding and promoting business model innovation in internet startups, providing theoretical and empirical foundations for enterprise management and innovation practices.

Keywords: Entrepreneurial Learning; Digital Business Management; Internet; Corporate Business Models; Innovation Research;

1. Introduction

In the rapidly developing era of digital economy, the popularity of the internet and constant evolution of technology have brought unprecedented opportunities and challenges to innovation and entrepreneurship. As the engine for global economic development, the internet economy has spawned a large number of new internet startups, and through business model innovation, changed the structure of traditional industries. In such a rapidly changing environment, entrepreneurial education and digital capabilities have become the key to enterprise success (Lei et al.,2021).

Firstly, it is necessary to recognize the importance and urgency of internet and digital economy for business model innovation. The internet economy not only changes people's lifestyles and social interactions, but also brings enormous opportunities to various industries. By utilizing internet technology, traditional industries can achieve digital transformation, improve efficiency, reduce costs, and expand their market by breaking geographical barriers. The digital economy, as an important component of the internet economy, promotes the digitization transformation of the economy through technological innovation and gives rise to new business models and opportunities. In this digital age, enterprises need to constantly adapt and innovate in order to remain competitive.

Secondly, innovation and entrepreneurship have tremendous potential and significance in the era of internet and digital economy. The emergence of the internet significantly lowers the threshold for entrepreneurship and provides a more convenient environment for innovation and entrepreneurship. Entrepreneurial education, as the process of acquiring knowledge, skills, and experience for entrepreneurs, is crucial for successful business model innovation. Through continuous learning and practice, entrepreneurs can better grasp market demands and opportunities, and increase the success rate of business model innovation (Hysenaj & Barjami, 2012). At the same time, digital capabilities have become indispensable for entrepreneurs' competitiveness. Entrepreneurs with digital capabilities can better utilize the internet and digital technology to build competitive business models and achieve commercial success.

Business model innovation, as the key to enterprises gaining competitive advantage in the internet and digital economy era, requires the support and impetus of entrepreneurial education and digital capabilities. Business model innovation is not just about creating new products or services, but also involves creating unique business value through the recombination of value chains (Bender et al.,2011).

2. Relevant Concepts and Theoretical Foundations

2.1. Business Model Innovation

2.1.1. Connotation of business model innovation

Business model innovation refers to the process in which companies change the logic of value creation and value capture, bringing new resource advantages and innovation advantages to themselves, renewing the internal value creation mechanism, driving product and technology innovation, and achieving innovative performance. A business model is a way of designing and constructing mechanisms for creating, delivering, and capturing value, determining how companies integrate various elements and organizational activities to transform resources into revenue and meet customer needs (Helena et al.,2022).

Business model innovation can be divided into two aspects: efficiency-oriented business model innovation and novel-oriented business model innovation.

Efficiency-oriented business model innovation focuses on achieving information sharing, enhancing transaction stability, and improving transaction efficiency through innovation. Its purpose is to reduce transaction costs, improve transaction efficiency, and reduce innovation costs by improving information accuracy and reducing information asymmetry. Effective market information can reduce direct and indirect transaction costs, promote innovation activities, and increase the output of innovation performance (V. O S,V. I S,V. A T,2021).

On the other hand, novel-oriented business model innovation emphasizes innovation in transaction mechanisms, achieving economic exchange in new ways. When implementing novel-oriented business model innovation, innovative companies integrate various elements and reach out to more potential customers, thereby obtaining richer resources, expanding existing markets, and bringing greater value and innovative performance to stakeholders and the company itself (Zhe et al.,2020). At the same time, novel-oriented business model innovation can also achieve product and service innovation, creating and expanding new market space for companies, further enhancing innovative performance. The framework of novel-oriented business model innovation is shown in Figure 1.

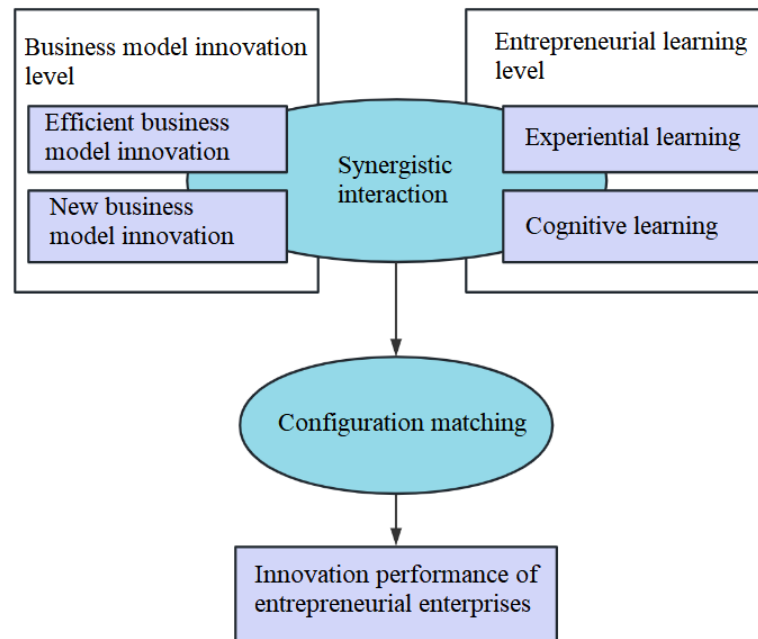


Fig.1: Novel business model innovation framework

In summary, business model innovation is an important means for companies to create, deliver value, and achieve innovative performance by changing the logic of value creation and capture, updating internal mechanisms. Efficiency-oriented business model innovation emphasizes improving information sharing and transaction efficiency, while novel-oriented business model innovation focuses on innovative transaction mechanisms and exploring new market space. Implementing business model innovation can help companies gain competitive advantage in a competitive market, promote sustainable growth and development.

2.1.2. A study of the impact of business model innovation in the digital age

In the digital era, digitalization and business models have merged, giving rise to increasingly innovative business models, which have attracted widespread attention from scholars. Researchers have gradually placed business model research in the context of digitalization and conducted research from the perspectives of digital technology, platforms, digital transformation, and dynamic capabilities, exploring how companies conduct business model innovation activities in the digital trend. In existing research, scholars have explored the impact of business model innovation in the digital era from different angles (Nwankpa et al.,2022). For example, some studies focus on digital enterprises, analyzing the integration process of technological innovation and business model innovation, extracting resources and innovation elements, and analyzing their impact on the innovation integration process. Other studies focus on the perspective of technological embedding, and through the analysis of specific cases, they discover different directions of influence of technology development and technology integration on business model innovation.

