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Effects of big data analytics capability on performance of internet enterprises: chain mediating effects of strategic flexibility and strategic innovation

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Abstract: The recent interest in big data has led many companies to develop big data analytics capability (BDAC) in order to enhance Firm Performance (FP). However, BDAC pays off for some companies but not for others. It appears that very few have achieved a big impact through big data. To address this challenge, this study proposes a BDAC model drawing on the resource-based theory and the dynamic capability theory. In order to carry out the research, this paper takes Chinese internet enterprises as the research object and obtains survey data from 629 employees through questionnaires. Through the test of the proposed chain mediation model using the bootstrap method, it is found that: (1) big data analytics capability has significant positive influences on firm performance of internet enterprises; (2) strategic flexibility and strategic innovation play chain mediating roles on the path joining big data analytics capability and firm performance.

Keywords: big data analytics capability; firm performance; internet enterprises; strategic flexibility; strategic innovation; chain mediating effects.

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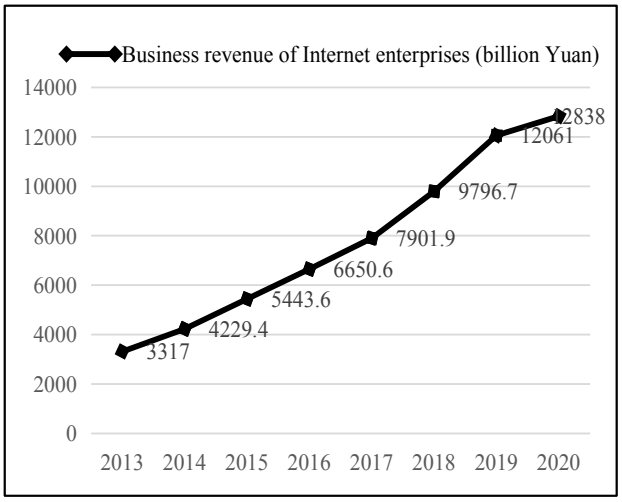
1 Introduction

Firms are increasingly challenged by 'Big Data', which has emerged as an exciting frontier of productivity and opportunity in the last few years. Internet enterprises are the producers, the processors and also the users of big data. Driven by big data context, their strategic logic, business model, organisational structure and network partnership have undergone significant changes. According to the latest announcement by the Ministry of Industry and Information Technology of China, with the development of 5G, cloud computing, artificial intelligence and other technologies, Internet Companies above designated size[1] in China, have achieved a steady increase in business revenue year by year from 2013 (the birth year of big data) to 2020 (see Figure 1). Especially at the end of 2019, the COVID-19 epidemic had a huge impact on almost all industries. However, internet enterprises have bucked the trend and achieved economic growth. In 2020, their business revenue reached 12,838 billion yuan, increased by 12.5% year on year, and their operating profit reached 1187 billion yuan, increased by 13.2% year on year. This situation triggers the thinking of this paper whether the steady rise of internet enterprise performance since 2013 is closely related to the development of big data analytics capability, and what is the relationship between big data analytics capability and internet enterprise performance?

Figure 1 Business revenue growth of internet enterprises from 2013 to 2020



In previous studies, scholars widely believed that big data analytics capabilities had a positive impact on firm performance and meanwhile they researched the mediation paths and mediation variables based on different research perspectives. First, some mediation paths were analysed based on the dynamic capability perspective by the researchers. Wamba et al. (2017) verified that big data analytics capability would positively influence firm performance and process-oriented dynamic capability played a mediating role. Mikalef et al. (2020) believed that big data analytics capability could enhance the firm's competitive performance and marketing and technological capability and operational capability played mediating roles. Rialti et al. (2019) verified that big data analytics capability positively influenced firm performance and dual innovation and organisational flexibility played a chain mediating role. Second, the mediation paths were analysed based on stakeholder's perspective by the scholars. Raguseo and Vitari (2018) identified that big data analytics capability could enhance firm performance and consumer satisfaction played a mediating role. Suoniemi et al. (2020) verified that big data analytics capability improved firm performance through the mediating path of market-oriented capability. Third, the mediation paths were analysed from the supply chain perspective. Zhu (2021) verified that big data analytics capability could positively influence supply chain performance and supply chain collaboration played a mediating role. Zhang and Lv (2021) verified that big data analytics capability positively influenced the performance of government intelligence services and supply chain integration played a mediating role in it. Finally, the mediation paths were analysed based on the organisational learning perspective. Ferraris et al. (2019) verified that big data analytics capability had a positive impact on firm performance and knowledge dissemination and knowledge response played mediating roles. Zhang et al. (2019) identified that big data analytics capability had a significant positive impact on firm performance with organisational learning playing a partially mediating role. In the previous studies, seldom scholars research the mediating paths from the strategic management perspective. Different from these researches, this paper discusses the chain mediating role of strategic flexibility and strategic innovation base on the strategic perspective to fill in the gaps of the existing research.

