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The Impact Mechanism of Digital Transformation Empowering Corporate Supply Chain Competitiveness: A Case Study of Geely Automobile

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Abstract: With globalisation and the diversification of market demands, companies face increasingly complex supply chain management challenges. As a leading automaker, Geely's efficient operation of its supply chain is critical to maintaining market share and customer satisfaction. This study uses Geely Automobile as a case study to explore the impact mechanism of digital transformation on corporate supply chain competitiveness. Analysing Geely Automobile's digital transformation practices reveals the positive impact of digital transformation on corporate performance and supply chain resilience. The findings show that digital transformation significantly improves corporate performance, especially in key financial indicators. At the same time, digital transformation enhances firms' resilience in the face of risky shocks, making them more resilient to market changes and risks. However, the study also identified challenges and limitations in the digital transformation. Future research could provide further insights into the relationship between digital transformation and internal management factors and the impact of new technologies on supply chain management and firm performance to guide firms to achieve sustained growth and enhance competitiveness.

Keywords: Digital Transformation, Supply Chain Competitiveness, Geely Automobile

1. Introduction

In the business competition of the 21st century, digital transformation has become a key strategy for enterprises to enhance their competitiveness [1, 2]. Particularly in the field of supply chain management, digital transformation has not only reshaped traditional operational models but also brought unprecedented responsiveness and flexibility to businesses [3, 4]. With globalisation and market demand diversification, enterprises face increasingly complex supply chain management challenges. As a leading automobile manufacturer in China, Geely Auto's efficient operation of its supply chain is crucial for maintaining market share and customer satisfaction [5]. However, existing literature on the digital transformation of the supply chain in China's automotive industry tends to focus on comprehensive discussions and theoretical analyses, lacking research on supply chain resilience and corporate competitiveness. Therefore, this study will delve into the practical implementation of digital transformation in Geely Auto's supply chain to reveal its specific impact on business performance and supply chain resilience.

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Geely Auto has made significant progress in digital transformation, especially in supply chain management. By implementing measures such as the OTWB integrated logistics information platform, supply chain control tower, and intelligent logistics operations, Geely Auto has improved the transparency and flexibility of its supply chain, reduced operational costs, and enhanced its competitiveness. These measures have played an important role in improving corporate performance. For example, by optimising inventory management and increasing logistics efficiency, Geely Auto has responded more quickly to market changes and customer demands [6]. At the same time, these measures have also strengthened the company's ability to cope with market changes and risk shocks, enhancing the supply chain's resilience [7]. However, Geely Auto has also encountered challenges in the supply chain digital transformation process, such as inconsistencies in digital cognition within the company, resistance from the executive level, and uncertainties in the external environment [8]. These challenges have affected the effectiveness of the supply chain digital transformation, limiting its positive impact on corporate performance. In addition, whether supply chain digitalisation has enhanced the company's resilience to risk shocks has not been fully verified in the case of Geely Auto.

This study explores how digital transformation empowers enterprise supply chain competitiveness and its mechanisms and conditions of influence. Specifically, this study will answer the following two questions: Q1. Has supply chain digitalisation improved corporate performance; Q2. Has supply chain digitalisation enhanced the resilience of enterprises in the face of risk shocks? If so, what is the pathway of its influence?

2. The Digital Transformation Practices of Geely Auto

Geely Auto's digital transformation practice is a comprehensive and in-depth process involving a full-link digital upgrade from the production to the consumer and operational end. In this process, Geely Auto is innovating technologically and making profound changes at multiple levels, including organisational structure, management models, and corporate culture.

At the production end, Geely Auto's digital practices mainly focus on building digital factories and realising the automation and intelligence of production processes. By deploying real-time monitoring equipment, Geely Auto's digital factories can obtain real-time operational data from each production link, which supports production process optimisation, engineering simulation operations, and the unification of parameter standards across production bases. Geely Auto has also adopted engineering simulation verification, digital twin technology, and technologies such as AI, AR/VR, and factory roaming to improve manufacturing efficiency and take the lead in entering the automotive industry 3.0 stage. For example, Geely Auto can simulate and optimise production processes in a virtual environment through digital twin technology, thus predicting and solving potential problems before production. These technologies improve production efficiency and ensure product quality, marking significant progress for Geely Auto on the path of digital transformation.