The business model innovation of internet platform companies has also become a focal point of

research. Studies have found that internet platform companies promote the value proposition of content production and consumption through digital content and connectivity technologies, and through innovative means such as empowering content creation, expanding social networks, and shared value capture, they enable equal participation of low-income groups in content value creation. Research on the digital transformation of traditional manufacturing companies provides different principles of model design and offers alternative solutions for companies' digital transformation. Furthermore, starting from the analysis of temporal and spatial fit in the internet environment, explorations have been made on the element support system, value creation mode, and revenue model of platform business model innovation, pointing out that real-time collaboration of element support systems plays a crucial role in the operational efficiency of platform business model innovation. In addition, from the perspectives of entrepreneurial learning and dynamic capabilities, there are also studies that explore the mediating role of service e-commerce platform business model transformation and family influence in digital business model innovation (Matteo wt al.,2020). These research findings provide important guidance and insights for companies' business model innovation in the digital age.

In conclusion, the digital era has had a widespread impact on business model innovation, and scholars have explored the role of factors such as digital technology, platforms, digital transformation, and dynamic capabilities in business model innovation from different angles. These research findings provide theoretical support and practical guidance for companies' business model innovation in the digital age, promoting further developments in innovation management, entrepreneurial management, information technology, strategic management, and supply chain management, among other fields (Cruz M M L,2020).

2.1.3. Review of Research on Business Model Innovation

Through the literature review, the essence of business model innovation and the factors influencing business model innovation in the digital age have been studied to a certain extent. However, there are still some shortcomings in the research on business model innovation, mainly manifested in the following aspects: Firstly, there is relatively insufficient empirical research on business model innovation in domestic studies, with theoretical research and case studies being the main approaches. Although theoretical research and case studies have played an important role in understanding the concept and practice of business model innovation, further empirical research is still needed on the factors influencing business model innovation and specific implementation methods. Secondly, there is not enough attention given to new startups implementing business model innovation strategies in the digital context. Existing literature mostly focuses on traditional and mature enterprises, while lacking in-depth research on new startups. However, new startups, as a driving force for promoting national innovation and entrepreneurship, are of great significance in maintaining economic vitality and achieving sustainable development. Especially digital startups, represented by internet startups, it is worthwhile to explore how they can engage in digital business model innovation based on identifying their own strengths and weaknesses to survive and thrive in fierce competition. Therefore, this paper selects internet startups as the research object, aiming to investigate the factors influencing business model innovation of internet startups. Through the study of internet startups, a better understanding of the characteristics and trends of business model innovation in the digital economy background can be achieved. At the same time, researching the business model innovation of internet startups is of great significance in providing targeted practical recommendations and promoting the sustainable development and innovation capabilities of internet enterprises.

2.2. Entrepreneurial learning

2.2.1. Inside Entrepreneurial Learning

Entrepreneurial learning refers to the learning activities that companies engage in during the entrepreneurial process through continuous reflection on experiences and lessons, enhancing network

capabilities, and acquiring new knowledge. It combines organizational learning theory with entrepreneurship theory and aims to help companies continually grow and develop during entrepreneurship. In the era of the digital economy, a large number of explicit and implicit knowledge resources have emerged on the Internet, and new venture companies can quickly acquire knowledge with digital value through entrepreneurial learning. Therefore, the importance of entrepreneurial learning for new venture companies is self-evident (Ravil et al.,2020).

From an academic research perspective, there are certain differences in the interpretation and understanding of entrepreneurial learning. Deakins and Freel (1998) define entrepreneurial learning as a learning activity that involves repeated reflection on experiences and lessons, enhancing network capabilities, and acquiring new knowledge, aiming to help companies grow during entrepreneurship. Wang and Chugh (2014) summarize the core concept of entrepreneurial learning as entrepreneurs exploring and utilizing entrepreneurial opportunities to determine the content they need to learn through the process of starting a new venture, achieving learning goals through exploratory learning and exploitative learning. Chen Hansong et al. (2020) define entrepreneurial learning as a knowledge accumulation, resource acquisition, and utilization process at the individual cognitive level (Moellers et al.,2019).

Furthermore, scholars have explored entrepreneurial learning from different research levels. Entrepreneurial learning at the individual level refers to how entrepreneurs explore how to obtain economic benefits through entrepreneurship based on personal experience. Corbett (2005) views entrepreneurial learning as the process in which entrepreneurs transform personal experience and information into new knowledge, including stages such as knowledge absorption, knowledge diffusion, and adaptation. Entrepreneurial learning at the organizational level focuses on how to achieve sustainable entrepreneurial development through identifying and developing entrepreneurial opportunities. Chen Wenting and Li Xinchun (2010) construct an entrepreneurial learning theoretical framework for Chinese companies, including elements such as innovative thinking, experiential reflection, and strategic experimentation (Aspara et al.,2013). It is important to note that there is a distinction between entrepreneurial learning and organizational learning. Using only organizational learning theory is not enough when it comes to the entrepreneurial learning process (Deakins and Freel, 1998). Zhao et al. (2011), through empirical research on 607 enterprises in eight provinces in China, prove the inverted U-shaped relationship between entrepreneurial orientation and exploratory learning. That is, the relationship between entrepreneurial orientation and exploratory learning is only significant when the enterprise's entrepreneurial orientation is close to the moderate level. There is a significant positive correlation between applied learning and firm performance (Flamholtz et al.,2012). After the enterprise has acquired external knowledge, there is only a weak relationship between exploratory learning and firm performance, as shown in Figure 2.