2 Theoretical background

2.1 The main concepts

Undoubtedly, modern process engineering industry offers great opportunities for harvesting tremendous amounts of data, both structured and unstructured (Maksimov and Koiranen, 2020). Big data analytics capability is becoming more and more significant with the integration of global economy and the increasingly fierce market competition. In general, there are two main theoretical foundations on the study of big data analytics capability: resource-based theory and dynamic capability theory. According to the theories, Xie et al. (2016) proposed that big data analytics capability is the ability of an enterprise to effectively integrate internal and external big data resources, and to predict and adapt to changes in the external environment through in-depth analysis of big data resources. Big data analytics capability is composed of three-tier factors: resource integration capability, in-depth analysis capability and real-time insight and prediction capability. Resource integration capability is the ability of enterprises to continuously acquire and integrate internal and external data resources and non-data resources. In-depth analysis capability refers to the ability of enterprises to conduct deep mining and analysis based on massive data and continuously obtain new insight. Real-time insight and prediction capability can help the enterprises predict the changes of market environment in real time after dealing with massive data.

Meanwhile, an increasing number of relevant studies show that strategic flexibility and strategic innovation are the keys to the success of enterprises in the 21st century and the source of competitive advantage. On one hand, strategic flexibility refers to the ability of an organisation to constantly interact with the external environment and continuously make internal adjustments through rapidly investing and effectively using resources in order to achieve organisational goals (Sanchez, 1997). Sanchez's research has made a great contribution and was highly recognised to the development of strategic flexibility. He believed that strategic flexibility organisations could use and quickly adjust internal resources to identify the external environment, and divided strategic flexibility into resource flexibility and coordination flexibility. On other hand, strategic innovation is often accompanied by the establishment of a new business model, redefinition of the existing customer market, improvement of the existing business processes and strategic adaptation to external reforms (Han and Gao, 2017).

2.2 Resource-based theory

Resource-based theory is the basic theory and dominant paradigm in the field of strategic management research, which is mainly applied to analyse the differences in enterprise performance caused by resource heterogeneity. At the beginning of the theory research, different scholars studied resources from different perspectives, which promoted and enriched the resource-based theory. Wernerfelt (1984) was the first to combine product market position competition with resource position competition. Rumelt (1982) proposed that resources are homogenous in enterprises at the initial stage, but with the development of enterprises, resources and characteristics of enterprises are integrated, thus forming heterogeneity. Barney (1991) believed that only when enterprise resources are Valuable, Rare, Imperfectly imitable and Non-substitutable (VRIN), can they help enterprises gain long-term competitive advantages. Helfat and Peteraf (2003) emphasised that the more resources the enterprise has, the better it is. However, his opinion ignored the impact of resources on performance differences. On the whole, scholars have demonstrated that firms with VRIN-characterised resources can gain sustained competitive advantages through implementing valuable strategies that are difficult for competitors to emulate.

2.3 Dynamic capability theory

With the development of resource-based theory, some scholars have questioned its viewpoints, believing that resource-based theory confuses resources and capabilities, and its viewpoints mainly focus on the static resources of enterprises while neglecting the dynamic environment. Teece and Pisano (1994) first proposed Dynamic Capability Theory, which is considered to be an extension of resource-based theory. This theory fully considers the dynamic environment in which the enterprise is located, and emphasises that the enterprises need to constantly build, reshape, configure and reconfigure all the internal and external technologies, resources and other capabilities in order to obtain sustainable competitive advantages.

With the deepening of the research, many researchers have supplemented and enriched the dynamic capability theory. Relevant researches are mainly based on two perspectives: capability perspective and process perspective. From the perspective of capability, Teece et al. (1997) proposed that dynamic capability is the ability of enterprises to establish, adjust, reconstruct and integrate internal and external resources, enabling enterprises to quickly respond to environmental changes. Winter (2003) believed that it is the higher-order ability from the expanding, changing and creating of the conventional lower-order ability. Zahra et al. (2006) put forwarded that it is the ability of enterprise managers to allocate resources in a predetermined way with a purpose. From the perspective of process, researchers believed that dynamic capability is not a simple capability, but a specific and identifiable strategic or organisational process. Eisenhardt and Martin (2002) proposed that dynamic capability is a process in which an enterprise acquires, integrates, restructures and releases resources to cope with market changes. Zollo and Winter (2002) believed that dynamic capability is a stable operation mode acquired by enterprises through learning, thus enabling enterprises to achieve higher efficiency.