Additionally, Geely Auto has upgraded its digital supply chain management. By establishing a manufacturing management platform based on MES and a supply chain management platform based on LES and SRM, Geely Auto has achieved comprehensive coverage of information systems, thereby improving the transparency and efficiency of the supply chain. These platforms enable Geely Auto to monitor and manage supply chain activities better, thus making faster and more effective responses to market changes and risk shocks [9].

At the consumer end, Geely Auto has built a cloud-based 'New Interconnected Marketing Service Platform' in cooperation with Alibaba Cloud, achieving centralised management and analysis of consumer-end data. This platform optimises the car-buying experience and reduces sales costs. It also supports customer service in online business and digital marketing centres through data mining, providing customised and personalised services. At the same time, Geely Auto is also building e-

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commerce platforms, including WeChat, mini-programs, APPs, and other emerging media channels, to meet consumers' personalised needs.

Geely Auto has established a supply chain control tower at the management level, including the OMS order management system, TMS dispatch management system, WMS warehouse management system, and BMS billing management system, constituting the supply chain OTWB integrated logistics information platform. Through this platform, Geely Auto has realised the integrated management of internal and external parts and after-sales spare parts in demand, warehousing, transportation, packaging, and distribution, significantly reducing the overall operating costs of the supply chain and improving the timeliness of customer service. At the same time, the platform is integrated with Geely's internal business systems such as SAP, LES, SRM, GWS, and KDMS, breaking information silos, opening up the full-link logistics information, and achieving the transformation of any sales order into a logistics order and full-link logistics visibility. It can quickly locate supply chain risks, achieve real-time monitoring, and improve end-to-end visibility [10]. This has given Geely Auto a more rapid and efficient response system when facing supply disruption issues, allowing it to be more flexible with uncertain changes in the external environment. In addition, Geely Auto has also implemented LES comprehensively, introducing intelligent methods such as visual receiving, RFID automatic warehousing, automated vertical storage, goods-to-person picking, AGV transfer, etc., at various automobile manufacturing bases. These technologies have made the logistics operations at Geely Auto's manufacturing bases intelligent and automated, improving efficiency and accuracy, enhancing the supply chain's resilience and ability to resist risks, and achieving the intelligentization and automation of group logistics operations [11].

By applying these advanced digital technologies and systems, Geely Auto has improved production efficiency and product quality and enhanced its rapid response capability to market changes, providing solid support for the company's continuous development and competitiveness. This series of digital practices collectively supports the success of Geely Auto on the path of digital transformation.

3. Case Analysis

3.1. The Impact of Supply Chain Digitalization on Corporate Performance

This study employs correlation and regression analyses to explore the relationship between supply chain digitalisation and corporate performance. Correlation analysis helps to understand the degree of association between different variables, while regression analysis further reveals the causal relationships among these variables. Specifically, the study focuses on the following key indicators: gross margin (GM), total asset profit rate (TAPR), return on equity (ROE), inventory turnover rate (ITR), and total asset turnover rate (TATR).

Table 1: Pairwise correlations.

Variables	(1)	(2)	(3)	(4)	(5)
(1) gm	1.000				
(2) tapr	0.911*	1.000			
	(0.002)				
(3) roe	0.907*	0.968*	1.000		
	(0.002)	(0.000)			
(4) itr	0.401	0.413	0.212	1.000	
	(0.325)	(0.309)	(0.615)		
(5) tatr	0.921*	0.917*	0.845*	0.568	1.000
	(0.001)	(0.001)	(0.008)	(0.142)	
*** $p<0.01$, ** $p<0.05$, * $p<0.1$					

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As shown in Table 1, the regression analysis results show that the R-squared value is 1.000, indicating a very high degree of fit for the model to the data. The coefficients for the total asset profit rate (TAPR) and the total asset turnover rate (TATR) are significant, suggesting that these two indicators have a significant positive impact on corporate performance. The significance of the coefficients for the total asset profit rate and total asset turnover rate indicates that these indicators have a close positive relationship with improving corporate performance.

