Analysis of the Influence of Exploratory Learning on Business Model Innovation of Internet Start-ups Based on SPSS Statistical Method—Digitalization Capabilities as Intermediary

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Abstract

Under the background of digital entrepreneurship, it is an inevitable trend for new ventures to cultivate digital capabilities and innovate business models to achieve entrepreneurial success. Based on the dynamic ability theory, this paper combines the organizational learning theory with the dynamic ability theory, and studies the interaction between exploratory learning, digitalization capabilities and business model innovation of Internet new ventures from the perspective of dynamic evolution. Based on the effective questionnaire survey data of 134 Internet start-ups in the Yangtze River Delta, the hypothesis is empirically tested by using the hierarchical regression analysis method of SPSS 25.0. The results show that in the era of digital economy, exploratory learning can significantly improve the business model innovation of Internet start-ups, and digitalization capabilities play a mediating role. Inspired by the dynamic uncertainty of the digital environment in the face of the Covid-19, Internet entrepreneurial enterprises should have a certain spirit of adventure and continue to explore learning in the process of promoting the construction and training of digitalization capabilities.

Keywords-*exploratory learning；digitalization capabilities；business model innovation；Internet start-ups; SPSS statistical method*

1.Introduction

In the era of digital economy, the connotation and form of entrepreneurship have been changing rapidly. Internet start-ups based on digital entrepreneurship have sprung up[1]. Many Internet start-ups in China have reversed the existing market rules with new business models, realized the rapid appreciation of value, and showed the characteristics of high growth. Typically, Pinduoduo Inc. created a new business model of ' social + e-commerce ', reversed the traditional model, and quickly obtained a large number of customers without major technological innovation.

The business model innovation of Internet start-ups is a dynamic process of putting forward new value propositions and creating new value creation logic[2]. Among them, exploratory learning is an important promoter of business model innovation, especially for start-ups. Although existing studies have recognized the positive role of exploratory learning in business model innovation, there is still a lack of relevant research on mechanism, especially the path through which exploratory learning can achieve business model innovation. According to dynamic capabilities theory, new ventures can promote continuous product innovation and business model innovation through specific dynamic capabilities in a changing entrepreneurial environment[3]. As a specific dynamic capability of a new enterprise in the digital environment, digitalization capabilities can help Internet enterprises quickly respond to environmental changes and develop new products, creatively improve the management process, reconstruct the resource structure of enterprises, and thus promote innovation activities [4]. Therefore, we will study how to implement business model innovation for Internet start-ups in the digital context based on entrepreneurial learning theory and dynamic capability theory.

2. Theoretical basis and research hypothesis

2.1. Exploratory Learning and Business Model Innovation of Internet Start-ups

With the integration of entrepreneurial theory and organizational learning theory, ' entrepreneurial learning theory ' has gradually emerged. As one dimension of entrepreneurial learning, exploratory learning represents the exploration of new possibilities. Exploratory learning is a process in which entrepreneurs seek new alternatives to explore entrepreneurial possibilities and acquire new knowledge and skills. It shows the characteristics of ' search, change, innovation, experiment, discovery and flexibility '. From the perspective of value creation, business model innovation is the innovation process of creating new value and reshaping value creation, value transmission and existing market structure, which is based on the re-understanding and definition of customer value[5]. In today ' s digital economy era, external knowledge began to ' blowout ', exploratory learning has become an important means for Internet entrepreneurs to quickly grasp these knowledge resources. For Internet start-ups, in the face of this complex and volatile environment and the changing needs of consumers, enterprises cannot set up a plan in advance to ensure success. Therefore, it will be very necessary to continuously innovate their business models in the entrepreneurial process with the help of exploratory learning to help enterprises keep the market. An empirical study by Stefan[6], based on 36 start-ups in the Swedish mobile internet industry, found that experimental learning could help start-ups improve the viability of their business models. Chesbrough [7]also indicated When the business model of new ventures is impacted by the external environment, low-cost experimental learning will be conducted through rapid trial and error, so that new ventures can quickly carry out business model innovation. Therefore, in a complex and rapidly changing digital market, Internet start-ups can integrate information and innovate business models through exploratory learning to obtain competitive advantages[8]. Through exploratory learning to tap and search for potential consumer demand, expand the development and market of new products, bring new knowledge and new information for enterprises, including asymmetric information such as specific knowledge, identify new entrepreneurial opportunities, and help Internet start-ups to innovate business models. The research results of scholars and the reality of the development of Internet start-ups profoundly reveal that in today ' s era of information technology to promote the continuous improvement of big data value, Internet start-ups need to establish open sharing, encourage questioning and inclusive innovation of entrepreneurial learning culture, and innovate the development model of the digital new era. Only in this way can they maintain the keenness of innovation in the dynamic environment and realize the innovation of the various elements of the business model. Based on the above analysis, assumptions are proposed:

