The Moderating Role of Supply Chain Relationships in Digital Transformation and Innovation Performance-Multiple Linear Regression Analysis

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Abstract. Enterprise digital transformation is a necessary step in the process of business development given the backdrop of the digital economy. The impact of supplier concentration and customer concentration on the relationship between digital transformation and innovation performance is examined in this article, which examines the relationship between digital transformation and innovation performance from the perspective of the supply chain. Multiple linear regression was used to conduct empirical research using data from A-share listed companies of China's retail enterprises between 2011 and 2021. The findings revealed that: enterprise digital transformation significantly promotes innovation performance; supplier concentration can enhance the positive correlation between enterprise digital transformation and innovation performance; and customer concentration positively modifies. The findings of this paper have implications for retail companies to restructure their supply chains and undergo digital transformation to improve innovation performance.

Keywords: Digital transformation; Supplier concentration; Customer concentration; Innovation performance

1 Introduction

In the context of the digital economy era, the rise of the digital economy has broken the limitations of the traditional economy on economic development and greatly changed the way of value creation[1]. The digital economy has become an important driving force for the high-quality development of the economy, and has also inspired enterprises to transform their development strategies and explore new development methods in line with the digital economy. In this environment, businesses have placed a lot of emphasis on digital transformation as a tactical option for adapting to changes in the global industrial digital economy and the necessary economic development. The promotion of transformation and upgrading, the enhancement of competitive advantages, and the realization of high-quality development are all facilitated by digital transformation, which has a significant impact on the survival and innovative growth of supply chain organizations[2]. The relationship between digital transformation and innovation performance has also become a hot issue in academic research, some scholars believe that digital transformation can promote the improvement of innovation performance, while other scholars believe that not all enterprises' digital transformation will have a positive impact on innovation performance, and the research on the

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relationship between digital transformation and innovation performance has not yet reached a consistent conclusion.Enterprise digital transformation can perform factor reconfiguration and resource integration, but due to its limited capacity, it must also rely on external relationship networks to acquire new resources in order to successfully integrate internal and external resources and improve enterprise innovation performance[3]. By enhancing the industrial structure and unleashing the power of data elements, digital transformation and supply chain integration become the fundamental components to drive corporate innovation and development[4]. Additionally, thanks to supply chain integration and digital transformation, businesses may effectively utilize a variety of resources. Customer consolidation and supplier consolidation are particularly important in supply chain integration. Higher supplier concentration stabilizes the supply chain and facilitates the relationship between digital transformation and innovation performance; higher customer concentration leads to stable revenues, deeper understanding of customer needs, facilitates innovation and product development, and improves the impact of digital transformation on innovation performance. Therefore, it is necessary to study the role of supplier concentration and customer concentration in digital transformation and innovation performance.

Retail businesses play an increasingly significant role in economic development. But retail enterprises are still facing the high cost of circulation, high risk of digital transformation.In the face of high distribution costs and the evolving digital era, retailers must recognize that digital transformation and fine supply chain management have become key factors in shaping their future success. This means that through the adoption of digital technologies, retailers can optimize inventory management, improve customer satisfaction, enable customized services, reduce operational costs, and be more flexible in adapting to market demands, thus ensuring their sustainable growth and success in a competitive market. However, fewer scholars have studied the relationship between digital transformation, supply chain integration and innovation performance of retail companiesIn order to investigate the relationship between supply chain integration, data transformation, and innovation performance of retail firms, this research employs the empirical technique, builds the multiple linear regression model, and uses Stata software.

2 Theoretical studies and research hypotheses

2.1 Digital Transformation and Innovation Performance

Digital transformation is the use of digital technologies and solutions by a business or organization to change business processes, develop new business models, and offer better goods, services, and experiences in order to adapt to the rapidly changing digital, Internet-driven, and technological era.Additionally, digital transformation is defined by dynamic capabilities that enable businesses to innovate in a variety of ways, deal with uncertain circumstances, and gain a competitive edge. In order for businesses to develop, generate, and maintain a competitive advantage in the digital economy, digital transformation becomes crucial.Digital transformation has the potential to increase innovation's effectiveness. The long cycle, high risk, and other uncertainties in the enterprise R & D and innovation process can be reduced by digital transformation transition, and the quality and speed of new product creation can be improved. And by utilizing a variety of digital technologies, it is possible to streamline