3 Research hypotheses

3.1 Big data analytics capability and internet enterprise performance

According to the resource-based theory, big data analytics capability refers to the collection, integration and utilisation of big data specific resources by enterprises, including big data tangible resources, human resources and intangible resources. Big data analytics capability can be seen as the ability of enterprises to utilise its resource in this situation (Gupta and George, 2016). The utilisation of information system resources can effectively promote enterprise performance, which is particularly evident in internet enterprises because they are 'collectors' of information system resources. This can be embodied in the following aspects: Firstly, the development of big data capacity strengthening the information system resource sharing and liquidity (Wei et al., 2021), can alleviate the internet enterprise resource constraints, contribute to the formation of the internet enterprise resource advantages, and sustainably promote their enterprise performance (Liu et al., 2018); Secondly, the development of big data analytics capability strengthens the availability and self-growth of information system resources (Chen et al., 2020b). Internet enterprises collect scattered information into their digital terminals, which become heterogeneous resources of enterprises. In addition, the performance of internet enterprises can be improved by further enabling and upgrading and developing into information system capability, information system quality and business processing performance (Gu and Jung, 2013).

Based on dynamic capability theory, big data analytics capability is an enterprise's ability which can integrate internal and external big data resources, predict and adapt to external environment changes based on in-depth analysis (Xie et al., 2016). The most important role of big data analytics capability is to do analysis and prediction in this situation, which can help the enterprises to improve their corporate performance comprehensively. Internet-oriented Enterprises are especially obvious because they are 'processors' of data. To be specific: First, big data analytics capability provides analytical methods and tools for internet enterprises, which build detailed consumer behaviour portraits (Liu et al., 2020) and accumulate dynamic big data such as user characteristics, consumption preferences, transaction records, and consumption evaluations (Chen et al., 2020a) to obtain valuable information and insights to meet the broad needs of their consumers, enhance the market share and sales volume of their products and services and ultimately improve the performance of internet enterprises. Second, the development of big data analytics capability enables many consumers to

participate in the research and development and production of internet products and services in a digitised way, which shortens the research and development and production time of internet enterprises' products and services, reduces the costs of research and development and production, thus improving enterprise performance (Tan and Zhan, 2017).

As to strategic decision-making, big data analytics capability is a highly integrated form of modern IT technology and enterprise management decision-making, it is also an important product of IT technology applied to enterprise decision-making process (Mcafee and Brynjolfsson, 2012). The effectiveness of strategic decision can promote the development of enterprise performance, especially for internet enterprises because they are very relied on databases. When making decisions, traditional enterprises mainly take financial statements and other officially released content as references, which usually leads to failure of decision-making because it is difficult to obtain comprehensive information. With the development of big data analytics capability, statistical yearbook, research report, news media, social network and other unofficial data provide favourable references for internet enterprises to make better decisions, which can greatly increase decision-making (Davenport and Patil, 2012), thus effectively promote the quality and efficiency of their strategic decisions. Ultimately, it surely will improve strategic decision-making performance (Ghasemaghaei et al., 2017).

Therefore, the following hypotheses are proposed in this paper:

H1: Big data analytics capability has a positive impact on the performance of internet enterprises.

3.2 The mediating role of strategic flexibility

Based on the resource-based theory, big data analytics capability strengthens the sharing and mobility of the information system resources of internet enterprises, alleviates the limitation of the scope of resource use and expands the potential use of the resources of internet enterprises. The expansion of resource use controls the cost of resource conversion and resource sharing, and improves the performance of internet enterprises. At the same time, the development of big data analytics capability makes the communication and coordination within internet enterprises no longer rely on formal and informal online and offline interaction, but turn to the common knowledge base and modular task architecture brought by virtual communication, which could bring out a better communication environment and promote the coordination in the process of resource consumption. Coordination in the process of resource consumption promotes the efficiency of resource conversion and resource sharing, and the improvement of efficiency. Above all, based on the resource-based theory, big data analytics capability can improve the performance of internet enterprises through strategic flexibility.

Based on dynamic capability theory, one of the most important roles of big data analytics capability is prediction. The ability to predict enables Internet Companies to efficiently anticipate environmental changes and then adopt 'pre-emptive' structural changes; and 'pre-emptive' structural changes can help The 'pre-emptive' structural changes can help Internet Companies effectively avoid potential risks and fundamentally drive their performance. In addition, another important role of big data analytics capability is analysis, which enables Internet Companies to grasp the dynamics of consumer market changes in real time and comprehensively, and then adopt 'improvised' structural adjustments; and 'improvised' structural adjustments can help Internet Companies grasp market opportunities and drive their performance. The 'improvised' structural adjustment can help Internet Companies grasp market opportunities, occupy the consumer market earlier than their competitors, increase the market share of products and services, and promote the development of Internet Companies' performance. Therefore, based on the dynamic capability theory, big data analytics capability can improve the performance of Internet Companies through strategic flexibility.