H1: Internet companies ' exploratory learning has a positive impact on business model innovation

2.2. Exploratory learning and digitalization capabilities

With the continuous development of digital economy, there are more and more researches on ' digital ', and the research on digitalization capabilities has gradually attracted the attention of scholars. In the field of management and entrepreneurship research, digitalization capabilities is the key factor for organizations to obtain sustainable competitive advantage in the digital age[9], which is extremely important for the survival and development of new ventures and the transformation and development of traditional enterprises[10][11][12].

Scholars have conducted preliminary studies on digitalization capabilities from the perspective of technology and dynamic capabilities. Westerman (2012) pointed out that digitalization capabilities are the basis of changing customer experience, optimizing business processes and updating business models, including technology development and data application capabilities. Khin and Ho (2019)[4] defined digitalization capabilities as a specific dynamic capability of new ventures in the digital environment, which is the ability to manage the skills and knowledge of digital technologies for new product development, including developed information management capabilities and flexible IT infrastructure. Zhou (2020) [13] combined with digitalization capabilities and dynamic capabilities, believes that digital dynamic capabilities are the ability of enterprises to perceive and identify opportunities through digital technology and big data-driven, integrate, establish and reorganize internal and external resources to seize opportunities, strengthen innovation and cooperation among all stakeholders to respond quickly to changing market needs, including digital organizational capabilities, digital operational capabilities and digital co-creation capabilities. Annarelli (2021) [14]constructed a model of digitization ability, which shows that a large number of studies regard digitalization capabilities as higher-order capabilities similar to dynamic capabilities and achieve competitive advantage by improving the ability to respond to changing environments in the digital age. On this basis, Yi (2021)[15]proposed that digitalization capabilities are a multi-dimensional and systematic ability including digital sensing capabilities, digital operational capabilities and digital resource synergy capabilities. In summary, scholars put forward different understandings of the connotation of digitalization capabilities according to their research purposes and perspectives. However, the existing literature generally believes that digitalization

capabilities is not only a kind of ability to apply digital technology, but also a dynamic ability of enterprises to combine and coordinate various factors (internal and external technology, resources, opportunities and capabilities) to adapt to the changes in the digital environment. Based on the three elements of entrepreneurship (resources, opportunities, teams) and the process mechanism of business model innovation from identifying opportunities, application opportunities to value creation and implementation, this paper recognizes Yi Jiabin 's (2021)[15] understanding of digitization ability.

The view that dynamic capabilities of enterprises are influenced by entrepreneurial learning is accepted by many scholars[16]. As a specific dynamic ability in digital situation, some scholars ' researches also support the effect of exploratory learning on digital ability. Wang(2018)[17] believe that Internet start-ups will realize the allocation of digital resources and problem solving through the dual entrepreneurial learning process, helping to improve the collaborative ability of digital resources. Others also found that exploratory learning can improve the opportunity recognition ability and business model innovation level of new ventures.

The application of digital technology has changed the way of exploratory learning, expanded the channels of learning, strengthened the ability of enterprises to form knowledge through data, promoted enterprises to insight into the frontier of technology, and made it possible for enterprises to achieve leapfrog development. A major feature of the digital economy era is the openness and sharing of knowledge. The rapid development of digital technology has broadened the sources of knowledge and information, accelerated the speed of information dissemination, and promoted the dissemination and diffusion of knowledge to a certain extent. The development of exploratory learning has increased the contact between Internet start-ups and the external environment, helping to identify the direction of digital technology change, clarify the target market and users 'digital needs, and then help start-ups identify digital opportunities. In addition, learning and applying new digital technologies (cloud computing, big data, etc.) is conducive for Internet enterprises to optimize business processes by digital means, bring new digital experience to users and provide targeted digital solutions. Specifically, in the external relationship network of Internet enterprises in the digital age, the interaction and communication between customers, suppliers and retailers are more frequent and rapid than ever , Exploratory learning can help more actively engage in external relationship interaction, help to obtain external digital resources, further integrate and collaborate internal and external complementary resources and competitive resources to break the data island, make Internet companies less detours, and enhance their digital

resource synergy capabilities. Based on the above analysis, this paper puts forward the hypothesis:

H2a: Internet companies ' exploratory learning has a positive impact on digital sensing capabilities

H2b: Internet companies ' exploratory learning has a positive impact on digital operating capabilities

H2c: Internet companies ' exploratory learning has a positive impact on digital resource synergy capabilities

2.3. Digitalization capabilities and business model innovation

Due to the short establishment time of Internet start-ups, lack of resources, poor anti-risk ability, imperfect organizational system and behavior norms, ability is particularly important for the survival and development of enterprises. Nambisan (2017)[18] pointed out that in the digital entrepreneurial environment, the success of digital product development and business model innovation depends highly on the digitalization capabilities of enterprises. Internet enterprises, born in the digital age, have certain digital thinking and ability at the beginning of their establishment. They are more inclined to use digital technology to develop new products, change customer experience, improve operational processes and optimize business models, so as to stimulate and realize the innovation of business models[4][19].

The existing literature on the relationship between digitalization capabilities and business model innovation believes that digitalization capabilities can provide new impetus and new path for business model innovation. Khin and Ho (2019)[4] studied 105 small and medium-sized Internet communication technology enterprises in Malaysia to explore the relationship between digitization ability, digital orientation, digital innovation and corporate performance. They found that digitalization capabilities can promote digital entrepreneurial activities of enterprises, and digitalization capabilities can also improve corporate performance. Eric and Richard (2019)[20] put forward the concept of digital technology capability, and believe that digital technology capability forms a digitalization capabilities system for enterprises to promote business model reconstruction and organizational innovation. Willemstein (2007) believed that the ability to identify opportunities in the digital environment in the context of the digital economy is one of the important capabilities of enterprises to promote business model innovation. René (2020)[21] studied the innovative solutions of the Internet of Things platform based on emerging digital technology capabilities. The results show that digitalization capabilities are an important link and converter for applying digital economy to organizational innovation. Through the full application of digital technology in the innovative solutions of the Internet of Things platform, the

digitalization capabilities system for enterprises to promote business model reconstruction and organizational innovation is formed. The formation of digitalization capabilities drives the innovation of organizations in business model elements such as value creation, value transmission and value acquisition. Yi (2021)[15] examined the mediating effect of digitalization capabilities in the mechanism of organizational inertia on business model innovation through an empirical study of 380 Internet enterprises.

In the digital economy environment, the cycle of technological change is shortened, and the digital technology drives the rapid iteration of business model, showing a rapidly changing and fleeting opportunity time window. Therefore, in the face of the uncertainty and complexity of the development of digital economy, Internet start-ups need to identify and perceive external needs in a timely manner through digital sensing capabilities, so that new products and new services that meet customer demand changes can be launched in a timely manner, which will require a matching business model and propose new ways of value orientation and value creation on this basis[15]. The new mode of collaborative symbiosis under the digital economy makes the boundary of the enterprise gradually blurred. Anyone can be a potential customer or a creator of enterprise value. Through the collaborative ability of digital resources, Internet entrepreneurial enterprises are conducive to the formation of ' cross-domain ' and ' multi-perspective ' target user groups and the supply mechanism of innovative products and services that are jointly involved, designed and used, and ultimately realize the innovation of business model. For example, ' Today ' s Headlines ' itself does not produce content, but encourages and cultivates a large number of We-Media users through the ' creator plan ', launches the creation in many fields such as military and entertainment, and recommends to users through the big data algorithm and artificial intelligence of Today ' s Headlines, thus forming a new value co-creation model that users are both consumers and creators. Therefore, based on the boundaryless and value co-creation requirements of the digital economy, Internet enterprises need to form a user-centered value network and activity mode in the digital age with users, partners, governments and employees, and constantly expand the scope and extent of value creation and transmission, so as to promote the dynamic innovation of business models. Therefore, the following hypothesis is proposed:

H3a: Digital sensing capabilities of Internet Enterprises have a positive impact on business model innovation

H3b: Digital operational capabilities of Internet Enterprises have a positive impact on business model innovation

H3c: Digital resource synergy capabilities of Internet Enterprises have a positive impact on business model innovation

2.4. Mediating role of digitalization capabilities

Digitalization capabilities is an inevitable choice to adapt to the tide of digital economy, and it is also the key to the depth of business model innovation of Internet entrepreneurial enterprises. Digitalization capabilities with environmental perception, operational realization and collaborative innovation is a new engine for Internet enterprises to improve value ecosystem and business model innovation[15]. However, this process is also inseparable from the support of the organizational level. In the face of highly uncertain innovation risk, digital ability-led business model innovation, Internet companies should actively carry out exploratory learning activities as a resource guarantee for capacity upgrading and innovation activities, and ultimately promote the sustainable innovation and development of business models by improving digitization ability.