the R&D process, increase cooperation efficiency, and decrease the cost of innovation while increasing its effectiveness.This will encourage businesses to devote more funds to technological innovation, product development, and other initiatives, all of which will have a positive effect. In addition, the adoption of digital transformation in businesses can increase their capacity for resource integration and coordination, efficient knowledge conversion into resources, innovation, and productivity enhancement in order to obtain a long-term competitive advantage. The development of new digital technologies encourages businesses to move from being innovative to being precise. Digital transformation integrated into production activities, with the aid of the corresponding technology, aids in the innovation of production technology and production methods, speeds up the innovation and breakthrough of core technology, encourages the iterative upgrading of goods and services, and boosts production effectiveness[5] Additionally, when the process of enterprise digital transformation is continuously expanded, it can significantly increase the business' operational efficiency, enabling it to produce more under the constraints of its resources for R&D and innovation[6]. By implementing services for process, and data customization to satisfy consumer expectations, better react to market changes, and enhance innovation performance, digital transformation also fosters innovation within the compan[7].

H1: Innovation performance is positively impacted by digital transformation

2.2 The moderating role of supply chain integration

Innovation is a key tool for businesses to gain an edge in a cutthroat market, and product innovation, which carries enterprise innovation, is a difficult process that requires the cooperation of many forces. Whereas supply chain relationships are hugely relevant to innovation. Supplier concentration and customer concentration are two key ideas in the operation of supply chains and marketplaces, and the majority of scholars also analyze supply chains from the perspectives of supplier concentration and customer concentration. Supplier concentration is the degree to which a supply chain's quantity and location of providers are concentrated. There are fewer vendors in the supply chain and the market may be dominated by a small number of large suppliers when supplier concentration is high. According to universal consensus, higher supplier concentration is linked to improved operational efficiency[8], while lower supplier concentration is thought to increase the complexity of the supply chain.Increased supplier concentration may promote resource integration and information sharing among suppliers. Long-lasting and stable cooperation relationships with suppliers can improve the level of trust between the two parties to a transaction and lower the danger of mistrust. This maximizes the effectiveness and competitiveness of the entire supply chain. An information network forms between businesses as supplier concentration increases, further enhancing the efficiency of information flow. By utilizing efficient resources, businesses can enhance their capacity for innovation, create a replacement external environment for digital transformation, and develop a sustainable competitive advantage for businesses[2]. In a close partnership, resources from suppliers and businesses are combined and shared via a digital platform to create unique and competitive resources. This can also increase the accuracy of information exchange between the two parties and lower operational and financial risks for the business, thereby enhancing the role of digital transformation in fostering innovation performance. Enterprises can lessen uncertainty in the digital transformation process, ensure the smooth execution of the digital transformation, and thereby

enhance the relationship between the digital transformation and innovation performance by establishing reliable supplier partnerships. Therefore, supplier management can improve the relationship between digital transformation and innovation performance as well as lower the risk and uncertainty associated with it.

H2: Supplier concentration has a positive moderating role in the impact of digital transformation on innovation performance.

Customer concentration is the degree to which a market's customers or clients are concentrated in terms of both quantity and position. High customer concentration occurs when a small number of clients or customers control a significant portion of the market and the company's sales and revenues. A successful customer concentration in the supply chain is a "means" of value creation for the business, lowering the knowledge asymmetry between customers and the business, while also boosting trust and lowering communication costs. A tight relationship with customers fosters information sharing and teamwork, which can take the place of understanding client demands and obtaining reliable information about them. Businesses will boost their investments in pertinent digital technology in order to improve communication with customer businesses, better integrate customer resources and information, and lower the cost of cooperation. This is done on the basis of long-term, solid relationships with customers[9]Customer concentration considerably raises an enterprise's inventory efficiency and premium valuation level and helps it reduce inventory more effectively. Additionally, a high concentration of customers lowers the expense of attracting new clients. Digital technology may improve customer and business communication, allowing businesses to provide better customer service. Enterprises must create digital platforms based on client needs as part of the digital transformation process. A high degree of client concentration helps businesses learn more rapidly about their customers' demands and raise consumer satisfaction with the digital platform. A good degree of customer concentration enables businesses to more effectively meet the needs of big clients, promotes steady development in the sales of goods and services, and gives businesses a reliable source of capital. Enterprises are also able to quickly gather and respond to customer input by implementing digital technologies and sharing platforms, which accelerates the digital transformation process and boosts delivery effectiveness.

H3: Customer concentration has a positive moderating role in the impact of digital transformation on innovation performance.

The specific assumed relationships are shown in Fig 1.