Based on the research perspective of strategic decision-making, big data analytics capability is an important product of IT capability development, which can enhance the speed of information flow and knowledge flow of internet enterprises, improve the flexibility of strategic decision-making and the quality of strategic decision-making of internet enterprises and promote the realisation of their strategic flexibility; flexible and resilient capability driven by the speed and quality of strategic decision-making can promote the value creation and growth of internet enterprises in their life cycle as a whole. Growth is the key to sustainable performance advantage for Internet companies. Therefore, based on the strategic decision-making perspective, big data analytics capability can drive the performance of internet enterprises through strategic flexibility.

To sum up, this paper proposes the following hypotheses:

H2: Strategic flexibility plays a mediating role in the improvement of internet enterprise performance by big data analytics capability.

3.3 Mediating effects of strategic innovation

According to the resource-based theory, strategic innovation emphasises the innovation of enterprise resource allocation mode. With the development of large data capacity, Internet Companies find a large amount of data resources in many ways, the influx of new data resources has made the original resource allocation pattern in broken and reconstituted, presents the all-round innovation. Thus, the matured data analysis tools and the enhanced data resource utilisation also boosted the internet enterprise resource allocation model of innovation. Furthermore, the benefits of resource allocation mode innovation for internet enterprises far exceed the loss of operational efficiency caused by resource reorganisation, which reduces the risk of operation failure of internet enterprises, helps them to establish their competitive advantage and promote their sustainable development of enterprise performance.

Based on dynamic capability theory, strategic innovation is an ability to create new value for consumers and enhance competitiveness. Large data capacity which promotes digital simulation, virtual reality and augmented reality technology, the Internet companies can design the best performance for consumer products by simulating the product design process. At the same time, the internet enterprise forms a network and dynamic ecosystem to provide integrated services for consumers by correlating products and services. Further, high-performance products and integrated services to internet enterprise constantly create new value for consumers, and consumers new value creation, to help enterprises to seek new market opportunities, the Internet creatively to reshape the market, improve market share, increasing the number of selling products and services, etc., in the end promotes the development of enterprise performance.

From the perspective of strategic decision, business model innovation is an important component of enterprise strategic innovation. The development of big data analytics capability has effectively promoted the innovation of business models of internet enterprises. Internet enterprises have realised the innovation of business models by opening up new payment channels, seeking new communication channels, launching differential pricing strategies, implementing bundled recommendation strategies, and promoting novel recommendation strategies. This series of business model innovation can help internet enterprises form imitation barriers, increase profit returns, provide consumers with quality value experience, and ultimately promote the performance development of internet enterprises.

To sum up, this paper makes the following assumptions:

H3: Strategic innovation plays a mediating role in the improvement of internet enterprise performance by big data analytics capability.

3.4 The chain mediating effect of strategic flexibility and strategic innovation

From the perspective of enterprise resources, big data analytics capability collects, analyses and utilises data resources, expands the coordination ability of resource application and use of Internet firms, and then promotes the innovation of resource allocation mode of internet enterprises, and finally creates resource advantages for internet enterprises. Tracing the chain relationship of 'big data analytics capability→strategic flexibility→strategic innovation→enterprise performance', we can find that it follows the resource evolution trend of 'resource collection→resource sharing and transformation→resource allocation mode innovation→resource advantage'. From the perspective of resource evolution, big data analytics capability can improve enterprise performance through strategic flexibility and strategic innovation.

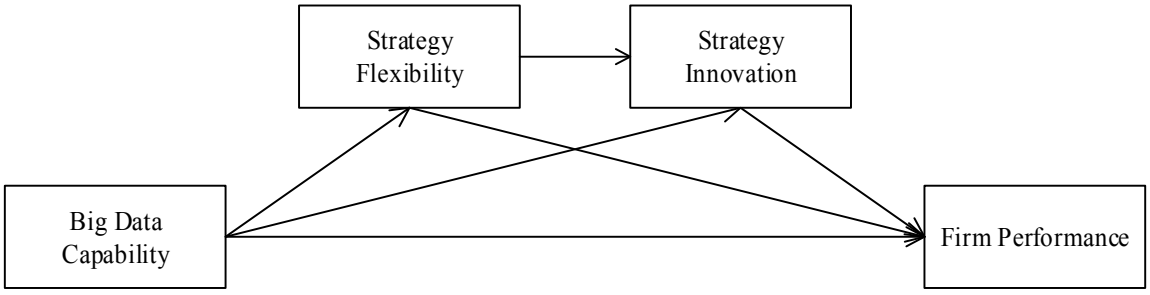
From the perspective of dynamic capability, the biggest role of big data analytics capability is to predict and analyse the external environment, enhance the adaptability of Internet firms to environmental changes, then promote the creative ability of internet enterprises to break the convention and bring forth the new, finally establish capability advantages for internet enterprises. It also traces the chain relationship of 'big data analytics capability→strategic flexibility→strategic innovation→internet enterprise performance' and finds that it follows the capability evolution trend of 'analytical capability→strain capability→creative capability→capability advantage'. According to the law of capacity development, big data analytics capability can improve enterprise performance through strategic flexibility and strategic innovation successively.