On the one hand, the exploratory learning activities of Internet enterprises based on the early stage of entrepreneurship are the basis of enterprise digitalization capabilities construction, which provides knowledge accumulation and experience support for the improvement of enterprise digital ability. According to the dynamic capability theory, when the imbalance between the innovative development needs of Internet enterprises and the existing resources and capabilities is insufficient, limited knowledge will enable enterprises to reflect more actively on the opportunities and threats between the current business and the innovative business, and then drive the willingness and behavior of building digitization ability. On the other hand, the improvement of the digitalization capabilities of Internet entrepreneurial enterprises helps enterprises to use digital sensing capabilities to find business model innovation opportunities contained in the digital economy, combine digital technology with consumer demand closely, and innovate value proposition and positioning. At the same time, the digital operational capabilities are applied to form a digital solution that drives value creation and transmission. In this process, the collaborative ability of digital resources is fully utilized. Through the coordination and integration of internal and external resources, the value co-creation mechanism based on open cooperation between enterprises, customers, partners and other stakeholders is realized, and the overall innovation of business model is finally realized. Thus, this study proposes the following assumptions:

H4: exploratory learning of Internet start-ups affects business model innovation through the mediating effect of digitalization capabilities

To sum up, the mechanism of action between exploratory learning and business model innovation of Internet start-ups is basically determined, in which digitalization capabilities is the mediating variable. The research framework of this paper is shown in Figure 1.
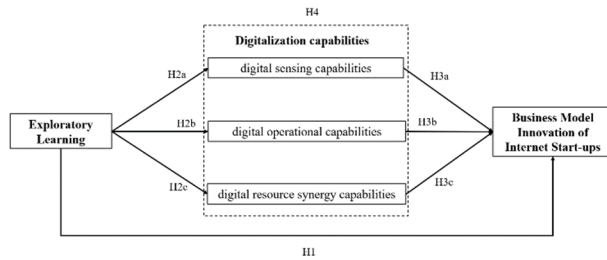

Figure 1 Theoretical framework of this research

3.Research design

3.1. Sample and data

Affected by the local epidemic, this study mainly collects data from respondents by sending WeChat links and filling out questionnaires. In order to ensure that the Internet start-ups surveyed have the experience of applying digital technology to promote digital capacity building and business model innovation, this paper sets up a question to measure whether Internet start-ups use digital technology to promote business model innovation. A total of 200 questionnaires were distributed in this study, and 134 valid questionnaires were obtained after filtering and screening of the recovered samples, with an effective recovery rate of 67 %. The personnel of the surveyed enterprises are mainly concentrated in the Yangtze River Delta region of China with relatively developed Internet economy.

3.2. Variable measurement

There are 27 items in the questionnaire of business model innovation of Internet start-ups, including exploratory learning, digitalization capabilities and business model innovation. The questionnaire adopts Likert5 scale, and the respondents choose to score from 1 to 5 according to the actual situation. Among them, 1 indicates very disagree, and 5 indicates very agree. The settings of various items are based on literature research and pre-analysis data, and are modified and improved. The Exploratory Learning Scale adopts the Chinese Enterprise Entrepreneurial Learning Scale with reference to Politis (2005), Jiang Chunyan (2006) and Chen Wenting (2010), including five items. According to the research of Yi (2021), the digitalization capabilities is divided into three dimensions: digital sensing capabilities, digital operational capabilities and d digital resource synergy capabilities. Each dimension contains five items, a total of 15 items. In addition, based on the research results of Zott and Amit (2007), this paper measures the business model innovation of Internet enterprises from

the aspects of value proposition, value creation and transmission, and value acquisition, with a total of seven measurement items. In terms of control variables, it is considered that enterprise age and enterprise scale are the influencing factors of business model innovation behavior of Internet start-ups, as variables to control organizational context, in order to obtain stable research conclusions.

