Original Research Article

Research on the path of the impact of digital transformation on supply chain resilience

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Abstract: Digital transformation has become a crucial trend in the current business landscape, yet the specific path through which it affects supply chain resilience remains relatively unclear. Given the complexity and uncertainty of global supply chains, understanding how digital transformation influences supply chain resilience is of paramount importance for companies. This study aims to explore the path of the impact of digital transformation on supply chain resilience. Using a combination of literature review and empirical analysis, the study selected a sample of publicly listed manufacturing companies from 2014 to 2024. The results of a two-way fixed effects regression analysis confirmed a significant impact on supply chain resilience. This research contributes to enriching the understanding of the relationship between digital transformation and supply chain resilience, providing valuable insights and strategic recommendations for companies undergoing digital transformation.

Keywords: manufacturing industry; digital transformation; supply chain resilience; path analysis

1. Introduction

With the rapid development of the global economy and intensifying competition, supply chain resilience has emerged as a critical strategic goal for enterprises to sustain competitive advantages and adapt to uncertain environments. However, its achievement is hindered by multiple challenges, including the complexity of global supply chains, the unpredictability of natural disasters and contingencies, and volatile market demand. Against this backdrop, digital transformation is widely recognized as a key pathway to enhancing supply chain resilience. Despite extensive existing research on the impact of digital transformation on supply chain resilience, significant gaps remain regarding the underlying mechanisms and transmission pathways—Particularly a lack of in-depth insight into how digital transformation influences supply chain resilience through diverse channels. Thus, further research on these pathways is imperative to uncover the internal mechanisms and specific implementation approaches.

2. Research design

2.1. Research hypotheses

For the manufacturing industry, digital transformation enables the supply chain to obtain and monitor key data in real time, including inventory levels, order status, traffic conditions, etc. Through the visualization of data and real-time monitoring, supply chain managers can have a more comprehensive understanding of the status and risks of the supply chain and make timely adjustments and decisions. Therefore, this paper puts forward the following assumptions:

H1: Digital transformation will have a significantly positive impact on the supply chain resilience of manufacturing enterprises.

2.2. Variable selection

The explanatory variable is the Degree of Digital Transformation of enterprises (DDT), which is measured by the total digital word frequency. The explained variable is Supply Chain Resilience (SCR), which is measured by the difference between accounts payable turnover days and accounts receivable turnover days. The control variables selected are enterprise Size (SIZE), enterprise asset-liability ratio (LEV), Revenue Growth Rate (RGR), and Proportion of Fixed Assets (PFA).

2.3. Model construction

This paper takes the degree of enterprise digital transformation as the independent variable, supply chain resilience as the dependent variable, and enterprise scale, enterprise asset-liability ratio, revenue growth rate, and the proportion of fixed assets as the control variables, and constructs the following regression model:

$$SCR_{it}=\alpha_0+\alpha_1 DDT_{it}+CV+\sum year+\sum ind+\varepsilon_{it} \quad (1)$$

Among them, α_0 is a constant term, α_1 is the regression coefficient, which is the coefficient value that needs to be estimated. i represents the i-th listed company, t represents the year or time, ε_{it} represents the random error term, which is the value that has not been observed and affects the performance of the enterprise, year is the year effect, and ind is the industry effect, controlling for the influence brought by the year and industry effects. To make the model estimation results more accurate, CV represents the control variable in this paper.

2.4. Sample selection and data sources

This paper takes listed manufacturing companies as the research sample and acquires the publicized data information of various variables from 2014 to 2024 through the CSMAR database.

3. Empirical analysis

3.1. Correlation analysis

The correlation analysis results show that there is a certain degree of positive correlation between supply chain resilience and digital transformation, with a correlation coefficient of 0.32. This means that as the digitalization level of enterprises increases, the resilience of their supply chains may strengthen.

3.2. VIF test

The VIF test shows that the VIF values of each variable are all less than 10, indicating that the model is not disturbed by multicollinearity results.

3.3. Model estimation

Next, a bidirectional fixed regression analysis was conducted, and the results are as follows:

Table 1. Model. estimation results.

	SCR	SCR
DDT	4.735***	7.279**
	(7.616)	(7.812)
SIZE		163.474**
		(160.009)
LEV		270.635***
		(46.845)*
RGR		8.117
		(20.235)
PFA		-2643.790*
		(1406.077)
_cons	388.357**	-3660.032
	(195.078)	(3561.090)
ind	control	control
year	control	control
r2	0.000	0.002
r_2		

* p<0.1, ** p<0.05, *** p<0.01

As shown in **Table 1**, when no control variables are added, the impact coefficient of digital transformation is 4.735, and it is significant at a 99% significance level. When adding control variables, the impact coefficient of digital transformation was 7.279, and it was significant at a 95% significance level, indicating that digital transformation would have a significant impact on supply chain resilience, proving the validity of Hypothesis H1

in this study.

3.4. Robustness test

To further test the robustness of the model, this paper conducts a regression analysis with the independent variable lagging by one period. The results are as follows:

Table 2. Robustness test.

	SCR	SCR
L.DDT	1.735***	3.29**
	(6.216)	(7.23)
SIZE		54.594**
		(160.009)
LEV		-16.398***
		(26.945)*
RGR		3.597
		(8.255)
PFA		-449.790*
		(606.077)
_cons	47.576**	1416.532*
	(195.078)	(3561.090)
ind	control	control
year	control	control
r2	0.003	0.006
r_2		

* p<0.1, ** p<0.05, *** p<0.01

According to **Table 2**, the data results show that digital transformation has a significant positive impact on supply chain resilience. It proves that the hypothetical relationship between digital transformation and supply chain resilience in this paper is relatively stable.

4. Research conclusion

Empirical results show that digital transformation has a significant impact on supply chain resilience. This is because digital transformation can enhance the informatization level and operational efficiency of enterprises, thereby strengthening the adaptability and responsiveness of the supply chain. The increase in the scale of an enterprise means the expansion of resources and capabilities, enabling the enterprise to better cope with market changes and supply chain risks. However, an increase in a company's asset-liability ratio may lead to an increase in the company's financial risks, thereby affecting the stability of the supply chain.

5. Research suggestions

Based on the impact of digital transformation on supply chain resilience, this paper puts forward the following suggestions: First, promote the application of automation and intelligent technologies. Enterprises should introduce automated warehousing and robot technology to enhance the efficiency and accuracy of logistics, leverage artificial intelligence and machine learning to optimize supply chain planning decisions, and strengthen the reliability of supply chain operations through technological empowerment. Second, strengthen digital collaboration both within and outside the supply chain. Build a digital collaboration platform to promote real-time information sharing among all parties in the supply chain, collaborative planning and resource allocation, and enhance the overall response capability of the supply chain. Third, persist in continuous improvement and innovation. Upgrade supply chain resilience through regular technological iterations and methodological innovations, collaborate with participants in the supply chain ecosystem, and jointly promote the deep integration of digital transformation and resilience building.

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