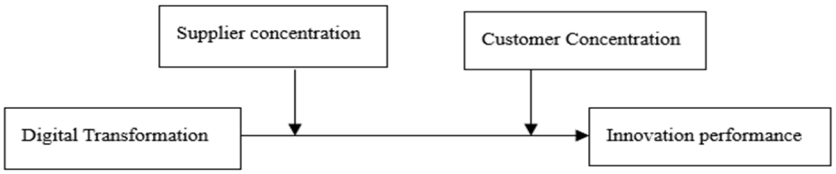

Fig 1. Hypothetical relationship diagram

3 Multiple linear regression analysis

3.1 Variable description and modeling

For empirical testing, the A-share retail statistics for China are taken from 2011 to 2021. All data from the CSMAR. The annual reports of businesses are used to gather data on digital transformation, while the Cathay Pacific Database is used for additional financial information. the empirical analysis of the pertinent data using Stata17.0 software, which produced a total of 740 valid data, and the multiple linear regression analysis (MLRA) on the valid data . Where innovation performance(Lnpatent) is expressed by adding 1 to take the logarithm of the number of enterprise patents; where supplier concentration(Supply) will be expressed by the ratio of the purchases of the top five suppliers disclosed in the notes to the financial statements of the enterprise to the total amount of purchases for the year; and customer concentration(Customer) is expressed by the ratio of the sales of the top five customers to the total amount of sales for the year; Digital transformation takes the approach of some academics, through the big data advance tool, the annual reports from listed companies are used to Extract the keywords related to digital transformation, use the frequency of these keywords to derive the indicators of digital transformation, due to the possible existence of data-based transformation is 0, this paper takes the natural logarithm after adding 1 to it. Control Variables: The following variables are chosen as controls: firm size (Size), firm age (Age), equity concentration (Shr), and gearing level (Lev). Among them, firm age (Age) is determined by the observation year minus the registration year, equity concentration (Shrhfd) is determined by the percentage of the shares owned by the company's first-largest shareholder, asset-liability level (Lev) is determined by the ratio of the company's total liabilities to its total assets, and the years 2011-2021 have been chosen for this purpose. dummy variable for the year.

3.2 Model building

To verify the relationship between digital transformation and operational performance, model (1) is constructed. To verify the moderating role of supply chain management, supplier concentration is added to model (2); customer concentration is added to model (3); the interaction term between supplier concentration and digital transformation is added to model (2) to obtain model (4); the interaction term between customer concentration and digital transformation is added to model (3) to obtain model (5).

$$Lnpatent=\beta 0+\beta 1\ EDT+\Sigma Controls+Year+\S 1 \quad (1)$$

$$Lnpatent=\gamma 1+\gamma 2\ EDT+\gamma 3\ Supply+\Sigma Controls+Year+\S 2 \quad (2)$$

$$Lnpatent=\gamma 4+\gamma 5 EDT+\gamma 6\ Customer+\Sigma Controls+Year+\S 3 \quad (3)$$

$$Lnpatent=\gamma 7+\gamma 8 EDT+\gamma 9\ Supply * EDT+\gamma 10\ Supply+\Sigma Controls+Year+\S 4 \quad (4)$$

$$Lnpatent=\gamma 11+\gamma 12\ EDT+\gamma 13\ Customer * EDT+\gamma 14 Customer+\Sigma Controls+Year+\S 5 \quad (5)$$

3.3 Descriptive statistics

The required variables are entered into the stata program, and descriptive statistics are run. The results are shown in Table 1

Table 1. Descriptive statistics.

Variable	N	Mean	SD	MIN	MAX
Lnpatent	740	0.60	1.3	0	7.3
Customer	740	6.84	11.1	0	78.5
Supply	740	23.28	21.0	0	98.5
EDT	740	1.98	1.15	0	6.3
Size	740	22.37	1.4	0	25.8
Age	740	19.92	6..37	3	39
Shrhfd	740	31.7	15.2	0	85.5
Lev	740	0.54	0.19	0.04	1.2

3.4 Results of multiple linear regression analysis

Table 2 (1)displays the findings of a multiple linear regression between the performance of innovation and digital transformation. It is clear that there is a significant positive relationship between digital transformation and innovation performance. The standard coefficient between digital transformation and innovation performance is 0.262($P < 0.01$), indicating that this relationship is significant. H1 confirmed. The regression results of the moderating effect of supplier concentration in the relationship between digital transformation and innovation performance are shown in(2)(4)in Table 2.From(2), supplier concentration and digital transformation are both positively related to innovation performance;From (4) the regression coefficient of the interaction term between digital transformation and supplier concentration is 0.067 ($P<0.01$) indicates that supplier concentration plays a positive moderating effect in the relationship between digital transformation and innovation performance. The regression results of the moderating effect of customer concentration in the relationship between digital transformation and innovation performance are shown in (3)(5) in Table 2. From(3), customer concentration and digital transformation are both positively related to innovation performance; From(5)The multivariate linear regression coefficient of the interaction term between customer concentration and digital transformation is 0.13($P<0.01$)indicating that supplier concentration plays a positive moderating effect in the relationship between digital transformation and innovation performance The hypotheses were all verified.