3.3. Reliability and validity analysis

This study used SPSS25.0 software for reliability and validity measurement. In this paper, Cronbach 's α coefficient test is used to test the reliability of each scale. As table 1 shows, the α values of each variable and its dimensions are greater than 0.8, indicating that the stability and internal consistency of the scale are good. In terms of validity, many scholars have tested the content validity of the scale many times, so the measurement scales used in this paper are relatively mature, so the content validity of this study is better. In view of the structural validity, this paper uses factor analysis method to test. Through the calculation of SPSS25.0 data analysis software, the KMO values of exploratory learning, digitalization capabilities and business model innovation are 0.890, 0.878 and 0.909, respectively, which are greater than 0.85. The Bartlett spherical test sig values of the three variables were all equal to 0.000, indicating that they all reached the level of saliency. Therefore, the sample data is suitable for factor analysis, and the items measured by each variable have common factors and can be extracted. In this paper, the principal component method is used to set the eigenvalue range of the extracted factor to be greater than 1 to extract the common factor of the pre-test data variables, and the factor is rotated orthogonally by the maximum variance method. Then, by observing the factor loading matrix after rotation, the number of common factors extracted from each scale is consistent with the division of each variable dimension in this study. Accordingly, the construct validity of each scale is also good. The specific values of reliability and validity test are shown in table 1.

Table 1 Reliability and validity test results

Construct	Cronbach'sα	Sig value	KMO value
EL	0.821	0.000	0.890
DSC	0.886		
DOC	0.824	0.000	0.878
DRSC	0.821		
BMI	0.835	0.000	0.909

4.Empirical Analysis

4.1. Main effect test

In this study, the hierarchical regression analysis

method is used to test the research hypotheses, and the regression model shown in Table 2 is obtained. The specific analysis is as follows: Model 1 is the regression model of control variables on business model innovation, and Model 2 is the regression model of exploratory learning on business model innovation. The results show that the regression coefficient of exploratory learning on business model innovation is 0.401 (p <0.01). It can be concluded that exploratory learning behavior of Internet start-ups has a positive impact on business model innovation, assuming that H1 is verified.

Model 3 is a regression model of three dimensions of control variables and digitalization capabilities to business model innovation. The results show that digital sensing capabilities (β= 0.462, p<0.001), digital operational capabilities (β= 0.280, p<0.01) and digital resource synergy ability (β= 0.450, p<0.001) are significantly and positively correlated with business model innovation, assuming that H3a, H3b and H3c are valid. Model 5, Model 6 and Model 7 are the regression models of exploratory learning on the three dimensions of digital ability. Among them, exploratory learning is significantly positively correlated with digital sensing capabilities (β= 0.426, p<0.01), digital operational capabilities (β= 0.162, p<0.05) and digital resource synergy ability (β=0.314, p<0.05), indicating that exploratory learning and digitalization capabilities of Internet start-ups are positively correlated, and H2a, H2b and H2c are assumed to be valid.

4.2. Mediation effect test

Model 4 is the regression model of control variables, exploratory learning and digitalization capabilities to business model innovation, which is used to test the mediating effect of digital ability. Compared with model 2, after adding intermediary variables, digital sensing capabilities (β= 0.350, p<0.05), digital operational capabilities (β= 0.213, p<0.05) and digital resource synergy ability (β=0.368, p <0.05) all significantly and positively affect business model innovation, exploratory learning still significantly and positively affect business model innovation (β=0.249, p<0.05), but the coefficient and visibility are weakened, which shows that digitalization capabilities plays a partial intermediary role in the relationship between exploratory learning and business model innovation. To sum up, the three links of digital ability, namely digital sensing capabilities, digital operational capabilities and digital resource synergy capabilities, have partial mediating effect between exploratory learning and Internet start-ups. Therefore, according to the above analysis, it can be concluded that Hypothesis H4 holds.