Based on enterprise strategy, big data capacity can help Internet companies which are relying on searching record, browsing record, page retention time, transaction record, purchasing evaluation data such as consumer's latest information, the internet enterprise strategic adjustment in real-time according to the changes of consumer's demand, promote the bundling recommendation, novel and recommend business model or the innovation of the strategic orientation, and build competitive advantages that are difficult for industry rivals to put into effect. Nowadays, the relationship of 'big data analytics capability→strategic flexibility→strategic innovation→internet enterprise performance' satisfies the strategic evolution trend of 'analysing demand→adapting to demand→creating demand→competitive advantage'. From the perspective of enterprise strategy, big data analytics capability can improve enterprise performance by better strategic flexibility and strategic innovation in an effective way.

To sum up, this paper proposes the following hypotheses:

H4: Strategic flexibility and strategic innovation play a chain mediating role between big data analytics capability and internet enterprise performance.

Figure 2 The theoretical model



4 Research methods

4.1 Data collection

The main data acquisition method in this study is questionnaire. In order to ensure the accuracy and reliability of the information, the research is mainly conducted by the alumni association of the Business School of Liaoning University in China. Respondents in the survey rated the items on a 5-point Likert scale ranging from 1=strongly disagree to 5=strongly agree. In this survey, 1000 questionnaires of Internet companies in China were distributed and 629 questionnaires were recovered, with an effective recovery rate of 62.9%. The sample enterprises investigated have the following characteristics (see Table 1).

Table 1 Descriptive statistics of the sample and respondents

Control variable	*Classification*	*Quantity*	*Percentage (%)*
Enterprise positions	Staffs	283	45.0
	Managers in mid-level positions	220	35.0
	Senior managers	126	20.0
Enterprise types	Network access and device	31	4.9
	Content and information service	157	25.0
	E-commerce transaction	126	20.0
	Communication and entertainment service	315	50.1
Enterprise age	<5 years	189	30.0
	5-10 years	220	35.0
	>10 years	220	35.0
Enterprise scale	Micro-enterprises (<10 people)	31	4.9
	Small enterprises (10–100 people)	189	30.0
	Medium-sized enterprises (101–300 people)	220	35.0
	Large enterprise (>300people)	189	30.0
Total		629	100.0

In terms of the positions in the companies, staffs account for the largest proportion among the respondents, accounting for 283 (about 45% of the total sample). Managers in the mid-level positions accounted for 220 (35%) and senior managers accounted for 126 (20%). In terms of Enterprise types, there are 31 (4.9%) enterprises providing network access and service devices, 157 (25%) enterprises providing content and information service, 126 (20%) enterprises providing E-commerce transaction service and 315 (50.1) enterprises providing communication and entertainment service. In terms of the Enterprise age, 189 enterprises (30%) were founded under 5 years. 220 enterprises (35%) and 220 enterprises (35%) were founded in 5–10 years and more than 10 years respectively. In terms of the enterprise scale, the number of micro and small enterprises with no more than 100 employees is 220 (35%). 220 enterprises are medium-sized enterprises with 101–300 employees (35%), and 189 enterprises are large enterprises with more than 300 employees (30%). On the whole, the surveyed enterprises basically cover different enterprise characteristics, and the samples are fairly representative.

4.2 Scale development

In order to ensure the validity and reliability of the measurement scale, the items used in this paper are all from the relatively mature measurement items in the existing literature (see Table 2). This study mainly refers to Xie et al. (2018) to measure the big data analytics capability. The selected variable derived from three first-order variables, namely resource integration capability, in-depth analysis capability and real-time insight and prediction capability and 10 items are included. Based on the description of strategic flexibility by Sanchez (1995), this paper adopts two dimensions to measure strategic flexibility, the resource flexibility and coordination flexibility. 8 items are measured. Strategic innovation is treated as a single dimension and the measurement items are selected according to Han and Gao (2017) and 4 items are measured. Firm performance is measured by two first-order dimensions and the measurement items are selected according to Lin and Zhao (2013) and 7 items are measured. According to the content of the study, this paper mainly regards enterprise positions, enterprise types, enterprise age and enterprise scale as the control variables.

4.3 Statistical analyses

Overall, all statistical analyses are performed using SPSS 23.0. Specific statistics steps include: Firstly, in order to test the reliability and validity of the questionnaire, this paper carries out reliability analysis and exploratory factor analysis. Secondly, this paper attempts to conduct descriptive statistical analysis and correlation analysis on the main research variables. Finally, this paper examines the mediating role of strategic flexibility and strategic innovation in the relationship between big data analytics capability and corporate performance by using the Bootstrap method.