Table 2. Multiple linear regression results.

Variable	(1)Lnpatent	(2)Lnpatent	(3)Lnpatent	(4)Lnpatent	(5)Lnpatent
EDT	0.262*** (6.53)	0.31*** （7.54）	0.262*** (6.91)	0.145*** (2.8)	0.126*** (3.03)
Customer			0.036*** (7.36)		0.008 (1.31)
Supply		0.012*** （4.31）		0.001 (0.36)	
Supply * EDT				0.067*** (4.21)	
Customer *EDT					0.13*** (5.20)

cons	-0.011 (-0.02)	-1.038 (-1.52)	-0.178*** (-2.78)	-1.012 (-1.48）	-1.758*** (-2.85）
Year	yes	yes	yes	yes	yes
R-squared	0.16	0.19	0.25	0.21	0.27

4 Conclusions and recommendations

This paper utilize multiple linear regression to empirically examine the influence of digital transformation, supply chain management, and innovation performance using the date of A-share retail firms from 2011 to 2021. The analysis's main findings demonstrate that, (1) Digital transformation can considerably boost innovative capacity.(2) Supply chain integration can positively strengthen the impact of digital transformation on innovation performance.

The findings of this article have some implications for how businesses should manage. (1) Focus on digital transformation:In the framework of the digital economy, firms may deepen digital transformation with the aid of a number of digital technologies. First and foremost, businesses should boost their investment in digital transformation. Second strengthening the talent pool for digital transformation is also crucial, and digital platform literacy should be a key consideration when choosing talent and introducing digital transformation talent. (2) Strengthening Supply Chain Management:In supply chain management, businesses should establish a supply chain management strategy that is in line with the digital transformation, strengthen their relationships with upstream and downstream partners, and realize the synergistic growth of innovation with the aid of digital technology, and optimize the structural system of the supply chain network. On the one hand, businesses can suitably increase their level of supplier concentration to achieve tight supplier cooperation and raise their performance bar. By combining the digital resources from all parties, they may increase the combination of complementary capabilities and continuous innovation capabilities with other businesses by utilizing a high level of supplier integration. On the other hand, businesses should be careful to preserve a certain level of client concentration in order to jointly profit from the digital transformation through solid customer relationships. Enterprises can more effectively undertake digital transformation, improve their competitiveness, and adjust to the development trend of the digital economy era through the aforementioned strategies.

References

[1] Filippo Bertani,Linda Ponta,Marco Raberto,Andrea Teglio,Silvano Cincotti.The complexity of the intangible digital economy: an agent-based model[J].Journal of Business Research,2020,(prepublish).

[2] Zhebia Tursun,Cai Xinxiu,Zeng Zhili et al. Digital Transformation, Supply Chain Integration and Corporate Innovation Performance - An Empirical Study Based on Agricultural Products Industry[J]. Journal of Shanxi Economic Management Cadre College,2023,31(02):17-25.

[3] Guo Tongmei, Li Qianyun, Zhang Yue et al. Research on the relationship between digital transformation and innovation performance of specialized, special and new enterprises[J]. Technological Economy,2023,42(05):68-78.

[4] H.S. Kak. The impact of supply chain integration and digital transformation on the innovation performance of distribution companies[J]. Research on Business Economy,2022(19):128-131.
[5] SADEGHI V J，BIANCONE P P，2018. How micro，small and medium-sized enterprises are driven outward the superior international trade performance？A multidimensional study on Italian food sector［J］. Research in International Business and Finance，45：597-606.
[6] Loebbecke C,Picot A. Reflections on societal and business model transformation arising from digitization and big data analytics: A research agenda[J]. Journal of Strategic Information Systems,2015,24(3).
[7] Xiaoli W,Ying G,Mahmood A, et al. The Impact of Digital Capability on Manufacturing Company Performance[J]. Sustainability,2022,14(10).
[8] Bozarth C C, Warsing D P, Flynn B B, et al. The impact of supply chain complexity on manufacturing plant performance[J]. Journal of Operations Management, 2009, 27(1): 78-93
[9] SHI Huibin, ZHANG Weihong, XU Wanying. Research on the impact of supply chain concentration on the performance of enterprise digital transformation[J]. Science and Management:1-12.