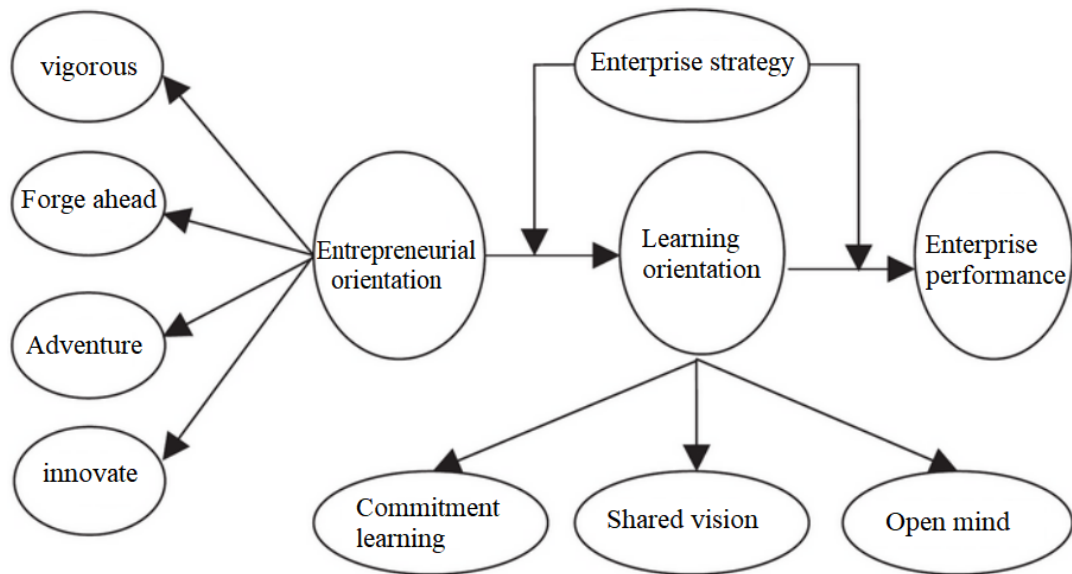


Fig.2: Relationship between entrepreneurial learning and firm performance

In summary, entrepreneurial learning refers to the learning activities that companies engage in during the entrepreneurial process, including continuous reflection on experiences and lessons, enhancing network capabilities, and acquiring new knowledge. It is crucial for new venture companies to achieve growth and development. The definition and understanding of entrepreneurial learning vary depending on the research perspective, and there are also differences between individual-level and organizational-level entrepreneurial learning. Entrepreneurial learning is distinct from organizational learning and requires the construction of an independent theoretical framework to better explain the entrepreneurial learning process and effects. In the era of the digital economy, entrepreneurial learning serves as an essential pathway for new venture companies to acquire knowledge resources with digital value, providing strong support for innovation and competition within the company (Karlsson,2019).

2.2.2. The impact of entrepreneurial learning on business model innovation

Entrepreneurial learning has a significant impact on business model innovation. Existing literature mainly explores the influence of entrepreneurial learning as an independent or mediating variable on business model innovation. Some studies suggest that engaging in exploratory learning activities during the entrepreneurial process can facilitate rapid business model innovation. An empirical survey based on 36 start-ups in the Swedish mobile internet industry found that exploratory learning activities during the entrepreneurial process positively contribute to driving business model innovation. Other studies demonstrate the pathway of entrepreneurial learning on business model innovation through specific cases. For example, a case study based on Zhuhai Zhongneng revealed the research pathway between entrepreneurial learning, opportunity recognition, and business model innovation. The results showed that entrepreneurial learning has a positive impact on business model innovation by promoting the recognition of entrepreneurial opportunities. Additionally, the relationship between entrepreneurial learning and business model innovation is influenced by entrepreneurial networks and experimental learning. A case study based on entrepreneurial firms found that learning by doing and experimental learning have intrinsic linkages with the content innovation of business models. Furthermore, entrepreneurial learning also acts as a mediator (Jon et al.,2022). A study explores the relationship between strategic experimentation and business model innovation in new ventures, with entrepreneurial learning as a mediator. The results indicate that the learning mechanisms provided by strategic experimentation offer potential resources for business model innovation in new ventures.

2.2.3. The Impact of Entrepreneurial Learning on Digital Capabilities

Digital capability is a concept developed in the current digital context, based on the theory of dynamic capabilities. Although there is relatively limited literature on the relationship between entrepreneurial learning and digital capabilities, scholars generally acknowledge the influence of entrepreneurial learning on the dynamic capabilities of enterprises (Liu Jingjian et al., 2011; Yu Hongjian, 2017). Liu Jingjian's research shows that entrepreneurial learning is a key element in supporting new ventures to adapt to environmental changes. It can promote the encoding, interpretation, and accumulation of experiential knowledge, identify valuable resources, and enhance the dynamic capabilities of new enterprises. Yu Hongjian (2017) discusses the relationship between entrepreneurial learning and dynamic capabilities in his research, suggesting that the organizational learning of new ventures should make enhancing dynamic capabilities an organizational goal. The process of entrepreneurial learning should involve the identification, acquisition, and development of entrepreneurial opportunities and strive to develop the new venture into a learning organization. Furthermore, some studies also support the impact of entrepreneurial learning on digital capabilities. Wang Haihua et al. (2018) conducted in-depth interviews with entrepreneurs from 15 internet startups using grounded theory and found that internet startups use entrepreneurial learning processes to allocate digital resources and solve problems. Liu Haijian et al. (2021) based their research on the digital transformation process of Beike, suggesting that data-driven utilization-focused learning can expand internet business, while community-oriented utilization-focused learning can strengthen user emotions and create more value in the process of continuous operation and viral traffic, thereby enhancing the company's digital operational capabilities.

From the above studies, it can be seen that entrepreneurial learning has a significant impact on digital capabilities. Entrepreneurial learning helps new ventures continuously accumulate experiential knowledge, enabling a better understanding of the business environment and market demands in the digital context. Through entrepreneurial learning, enterprises can more keenly identify and seize digital opportunities, effectively allocate digital resources, and solve various problems and challenges in the digital transformation process. Entrepreneurial learning also contributes to the establishment of a learning organization within the enterprise, constantly optimizing and improving its digital capabilities. Through continuous trial and reflection, enterprises can quickly adapt to the changes brought about by the digital era and continuously enhance their innovation and competitiveness.

Furthermore, there is a mutually reinforcing relationship between entrepreneurial learning and digital capabilities. Digital capabilities enhance the demand for entrepreneurial learning in enterprises, while entrepreneurial learning helps enterprises better utilize and develop digital capabilities. Through entrepreneurial learning, enterprises can continuously improve and refine various aspects of their digital capabilities, including data analysis, digital marketing, and innovative technology applications. Entrepreneurial learning can also drive enterprises to pursue innovation and change, promoting the continuous enhancement of digital capabilities and the cultivation of innovation capabilities.

2.2.4. Entrepreneurship Learning Research Review

Research reviews on entrepreneurship learning indicate that researchers are gradually recognizing and focusing on the relationship between entrepreneurship learning, digital capabilities, and business model innovation. However, there are several research gaps. Firstly, there is a scarcity of research on organizational-level entrepreneurship learning. Current research mainly focuses on the influence of entrepreneurship learning on individual entrepreneurs, while the study of the process and effects of entrepreneurship learning within the entire organization is relatively limited. Further research in this area can delve into how organizational-level entrepreneurship learning can promote the enhancement of digital capabilities and its impact on business model innovation. Secondly, there is a relative lack of research on the pathways through which entrepreneurship learning affects business model innovation. Business model innovation is a significant strategy for companies facing digital

challenges, and entrepreneurship learning, as a learning process, has potential implications for business model innovation. However, there is still insufficient research on the specific pathways through which entrepreneurship learning influences business model innovation. Future research can further explore the mediating mechanisms and associated factors between entrepreneurship learning and business model innovation to gain a more comprehensive understanding of their relationship.

Given the aforementioned research gaps, future studies can explore and expand in the following areas. Firstly, the relationship between entrepreneurship learning and digital capabilities can be further investigated. Digital capabilities refer to the ability of businesses to cope with and compete in the digital environment, and entrepreneurship learning, as one of the important factors for enhancing a company's dynamic capabilities, also has potential implications for the improvement of digital capabilities. Secondly, there can be in-depth research on organizational-level entrepreneurship learning. Organizational-level entrepreneurship learning refers to the learning process within the entire organization regarding innovation and change. Researchers can conduct cross-departmental surveys and observe internal innovative behaviors to explore the impact and mechanisms of organizational-level entrepreneurship learning on digital capabilities and business model innovation.