5 Analyses and results

5.1 Reliability and validity of the survey

When conducting the reliability test, this paper makes judgement by calculating the internal consistency reliability coefficient. As is shown in Table 2, the CITC values of each question item in the data are all greater than 0.4, which indicates that the correlation between the measurement items and the constructs in this questionnaire is strong. Meanwhile, the Cronbach's Alpha (α-value) of the four main variables big data analytics capability, strategic flexibility, strategic innovation and firm performance are 0.818, 0.828, 0.835 and 0.782, respectively, all of which are greater than 0.7. Therefore, the scale has a high reliability.

Table 2 Summary of the reliability analysis

Codes	*Measurement items*	*CITC*	α^*	α
BDC1	The company can obtain internal and external data resources to support their business	0.444	0.809	0.818
BDC2	The company can obtain enough talents for data analysis	0.512	0.801	
BDC3	The company can obtain sufficient technical equipment and skills needed for data analysis	0.523	0.799	
BDC4	The company can process raw data to get high quality information	0.524	0.799	
BDC5	The company can effectively analyse all kinds of text, speech and other unstructured data	0.545	0.798	
BDC6	The company has a strong massive data processing capacity	0.532	0.799	
BDC7	The company can derive valuable knowledge from vast amounts of data	0.541	0.798	
BDC8	The company can discover customers' potential needs through data analysis	0.398	0.814	
BDC9	The company can use data analytic to support management decisions	0.513	0.800	
BDC10	Data analysis can support business activities such as research and development, production, marketing and so on	0.508	0.801	
FP1	The company's investment return rate in the past three years is higher than the competitors'	0.539	0.748	0.782
FP2	The company's return on equity in the past three years is higher than the competitors'	0.577	0.742	
FP3	The company's profit growth rate in the past three years is higher than the competitors'	0.611	0.735	
FP4	The company's income growth rate in the past three years is higher than the competitors'	0.524	0.751	
FP5	The company's product R&D efficiency in the past three years is higher than the competitors'	0.371	0.786	
FP6	The company's internal operation efficiency in the past three years is higher than the competitors'	0.501	0.756	
FP7	The company's market share in the past three years is higher than the competitors'	0.463	0.763	
SF1	The same resource is shared among different departments within the company	0.538	0.811	0.828
SF2	The same resource is used to develop, manufacture and sell different products or service	0.513	0.813	
SF3	The cost and difficulty of moving the same resource from one use to another is small	0.560	0.807	
SF4	The same resource can change from one use to another in a very short time	0.578	0.804	
SF5	Departments are allowed to break down the formal work procedures to keep work flexible	0.583	0.804	
SF6	The working mode of the internal operation of the company is different from person to person and adapt to different situations	0.571	0.805	
SF7	The company has very smooth internal communication channels and mechanisms	0.551	0.808	
SF8	The company can actively and proactively respond to external competition	0.530	0.811	
SI1	The company has a unique business model	0.775	0.740	0.835
SI2	The company's strategy is different from others in the industry	0.632	0.806	
SI3	The company strives to have an unusual strategy	0.640	0.803	
SI4	The company's competitive strategy is of great potential value	0.632	0.806	

Note: α^* is α value after deleting the item.

In terms of validity test (see Table 3), exploratory factor analysis is carried out. The KMO value of each variable ranges from 0.778 to 0.828 (all greater than 0.7) and the significance probabilities in Bartlett's sphericity tests are all less than 0.05. The questionnaire data in this paper meet the conditions for exploratory factor analysis. The results of factor analysis show that the cumulative variance interpretation rate of each dimension is more than 60%. The results obtained from the factor load rotation component matrix are consistent with the scale and dimension divided by the research design. The load value of the corresponding items of each dimension is also greater than 0.5. Therefore, the structural validity of the questionnaire in this paper is good.

5.2 Descriptive statistics and correlation analyses

The mean value, standard deviation and correlation coefficient of the main variables are shown in Table 4. Big data analytics capability is positively correlated with strategic flexibility (r=0.530, p<0.01), strategic innovation (r=0.469, p<0.01) and firm performance (r=0.593, p<0.01). Strategic flexibility is positively correlated with strategic innovation (r=0.435, p<0.01) and firm performance (r=0.542, p<0.01). Strategic innovation is positively correlated with firm performance (r=0.544, p<0.01). On the whole, the Hypothesis 1–4 is supported. However, only a single variable analysis was carried out and other influencing factors were not controlled. Therefore, in order to ensure the reliability of empirical evidence, this paper continues to carry out the regression analyses.