5.Conclusions

5.1. Research conclusions

At present, there are many studies on the relationship between exploratory learning and business model innovation in the field of entrepreneurship, but there are few empirical studies on the introduction of digitalization capabilities variables based on the digital age, and few studies on Internet start-ups. From the perspective of entrepreneurial learning theory, this study discusses the relationship between exploratory learning and business model innovation of Internet start-ups. Based on the dynamic capability theory, this paper analyzes the mediating role of digitalization capabilities from the perspective of dynamic evolution. Through the empirical test of the mechanism model of "exploratory learning → digitization ability→ business model innovation of Internet start-ups" this study draws the following three conclusions. First, for Internet start-ups, exploratory learning has a positive and significant indigenous impact on their own digitalization capabilities and business model innovation in the early stage of entrepreneurship. Therefore, in the process of building and cultivating digitalization capabilities and business models, Internet start-ups should pay attention to the positive role of exploratory learning, cultivate the Internet spirit of enterprises, and be brave in exploration and innovation. Second, digitalization capabilities have a significant positive impact on business model innovation of Internet start-ups. It shows that in the digital economic environment, Internet start-ups need to fully construct, cultivate and utilize digital sensing capabilities, digital operational capabilities and digital resource synergy ability to perceive and cleverly use digital technology, construct digital solutions and integrate collaborative digital resources to drive the sustainable development of business model innovation. Third, digitalization capabilities have mediating effect on the relationship between exploratory learning and business model innovation of Internet start-ups. This conclusion shows that, on the one hand, the knowledge of digital environment cognition, digital opportunity grasp and structural innovation precipitated by Internet start-ups based on exploratory learning is the foundation of organizational digital capacity building. On the other hand, the improvement of the digitalization capabilities of Internet enterprises helps to realize the value co-creation mechanism and finally realize the overall innovation of the business model.

5.2. Research significance

From the perspective of academic research, this study enriches the empirical research on business model innovation in the digital context. Although business model innovation is crucial for new ventures, the current academic research on business model innovation is more

targeted at incumbent enterprises or industry leaders. The research on business model innovation of Internet new ventures born in the digital age is relatively lacking. In addition, there is no sufficient discussion and answer on how digitalization capabilities affect corporate innovation activities in the digital environment and entrepreneurial scenarios. The research on digitalization capabilities is still in the basic theory research stage, lacking empirical research to verify the theory. Therefore, on the basis of combing the relevant research on digitization ability, this study explores how Internet start-ups apply digitalization capabilities to promote business model innovation from a strategic and dynamic perspective.

From a practical point of view, in the face of the dynamic uncertainty of the digital environment, Internet entrepreneurial enterprises should have a certain spirit of adventure and continue to explore learning in the process of promoting the construction and training of digitization ability. In addition, in the process of promoting business model innovation in the digital economy environment, Internet enterprises should actively empower digital sensing capabilities, digital operational capabilities and digital resource coordination ability through exploratory learning knowledge, experience and information. On this basis, based on the improvement of digitalization capabilities to promote the degree of business model innovation of Internet entrepreneurial enterprises. This is also in the context of the vigorous development of digital economy, Internet companies through digitalization capabilities to drive business model innovation to adapt to an open, dynamic, multi-dimensional digital economic environment and build a dynamic competitive advantage of the inevitable way.

5.3. Research limitations

First, this paper studies the cross-sectional data, and the sample size is relatively small, there are some defects in the support of causality. If longitudinal large sample data can be obtained, it can provide stronger empirical support for the relationship between exploratory learning, digitalization capabilities and business model innovation of Internet start-ups ; second, this paper only focuses on the enterprise level factors such as exploratory learning, digitalization capabilities and business model innovation, without examining the impact of external environmental dynamic factors such as market volatility, competition intensity and technological change. Therefore, alternative explanations cannot be completely excluded for the determinants affecting business model innovation.

Acknowledgment

Table 2 Regression Model and Results

Variable	Business model innovation				Digitalization capabilities		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Controls							
Enterprise scale	0.375**	0.220	0.185	0.125	0.162	0.291*	0.063
Enterprise age	0.166	0.141	0.014	0.028	0.193	0.263	0.179
Independent variable							
Explorative learning		0.401**		0.249*	0.426**	0.162*	0.314*
Mediator							
Digital sensing capabilities			0.462***	0.350*			
Digital operational capabilities			0.280**	0.213*			
Digital resource synergy capabilities			0.450***	0.368*			
R²	0.216	0.349	0.420	0.464	0.361	0.296	0.184
Adjust R²	0.187	0.312	0.387	0.422	0.324	0.256	0.136
F value	7.310**	9.300***	12.560***	11.057***	9.781***	7.304***	3.896**

Note: *p<0.05, **p<0.01, ***<0.001.

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