Additionally, exploring the pathways through which entrepreneurship learning influences business model innovation is also an important direction for research. Business model innovation is one of the crucial strategies for companies in the digital age, and entrepreneurship learning, as a learning process, has potential implications for a company's business model innovation. Researchers can delve into the learning content, learning methods, and learning environment involved in entrepreneurship learning to explore the pathways through which entrepreneurship learning influences business model innovation. They can also propose corresponding theoretical models and management practice recommendations.

2.3. Digital Competence

2.3.1. The meaning of digital competence

With the vigorous development of the digital economy, the study of digital capabilities has gradually captured the attention of scholars. The research on digital capabilities mainly explores from the perspectives of technological capabilities and dynamic capabilities, laying a preliminary foundation for understanding its essence. Researchers, such as Westerman et al. (2012), believe that digital capabilities include technological development capabilities, big data analytics capabilities, and data application capabilities. These capabilities serve as the foundation for optimizing customer experiences, improving operational processes, and adjusting business models. Similarly, Khin and Ho (2019) define digital capabilities as information management capabilities and IT infrastructure capabilities, which are the abilities to manage skills and knowledge with the support of emerging technologies. These capabilities play a crucial role in areas like new product development. Zhou Wenhui et al. (2020) consider digital capabilities as a type of digital dynamic capabilities, which include digital organizational capabilities, digital operational capabilities, and digital co-creation capabilities. They enable companies to adapt to changing market demands by perceiving opportunities, integrating internal and external resources, and strengthening collaborations with relevant stakeholders, all driven by digital technologies (Kim et al., 2016). On the other hand, Annarelli et al. (2021) constructed a model of digital capabilities based on a literature review. This model suggests that many studies regard digital capabilities as advanced capabilities similar to dynamic capabilities, enabling companies to achieve competitive advantages by continuously enhancing their ability to adapt to the ever-changing digital age environment. This research views digital capabilities as organizational abilities that allow companies to combine digital assets and business resources extensively, innovate products, services, and processes through digital networks, and ensure sustainable competitive advantages. In addition, Yi Jiabin et al. (2021), with internet companies as the research object, propose that digital capabilities include digital sensing capabilities, digital operations capabilities, and digital resource coordination capabilities (Page & Spira, 2016).

2.3.2. Impact of digital capabilities on business model innovation

Digital capabilities have a significant impact on business model innovation. Some studies have shown that digital capabilities can provide new driving force and engine for business model innovation. In the research of digital sensing capabilities, an empirical analysis of 80 Dutch medical biotechnology companies found that the ability to identify digital environmental opportunities is crucial for driving the dynamic development of business models. This means that through enhancing digital sensing capabilities, companies can better identify and seize opportunities in the digital environment, thus promoting business model innovation. Another study based on small and medium-sized IT companies in Malaysia explored the influence of digital orientation and digital capabilities on digital innovation. The results showed that digital capabilities drive digital innovation behavior in IT companies. This indicates that improving digital capabilities can enable companies to create innovative digital products and services using emerging digital technologies, thus promoting business model innovation (Armando S,2017).

Digital technological capabilities are also considered to play an important role in business model innovation. Researchers believe that the value capture stage of business model innovation relies on digital technological capabilities to leverage core technologies such as social networks, cloud computing, and big data analytics, to drive digital enterprises in creating innovative value and gaining sustainable competitive advantages. Additionally, an empirical study examined the mediating effect of digital capabilities in the impact mechanism of organizational inertia on business model innovation. The results showed that digital capabilities mediate the relationship between organizational inertia and business model innovation (Yongrok,2017).

2.3.3. Research Review on Digital Capability

Digital capability plays a significant role in the development of internet startups. It helps businesses achieve a dynamic balance in their internal and external environments, providing potential room for innovation in their business models. However, there is still relatively limited research on digital capability in the entrepreneurial field, with most studies focusing on the digital transformation capabilities of traditional manufacturing industries and the impact of internet technologies on digital capability. Domestic research primarily consists of theoretical and case studies, with a need for further strengthening, improving, and supplementing empirical research.

In light of the current status of research on digital capability, future studies can be expanded in the following aspects. Firstly, there is a need for in-depth exploration of the applications and effects of digital capability in the entrepreneurial field. Digital capability plays a crucial role in the development of startups, but further research is required on how it affects a company's innovation capability, market competitiveness, and long-term development. Additionally, the specific application scenarios of digital capability in different industries and environments are also worth further investigation. Secondly, the shaping process of digital capability can be explored from the perspective of institutional environments and organizational factors. The formation of digital capability depends on the institutional environments and organizational factors within a company. Researchers can delve into the shaping process of digital capability from aspects such as organizational learning, knowledge management, and organizational innovation, exploring the influence and mechanisms of internal factors on digital capability. Furthermore, there is a need for empirical research on digital capability in the entrepreneurial field. Research on digital capability is mainly limited to theoretical and case studies, lacking sufficient empirical research support. Future studies can employ methods such as questionnaire surveys, field observations, and experiments, integrating a large volume of practical data to conduct more comprehensive and in-depth research on the measurement and impact of digital capability. Lastly, interdisciplinary research collaboration can be strengthened. Digital capability involves multiple disciplinary domains, including management, information systems, and innovation research. Future research can enhance interdisciplinary collaboration, integrating theories and

methodologies from different fields to jointly explore the mechanisms and practical significance of digital capability in the entrepreneurial field. This will contribute to further advancement in the research of digital capability and provide more targeted recommendations for practice.

3. Models and Assumptions

3.1. Model and assumptions

3.1.1. Construction of the Theoretical Model

The present study focuses on internet startups and primarily explores the relationship between entrepreneurial learning, digital capabilities, and business model innovation in internet enterprises, as well as investigates the formation path of digital capabilities. In the research model, entrepreneurial learning is considered as the independent variable, digital capabilities as the mediating variable. The study examines their impact mechanism on digital capabilities in internet startups, as well as the interrelationships among entrepreneurial learning, digital capabilities, and business model innovation in internet startups. The research model is illustrated in Figure 3.