Table 3 Summary of exploratory factor analysis

Variables	*Codes*	*Common factors*		
		1	*2*	*3*
BDAC KMO=0.801, *P*<0.001, Accumulated variance interpretation rate=72.76%	BDC1		0.899	
	BDC2		0.824	
	BDC3		0.807	
	BDC4	0.900		
	BDC5	0.767		
	BDC6	0.814		
	BDC7	0.782		
	BDC8			0.887
	BDC9			0.808
	BDC10			0.827
		1	*2*	
SF KMO=0.828, *P*<0.001, Accumulated variance interpretation rate=69.231%	SF1		0.898	
	SF2		0.777	
	SF3		0.782	
	SF4		0.809	
	SF5	0.891		
	SF6	0.800		
	SF7	0.822		
	SF8	0.772		
SI KMO=0.793, *P*<0.001, Accumulated variance interpretation rate=67.007%				
		1	*2*	
FP KMO=0.778, *P*<0.001, Accumulated variance interpretation rate=71.623%	FP1	0.902		
	FP2	0.807		
	FP3	0.812		
	FP4	0.788		
	FP5		0.898	
	FP6		0.814	
	FP7		0.837	

5.3 Regression analyses

According to Hayes (2013) and Preacher and Hayes (2004), this paper tests the chain mediation model using SPSS PROCESS macro. Specifically, the paper conducts a multiple mediation analysis using model 6 of PROCESS. Bootstrap test is used based on 5000 bootstrap samples and 95% bias-corrected Lower-Level Confidence Intervals (LLCIs) and Upper-Level Confidence Intervals (ULCIs) around the estimates of the indirect effects are calculated (Zollo et al., 2019).

Independent variables of big data analytics capability should be significantly related to the mediation variables of strategic flexibility and strategic innovation. After controlling for the effect of the independent variables, the mediation variables should also be significantly related to the dependent variable of corporate performance. According to Hayes (2013), an important indication of mediation is the significance level of the indirect effect from organisational big data analytics capability (the '*X*' variable) to firm performance (the '*Y*' variable) through strategic flexibility and strategic innovation (the '*M*' variables), as indicated by the *p*-value or the LLCIs and ULCIs. In other words, the total effect of big data analytics capability on firm performance should differ from the direct effect of such a relationship, resulting in an indirect effect different from zero.

Table 4 Descriptive statistics and correlation analyses

Control variables	*Variables*	*1*	*2*	*3*	*4*
Enterprise Positions Types Age Scale	1 BDAC	1			
	2 SF	0.530**	1		
	3 SI	0.469**	0.435**	1	
	4 FP	0.593**	0.542**	0.544**	1
	Mean value	3.232	3.266	3.248	3.268
	Standard deviation	0.727	0.792	0.944	0.773

Note: $^{*}p<0.05$; $^{**}p<0.01$.

The results of the mediating effect are shown in Table 5. Firstly, the total effect of big data analytics capability on firm performance (without considering the mediating variables) is significant and high in the model 1 (β=+0.627, p<0.001). Secondly, big data analytics capability impacts strategic flexibility strongly in the model 2 (β=+0.576, p<0.001). Big data analytics capability (β=+0.428, p<0.001) and strategic flexibility (β=+0.310, p<0.001) joint influence strategic innovation positively in model 3. Big data analytics capability (β=+0.350, p<0.001), strategic flexibility (β=+0.237, p<0.001) and strategic innovation (β=+0.232, p<0.001) joint influence firm performance positively in model 4. H1 to H4 can be verified.

The direct effect and indirect effect value of the models are shown in Table 6. The direct effect value is 0.350 and the total indirect effect value is 0.277. The effect value of the three indirect paths is 0.136, 0.041 and 0.099, respectively. It is obtained that BDA→SF→FP is the main indirect influencing path and strategic flexibility plays a significant role in the process through the comparison of the effect value of the three indirect paths.

Table 5 Mediating effect of strategic flexibility and strategic innovation

	Model1 (DV:FP)		*Model1 (DV:SF)*		*Model3 (DV:SI)*		*Model4 (DV:FP)*	
	β	*t*	*β*	*t*	*β*	*t*	*β*	*t*
Constant	1.177	8.196***	1.489	9.606***	0.729	3.648***	0.549	3.942***
Enterprise position	0.036	0.577	0.034	0.510	0.192	2.370*	–0.019	–0.342
Enterprise type	0.111	1.771	0.081	1.200	0.037	0.455	0.077	1.378
Enterprise age	0.070	0.808	0.141	1.517	–0.091	–0.809	0.047	0.611
Enterprise scale	–0.170	–2.105*	–0.237	–2.720**	–0.049	–0.468	–0.085	–1.175
BDC	0.627	18.365***	0.576	15.614***	0.428	8.184***	0.350	9.232***
SF					0.310	6.425***	0.237	6.895***
SI							0.232	8.397***
R	0.541				0.531		0.701	
R^2	0.293				0.282		0.492	
F	51.650***				40.627***		85.841***	

Notes: * $p<0.05$ ** $p<0.01$ *** $p<0.001$.