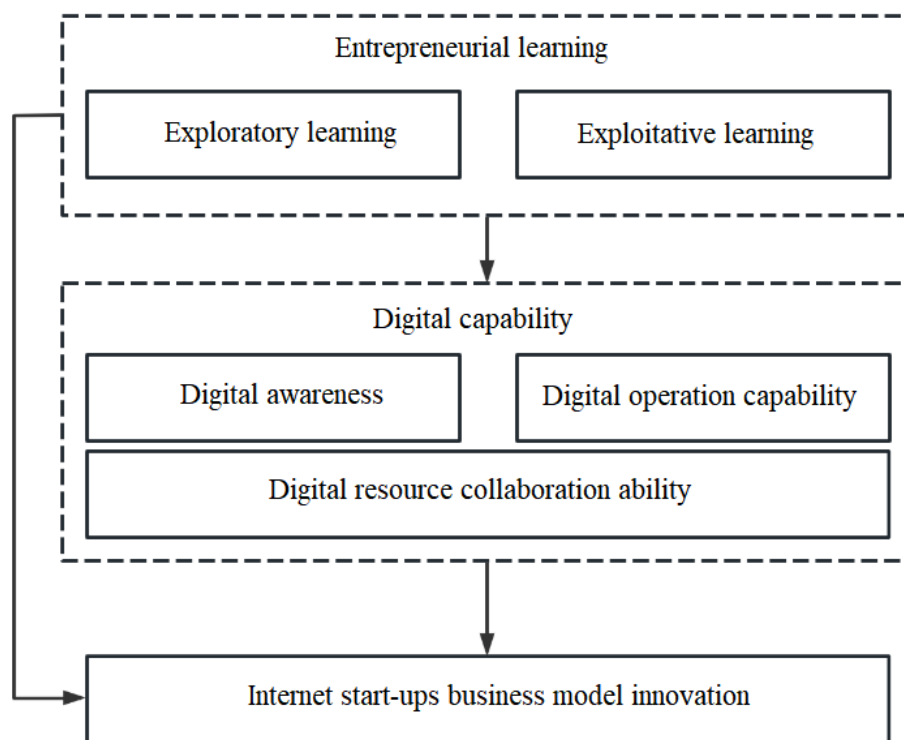


Fig.3: Research model

The construction of this research model aims to reveal the important roles of entrepreneurial learning and digital capabilities in internet startups. Entrepreneurial learning influences the digital capabilities of internet startups by enhancing network capabilities, acquiring new knowledge through the summary of experiences and lessons. With digital capabilities as the mediating variable, it further strengthens the impact of entrepreneurial learning on business model innovation in internet startups by enhancing the company's abilities in technological development, big data analytics, and data application. By studying this model, a better understanding of the relationship between entrepreneurial learning, digital capabilities, and business model innovation can be gained, providing theoretical support and guidance for the development of internet startups (Zhao et al.,2021).

3.1.2. Research hypothesis

(1) Entrepreneurial Learning and Business Model Innovation of Internet New Ventures

In the current digital economy era, internet startups face challenges and opportunities of continuously emerging explicit and implicit knowledge. Entrepreneurial learning is considered an effective way to

help internet startups quickly grasp knowledge resources with digital value. For internet startups, continuous innovation of their business models is key to gaining more market share. Past studies have shown that entrepreneurial learning is an effective approach to facilitate the rational allocation of internal and external knowledge resources, thus driving business model innovation in the digital economy era for internet startups (Yi et al.,2021).

In the digital environment, companies are gradually shifting from a product-oriented approach to a customer-oriented approach. As inherently digital enterprises, internet startups have been customer-oriented since their establishment. Through exploratory learning, internet startups seek potential user needs, acquire specific knowledge and asymmetric information, and capture digital entrepreneurial opportunities from digital information, enabling targeted innovation of business models. At the same time, internet startups can use exploitative learning to analyze existing user needs and the digital market, obtaining information beneficial to innovative value propositions. Additionally, entrepreneurial learning can enhance startups' selectivity and evaluative capabilities, leading to innovation in transaction mechanisms. Through exploratory learning, internet startups can access more external digital and non-digital resources, while exploitative learning enables them to develop and leverage existing digital and non-digital resources, clarifying the positioning of the company in the value chain and achieving innovation at the value creation level. Case studies demonstrate that community interaction through exploitative learning becomes the primary direction of entrepreneurial learning, which helps internet enterprises form conventions based on community development and enhance the innovation capacity of value delivery. In the era of digital transformation, internet startups need to establish a culture of entrepreneurial learning that is open, inclusive, and questioning in order to achieve core innovation of their business models in highly uncertain environments.

The hypotheses proposed in this study can be summarized as follows:

H1: Entrepreneurial learning has a positive impact on business model innovation in internet startups.

H1a: Exploratory learning has a positive impact on business model innovation in internet startups.

H1b: Exploitative learning has a positive impact on business model innovation in internet startups.

(2) Entrepreneurial Learning and Digital Capability of Internet Startups

The success of internet startups largely depends on the development of their digital capabilities. Entrepreneurial learning, as a learning process, plays a crucial role in enhancing the digital capability of internet startups. Utilization-based learning is an important approach in entrepreneurial learning, as it expands the depth and breadth of existing knowledge, enabling startups to increase their knowledge resources and enhance their digital capabilities. Research has shown a positive correlation between resource accumulation and dynamic capabilities of internet startups and their digital capabilities. Utilization-based learning helps expand a company's knowledge resources, enabling it to respond better to market changes and competition. In the digital era, internet startups, guided by user demand, need to continuously pay attention to user feedback and needs to objectively understand their strengths, weaknesses, opportunities, and threats. This user-oriented learning process helps enhance the digital capabilities of startups. Furthermore, research has found that utilization-based learning has a positive impact on the digital capabilities of internet startups. For instance, data-driven utilization-based learning can assist companies in expanding their internet business. By analyzing and utilizing large amounts of data, companies can gain more business insights and better allocate digital resources to solve problems. Additionally, community-oriented utilization-based learning can strengthen user engagement, increase user stickiness and loyalty, thereby enhancing the digital capabilities of the company. Moreover, internet startups generate a considerable amount of data during their day-to-day operations. Through utilization-based learning, companies can place greater emphasis on and effectively utilize their internal digital resources. This learning process enables companies to fully recognize and leverage their digital capabilities, further enhancing their

competitiveness in the digital age.

Based on the above analysis, this article proposes the following hypotheses:

H2: Entrepreneurial learning of internet startups has a positive impact on their digital capability.

H2a: Exploratory learning of internet startups has a positive impact on their digital capability.

H2b: Utilization-based learning of internet startups has a positive impact on their digital capability.

(3) Digital Capability and Business Model Innovation for Internet Startups

In the digital economy era, internet startups face challenges of uncertainty and complexity, requiring a certain level of digital capability to address these challenges and achieve business model innovation. Digital capability can help businesses perceive changes in external demands in a timely manner, launch products and services that meet new user needs, and gain competitive advantage in the market. The digital perceptual capability of internet startups is a crucial driving factor for achieving business model innovation. Through digital perceptual capability, businesses can accurately identify changes in external demands, seize market opportunities in a timely manner, and introduce innovative products and services that meet new needs. This acute perceptual capability can help businesses position their business models and create new value, thereby driving business model innovation. Additionally, digital operational capability plays an important role in promoting business model innovation for internet startups. Through digital operational capability, businesses can efficiently operate digital businesses and improve the efficiency and flexibility of business processes. Effective digital operational capability can help businesses optimize and innovate business models, rejuvenate business processes, and enhance competitiveness. Moreover, in the digital economy era, internet startups can achieve collaborative and symbiotic development with various stakeholders through digital resource coordination capability. By establishing a user-centered digital value network, businesses can engage users, partners, and supply chains in the design and use of new products and services. The digital resource coordination capability can assist businesses in achieving collaborative and symbiotic development, promoting dynamic innovation in business models. Based on the analysis above, this article proposes the following hypotheses:

H3: The digital capability of internet startups has a positive impact on business model innovation.

H3a: The digital perceptual capability of internet startups has a positive impact on business model innovation.

H3b: The digital operational capability of internet startups has a positive impact on business model innovation.

H3c: The digital resource coordination capability of internet startups has a positive impact on business model innovation.

(4) Entrepreneurship Learning, Digital Capability, and Business Model Innovation of Internet Startups

There is a certain relationship between entrepreneurship learning, digital capability, and business model innovation of internet startups. Entrepreneurship learning serves as the foundation for building the digital capabilities of internet startups. Through learning activities, companies can accumulate knowledge and innovative resources, gain experiential support, and establish a foundation for cultivating and upgrading digital capabilities. At the same time, business model innovation of internet startups often depends on the support and empowerment of digital capabilities. Using the research of Khin and Ho (2019) as an example, they found that digital capability can facilitate digital innovation activities in small and medium-sized IT companies in Malaysia. Companies leverage emerging digital technologies to create innovative digital products and services, thereby achieving business model innovation. This suggests that digital capability has a positive impact on the business model

innovation of internet startups. Additionally, Wang Haihua et al. (2018) applied the theory of groundedness to study how entrepreneurship learning helps enhance digital resource coordination ability through digital capability. The process of entrepreneurship learning can assist companies in digital resource allocation and problem-solving, thus enhancing digital resource coordination ability. The improvement of digital resource coordination ability can promote the business model innovation of internet startups. Based on the above analysis, this study proposes the following hypotheses:

H4: Entrepreneurship learning influences the business model innovation of internet startups through the mediating role of digital capability.

H4a: Digital sensing capability mediates the relationship between entrepreneurship learning and business model innovation of internet startups.

H4b: Digital operational capability mediates the relationship between entrepreneurship learning and business model innovation of internet startups.

H4c: Digital resource coordination capability mediates the relationship between entrepreneurship learning and business model innovation of internet startups.

3.2. Research Design

3.2.1. Selection of survey respondents and data collection

(1) Selection of Survey Participants

This study focuses on the phenomenon of digital entrepreneurship in the context of the digital economy, with special attention to internet startups. The aim is to explore the underlying mechanisms of how entrepreneurial learning, through its influence on digital capabilities, affects business model innovation. In the digital era, there has been a proliferation of entrepreneurial ventures that create value through the use of digital technologies, with internet startups being a typical example. Therefore, selecting internet startups as the research subject holds practical significance (LIAO et al., 2013).

Through a review of relevant literature, it was found that scholars generally define internet entrepreneurial ventures as early-stage companies that are founded, developed, or utilize information products and engage in commercial activities supported by internet technologies. Following Batjargal et al. (2007), this study defines startups as companies established within the past 8 years.

It is worth noting that the selection of the target audience and sample data in the questionnaire survey will have an impact on the quantification of key research variables in this study. Therefore, the questionnaire design should clearly identify the target population from the beginning, and invalid samples should be eliminated during data collection and preliminary processing to ensure the accuracy of empirical data. As such, the questionnaire in this study primarily targets middle to upper-level management of internet startups. There are several reasons for selecting this group: firstly, middle to upper-level executives possess rich experience and a deep understanding, which enhances the credibility of their questionnaire responses. Secondly, information related to entrepreneurial learning, digital capabilities, and business model innovation primarily reside at the organizational strategic level. Middle to upper-level managers often have longer tenures within the company and a more in-depth understanding of this information, while ordinary employees may have lower sensitivity to such information. Therefore, choosing middle to upper-level management as the main survey participants is more appropriate.

(2) Data collection

Due to the impact of the pandemic, this study adopted a combination of online and offline methods for data collection. Offline data collection primarily involved visiting some entrepreneurial parks in Hangzhou and distributing questionnaires to employees of internet startups for completion. Online data collection, on the other hand, was conducted through various channels to ensure a wide sample coverage. During the online data collection phase, various methods were used to distribute and collect

questionnaires. Firstly, leveraging social platforms such as WeChat and QQ, connections were established with friends and acquaintances in the internet industry, and the questionnaires were further disseminated through their social networks. Secondly, enterprise resources from data collection platforms such as Wenjuanxing and Jianshu were utilized for questionnaire distribution and collection. Additionally, digital platform-based apps like "Xiaohongshu" were used to distribute the questionnaires to practitioners in internet startups. Throughout the questionnaire distribution process, the emphasis was placed on targeting internet startups as the primary audience.

To ensure the accuracy and validity of the data, the questionnaire included two screening criteria, including whether the respondent's company belonged to the internet industry and whether the company was established after 2014. These screening criteria helped ensure the representativeness of the samples and the internal relevance of the study. The survey was distributed and collected over a period of three months, from early April 2022 to the end of June 2022. Out of the 270 questionnaires collected, after excluding those that did not pass the screening criteria, had inconsistent company information, incomplete data, or were completed within a too short timeframe, a final sample of 180 valid questionnaire responses was obtained. The effective response rate of the questionnaire reached 66%.

3.2.2. Data analysis methods

Before the research is formally conducted, a pre-survey with a small sample size is usually conducted to assess the reliability of the questionnaire design and to target modifications. The process of market research is shown in Figure 4.