Table 6 Summary of the effect value

Paths	*Effect*	*SE*	*LLCI*	*ULCI*
DE	0.350	0.037	0.276	0.425
TIE	0.277	0.028	0.225	0.334
BDA→SF→FP	0.136	0.021	0.096	0.181
BDA→SF→SI→FP	0.041	0.009	0.027	0.061
BDA→SI→FP	0.099	0.017	0.069	0.136
IEC1 : IE1 – IE2	0.094	0.023	0.048	0.141
IEC2 : IE1 – IE3	0.036	0.027	–0.016	0.090
IEC3 :IE2 – IE3	–0.057	0.019	–0.100	–0.024

Notes: SE: standard error LLCI: lower level of confidence interval; ULCI: upper level of confidence interval.

6 Conclusions and discussions

6.1 Conclusions

This paper used the bootstrap method to test the chain mediation role of strategic flexibility and strategic innovation in the relationship between big data analytics capabilities and the performance of Internet companies. The results showed that the chain mediation role of strategic flexibility and strategic innovation were validated and hypotheses H1 to H4 are supported. The indirect effect values of the three intermediary paths in the chain model were calculated and compared, and it was found that the total indirect effect value was 0.277, of which the indirect effect value of path 1 was 0.137, the indirect effect value of path 2 was 0.099 and the indirect effect value of path 3 was 0.041. The indirect effect played by path 1 was approximately equal to the total indirect effects played by path 2 and path 3. The results indicated that most of the mediating effect was exerted through strategic flexibility in the chain mediating process.

Big data analytics capability can enhance firm performance through strategic flexibility and strategic innovation. Firstly, from the viewpoint of resource formation process, the chain relationship is consistent with the resource development rule of 'resource collection→resource sharing and transformation→resource allocation model innovation → resource advantage'. Secondly, from the viewpoint of firm dynamic capability, the chain relationship is in line with capability evolution trend of 'analytical capability→contingency capability→innovative capability→capability advantage'. Thirdly, from the perspective of enterprise strategy, the chain relationship is in line with the strategic evolution trend of 'analysing demand→adapting to demand→creating demand→competitive advantage'. Therefore, big data analytics capability can sequentially drive the performance of Internet companies through strategic flexibility and strategic innovation.

6.2 Recommendations

With the advent of the era of big data, the importance of data is comparable to that of fuel in the industrial era, and data is the source of enterprise development and social progress. Especially for internet enterprises, which are closely related to big data, the coming of the era of big data will bring significant opportunities for them. Internet enterprise managers should change the traditional development thinking, consciously cultivate their own big data thinking and strengthen the use of big data.

To be specific, strategic flexibility highlights the 'adapting to demand', while strategic innovation highlights the 'creating demand'. Internet companies should develop big data analytics capability to achieve the strategic upgrade from 'adapting to demand' to 'creating demand', so as to effectively improve corporate performance. With the development of big data analytics capability, internet companies can more accurately understand consumers'

potential needs, and provide support through automated and intelligent tools to transform consumers' potential needs into real needs, thus achieving 'demand creation'.

With the development of digital technology and the consequent changes in consumer habits, consumers increasingly pursue satisfying their different types of needs in a one-stop, seamless manner, and prefer to complete a series of consumption activities through a simple interface or click. The ecosystem competition is a new competitive model at the moment. Internet companies should rely on mobile Internet, Internet of Things, cloud computing and other technologies driven by big data analytics capabilities to link unrelated products or services in the past, forming a networked and dynamic 'ecosystem' to create and meet the integrated needs of consumers.

6.3 Limitations and future research directions

The research in this paper has certain theoretical and practical value, but there are also certain research limitations. First, there are limitations in terms of research objects. The object this study are Chinese internet enterprises, however, the industries that have been more closely studied on big data analytics capabilities include the Internet industry, manufacturing, agriculture, and the medical industry over recent years. With the penetration of big data analytics capabilities in various industries, other industry types could be selected as research subjects to broaden the applicability of the research findings. Second, there are limitations in variable selections. When this paper explored how big data analytics capabilities mechanism influences firm performance, the chain mediating role of strategic flexibility and strategic innovation were analysed. Owing time and resource constraints, other mediating and moderating variables were not introduced into the model, the variables that can influence the mediating and moderating variables were not discussed, the antecedent variables of the independent variables were not explored and the study needs to be further enriched. In the field of strategic management, there are many other variables that are closely associated with these main research variables, such as: strategic rigidity, strategic alliances, cross-border search, business model innovation, collaborative innovation and innovation performance. In future research, the mechanism of the role of big data analytics capabilities and corporate performance can be investigated by extending the range of literature review, and other correlated variables can be further explored so as to make greater theoretical contributions and guide practice to corporations.

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Note

1 The turnover of the internet companies was above 5 million last year.