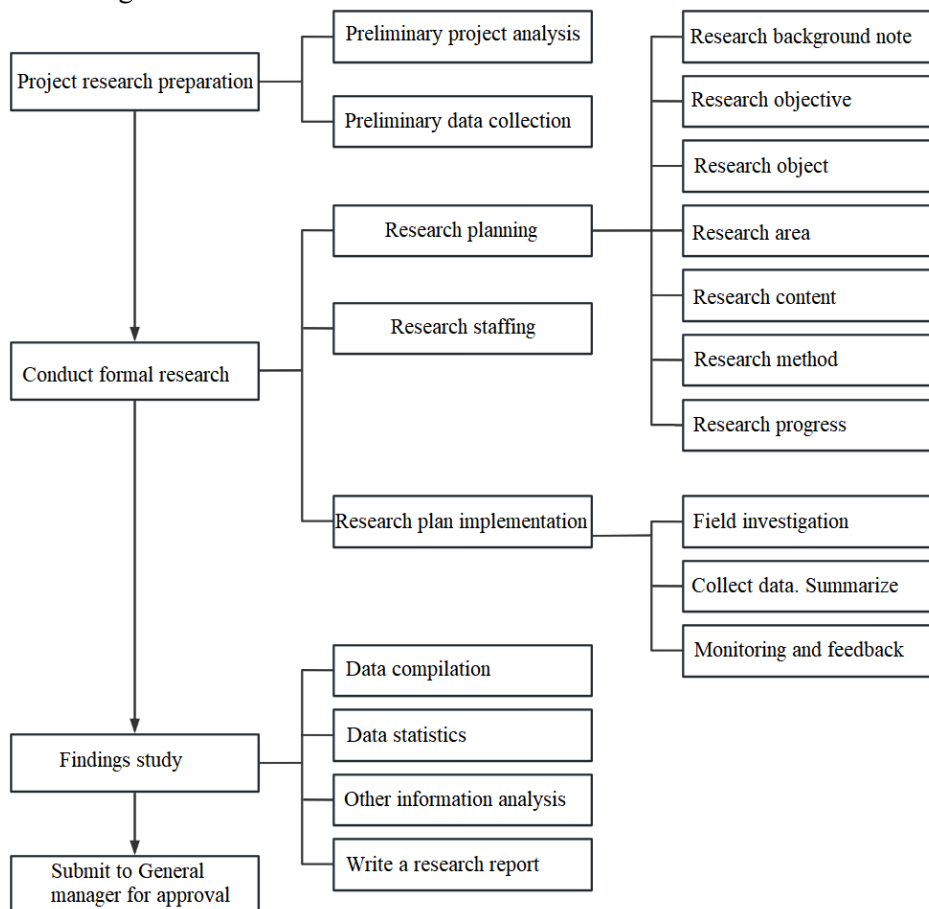


Fig.4: Market research process

Firstly, the preliminary designed questionnaire was distributed on a small scale, and the process of questionnaire distribution, collection, and screening was carried out. Resources available were utilized to communicate and seek feedback from a small group of respondents to ensure the clarity and

acceptability of the questionnaire. Secondly, the validity of the collected questionnaire samples was examined using the Cronbach's Alpha coefficient, which determines the reliability of the questionnaire. Additionally, factor analysis was conducted on the questionnaire data to examine its construct validity. This study plans to use commonly used tests such as the KMO (Kaiser-Meyer-Olkin) test and Bartlett's test of sphericity to evaluate whether the key variables are suitable for factor analysis. If the KMO value of the variables is above 0.6, it indicates that the variables support factor analysis, and the factor loading results can help refine the questionnaire to improve the validity of the questionnaire items. In this study, with the help of available resources and online platforms such as Wenjuanxing and Jianshu, a total of 100 questionnaires were distributed. In the end, 76 questionnaires were collected, and after excluding 24 invalid questionnaires, 52 valid questionnaires were obtained. The effective response rate of the questionnaire reached 52%.

(1) Reliability Analysis

In the confidence analysis, we evaluated six variables: exploratory learning, utilization learning, digital perception capability, digital operation capability, digital resource synergy capability and business model innovation. Table 1 shows the pre-study reliability analysis.

Table 1. Pre-survey reliability analysis

scale	Number of terms	Cronbach's Alpha
Exploratory learning	4	0.822
Exploitative learning	4	0.830
Digital awareness	5	0.872
Digital operation capability	5	0.917
Digital resource collaboration ability	5	0.897
Business model innovation	7	0.934

According to the data in the table, the Cronbach's Alpha coefficients of the variables are 0.822, 0.830, 0.872, 0.917, 0.897, and 0.934, respectively. These coefficients are greater than 0.8, which indicates that the variables have a high reliability, i.e., the design of the questionnaire has a high reliability in these aspects. Based on the results of the reliability analysis of the pre-survey, we can confirm that the designed questionnaire has a high level of reliability and trustworthiness, which provides a solid foundation for the subsequent formal research.

(2) Validity Analysis

The validity analysis of the questionnaire began with a KMO and Bartlett's Sphericity test to determine the suitability for factor analysis. The results showed that the KMO value was 0.812, which is higher than the criterion of 0.7. Meanwhile, the value of Bartlett's Sphericity Test was 1615.098 with a p-value of 0.000, which is a significant result. This indicates that the overall questionnaire is suitable for factor analysis. Please refer to Table 2 for detailed data.

Table 2. Rotating load sum of squares

total	Percent variance	Accumulate to %
9.008	30.027	30.027
3.320	11.068	41.094
3.000	10.000	51.094
2.994	9.980	61.074
2.840	9.466	70.540
2.701	9.003	79.543

We conducted an exploratory factor analysis of the overall questionnaire using SPSS 25.0. Based on the results of the squared loadings after rotation, we found that all items could be extracted into six factors, with a cumulative loading of 79.543%, which exceeds the requirement of 70%. Therefore, we chose to retain all the items. Through these analyses, we validated the validity of the questionnaire. The KMO value and the result of Bartlett's test of sphericity indicated that the overall questionnaire

was suitable for factor analysis and could extract a reasonable number of factors. This indicates that the items we designed have a high level of validity in measuring the target variables.

4. Results and Discussion

4.1. Reliability Test

In the questionnaire design of this study, we judiciously incorporated mature scales that have been developed and used by scholars, and made appropriate modifications and adjustments based on the research focus. Cronbach's α coefficient is an important criterion for assessing the measurement reliability when evaluating the measurement reliability of the questionnaire. It has high confidence and reliability. When the influence of factors such as measurement methods and time on the observed values is relatively small, the α coefficient can provide reliable information about the reliability. This study used Cronbach's α coefficient to measure the reliability of the questionnaire. According to the views of scholars such as Nunnally (1978), when the α value falls within the range of 0 to 1 and exceeds 0.7, it can be considered that the questionnaire has good reliability. Through the analysis of the questionnaire data, we can calculate the Cronbach's α coefficient for each dependent variable. The specific numerical analysis results can help us evaluate the level of reliability and determine the reliability of the questionnaire. For each variable in this study, we will evaluate its reliability and determine whether it meets expectations based on the numerical value of the Cronbach's α coefficient.

4.2. Validity Check

Validity testing is an evaluation of the effectiveness of a questionnaire, which examines the accuracy and reasonability of the measurement indicators. In validity analysis, we can start from two aspects: content validity and construct validity. Firstly, content validity reflects the representativeness and applicability of the scale. The entrepreneurship learning scale, digital capability scale, and business model innovation scale in this study fully incorporate relevant research from scholars and the specific requirements of this study in the design process. Through pre-survey, the items were modified and adjusted to form a scale with good content validity. Secondly, construct validity evaluates whether the measurement indicators conform to the expected dimensional structure. We conducted principal component analysis on entrepreneurship learning, digital capability, and business model innovation. The specific results are as follows:

For the entrepreneurship learning scale, factor loadings were rotated using the maximum variance method for eight items, as shown in Table 3. The cumulative explained total variance is 67.955%. The factor loadings of exploratory learning and exploitative learning items in their respective dimensions are greater than 0.6, and no cross-loadings are observed, indicating that the measurement items for each dimension of entrepreneurship learning have good structural validity (Kerr,2010).

Table 3. exploratory factor analysis matrix for entrepreneurial learning

Item coding	Factor loading	
	Exploratory learning	Exploitative learning
EL1	0.856	
EL2	0.814	
EL3	0.756	
EL4	0.849	
AL1		0.829
AL2		0.737
AL3		0.676
AL4		0.808
Cumulative explanatory variance (%)	36.240	67.955

For the digital capability scale, factor loadings were rotated using the maximum variance method for 15 items, as shown in Table 4. The cumulative explained total variance is 69.346%. The factor loadings of digital sensing capability, digital operating capability, and digital resource coordination

capability items in their respective dimensions are also greater than 0.6, and no cross-loadings are observed, indicating that the measurement items for each dimension of digital capability have good structural validity.

Table 4. Exploratory factor analysis matrix for digitization capacity

Item coding	Factor loading		
	Digital awareness	Digital operation capability	Digital resource collaboration ability
DP1	0.753		
DP2	0.723		
DP3	0.807		
DP4	0.758		
DP5	0.803		
DO1		0.760	
DO2		0.766	
DO3		0.805	
DO4		0.684	
DO5		0.611	
DR1			0.805
DR2			0.789
DR3			0.729
DR4			0.792
DR5			0.829
Cumulative explanatory variance (%)	24.288	47.812	69.346

For the business model innovation scale, the component matrix shows the factor loadings for each dimension and its component matrix is shown in Table 5. The total cumulative explained variance is 60.426%, which is sufficient to explain most of the variance. The factor loadings of these dimensions are all greater than 0.7, indicating that they represent the information on the topic of the variable well, and therefore the Business Model Innovation Scale has good structural validity.

Table 5. exploratory factor analysis matrix for business model innovation

Item coding	Factor loading
BMI1	0.771
BMI2	0.803
BMI3	0.793
BMI4	0.707
BMI5	0.785
BMI6	0.733
BMI7	0.842
Cumulative explanatory variance (%)	60.426

The three control variables competitive openness, competitive uncertainty, and demand uncertainty were subjected to principal component analysis, respectively, and their component matrices are shown in Table 6.

Table 6. exploratory factor analysis matrix for control variables

Control variable	Item coding	Factor loading	Cumulative explanatory variance (%)
Openness to competition	CO1	0.873	71.192
	CO2	0.862	
	CO3	0.794	
Competitive uncertainty	CU1	0.797	69.827
	CU2	0.888	
	CU3	0.819	
Demand uncertainty Control variable	DU1	0.844	67.509
	DU2	0.820	
	DU3	0.800	

Openness to competition			
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In summary, through the validity test, we can conclude that the Entrepreneurial Learning Scale, Digital Competence Scale and Business Model Innovation Scale of this study perform well in terms of content and structural validity, and are able to accurately measure the relevant concepts and elements. This provides a reliable basis for subsequent data analysis and research interpretation.

4.3. Homologous method bias test

In this study, since the questionnaire data was collected through self-reporting, there may be an issue of common method bias (CMB). To detect CMB, we employed the widely recognized Harman's single-factor test. This method utilizes exploratory factor analysis (EFA) to assess the degree of bias present in the data. By performing an unrotated principal component analysis on all items using the EFA approach, we can determine the extent of bias by examining the amount of variance explained by a single factor. Following the criterion set by Tang and Wen (2020), we set a threshold of not exceeding 40% of variance contribution for a single factor in order to test CMB. In this study, we found that the first principal component extracted through factor analysis accounted for 35.791% of variance, meeting the set criterion. This indicates that this study has effectively controlled for common method bias and does not suffer from severe issues of multicollinearity. Therefore, based on the CMB test, we can conclude that this study has appropriately addressed common method bias in data analysis, ensuring the accuracy and reliability of the questionnaire data. This helps enhance the scientific rigor and credibility of the research and provides a solid foundation for explaining research findings.

4.4. Results of hypothesis testing

A total of 14 hypotheses were formulated in this study, including 4 main hypotheses and 10 sub-hypotheses. In order to verify these hypotheses, after analyzing the research data, the corresponding hypothesis tests were conducted. Table 7 shows the test results of all the research hypotheses:

Table 7: Results of hypothesis testing

Research hypothesis	Results
H1 There is a positive effect of entrepreneurial learning on business model innovation in Internet start-ups	Support
H1a Internet start-ups exploratory learning has a positive effect on business model innovation	Support
H1b There is a positive effect of utilized learning on business model innovation in Internet start-ups	Support
H2 Internet start-up entrepreneurial learning has a positive effect on digital competence	Support
H2a Internet start-up exploratory learning has a positive impact on digital competence	Support
H2b Internet start-ups exploitative learning has a positive impact on digital competence	Support
H3 Internet start-ups digital competence has a positive impact on business model innovation	Partial Support
H3a There is a positive effect of digital perceptual competence on business model innovation in Internet start-ups	Not Supported
H3b There is a positive impact of digital operation capability of Internet start-ups on business model innovation	Supported
H3c Digital resource synergy capability of Internet start-ups has a positive impact on business model innovation	Supported
H4 Entrepreneurial learning influences business model innovation of Internet start-ups through the mediating effect of digital competence	Partially Supported
H4a Digital perception capability plays a mediating role in entrepreneurial learning and business model innovation of Internet start-ups	Not Supported

H4b Digital operational capabilities play a mediating role in entrepreneurial learning and business model innovation of Internet start-ups	Supported
H4c Digital resource synergy capability plays a mediating role in entrepreneurial learning and business model innovation of Internet start-ups	Supported

Summarizing the above test results, the hypotheses proposed in this study are validated with the support of the research data. These results are important for understanding the development process of Internet start-ups and guiding their business model innovation. However, it should be noted that the hypothesis testing results of this study are only based on a specific sample and research methodology, so further validation and research are needed for wide application.

5. Conclusion

This paper focuses on entrepreneurship learning, digital operation management, and business model innovation in internet startups, exploring their relationships and influencing mechanisms. Through theoretical analysis and empirical research, the following conclusions have been drawn: Entrepreneurship learning has a positive impact on business model innovation in internet startups. Entrepreneurs, by acquiring knowledge and experience, can better capture market opportunities and create unique business models. Digital capability plays a crucial mediating role in the process of entrepreneurship learning. By providing digital technology support and resource integration capabilities, it facilitates the implementation of business model innovation. In conclusion, the research findings of this paper provide theoretical and empirical foundations for business model innovation in internet startups. They also offer valuable insights for promoting the development and innovation of the digital economy. It is hoped that these research outcomes can positively impact the management practices of relevant industries and companies.

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