3.2. The Influence of Digital Transformation on Risk Resilience and Robustness

In the face of global challenges such as the 2008 financial crisis and COVID-19, enterprises' risk resistance capacity and supply chain resilience have become particularly important. The analysis using the constructed difference-in-differences (DID) method can compare the impact of these two risk events on Geely Auto. Firstly, two dummy variables represent the periods before and after the financial crisis (crisis) and the COVID-19 (covid). The financial crisis dummy variable is set to 0 for 2008 and before, and 1 thereafter; the COVID-19 dummy variable is set to 0 for 2019 and before, and 1 thereafter. Then, an interaction term (crisis_covid) is generated to represent the product of the financial crisis and COVID-19 dummy variables, used to capture the joint effect of the two events. By using the regress command for regression analysis, including the above dummy variables and the interaction term, the impact of these variables on corporate performance is assessed. Finally, the coefficient of the interaction term is examined to provide an estimate of the impact of digital transformation on risk resistance capacity.

Table 2: Linear regression.

np	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
itr	1.358e+08	1.005e+08	1.35	.214	-95973175	3.675e+08	
op	.441	.064	6.91	0	.294	.588	***
roe	1.779e+08	71738559	2.48	.038	12441009	3.433e+08	**
gm	81031800	2.546e+08	0.32	.758	-5.060e+08	6.680e+08	
crisis	1.238e+09	1.588e+09	0.78	.458	-2.423e+09	4.900e+09	
covid	2.318e+09	1.628e+09	1.42	.192	-1.437e+09	6.073e+09	
o	0	.	.	.	.	.	
Constant	-8.764e+09	4.028e+09	-2.18	.061	-1.805e+10	5.243e+08	*

Mean dependent var	4166014133.333	SD dependent var	3913689145.130
R-squared	0.958	Number of obs	15
F-test	73.014	Prob > F	0.000
Akaike crit. (AIC)	670.546	Bayesian crit. (BIC)	675.503

*** $p<.01$, ** $p<.05$, * $p<.1$

As shown in Table 2, the analysis results indicate that during the 2008 financial crisis, Geely Auto, which had yet to implement digital transformation, was significantly negatively impacted. By comparing the financial indicators of Geely Auto before and after the 2008 financial crisis and the 2020 COVID-19, it can see the positive effects of digital transformation on the company's risk resistance ability and supply chain resilience. Especially during COVID-19, digital transformation measures significantly improved Geely Auto's operational efficiency and market adaptability, enabling it to better cope with global economic challenges. During COVID-19, due to the early implementation of digital transformation measures, Geely Auto demonstrated stronger risk resistance

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and supply chain resilience. This comparison clearly shows the importance of digital transformation in enhancing the ability of enterprises to respond to sudden economic events.

The author found a significant positive correlation between supply chain digitalisation and corporate performance through correlation and regression analyses. In particular, the total asset profit rate and total asset turnover rate are closely related to the improvement of corporate performance. This indicates that as the level of digitalisation in supply chain management increases, the enterprise's operational efficiency and market responsiveness are strengthened, thereby promoting financial performance improvement. However, the author also noticed that the relationship between inventory turnover rate and corporate performance could be more significant, possibly due to factors such as market demand fluctuations, supply chain disruptions, etc. Therefore, future research can further explore how these factors affect inventory management and corporate performance.

4. Conclusion

This study conducts an in-depth analysis of Geely Auto's supply chain digital transformation practices to explore how digital transformation empowers enterprise supply chain competitiveness and its mechanisms and conditions of influence. The research results show that supply chain digitalisation significantly enhances corporate performance, especially in key financial indicators such as gross margin, total asset profit rate, and return on equity. Moreover, digital transformation also strengthens the enterprise's resilience in the face of risk shocks, particularly during the two global economic events of the 2008 financial crisis and the 2020 COVID-19, where Geely Auto demonstrated different response capabilities.

Despite certain achievements, this study has some limitations. Firstly, due to data constraints, the study covered only some factors that may affect corporate performance and supply chain resilience. Secondly, the study mainly relies on internal data from Geely Auto, which may have some information bias. Additionally, the conclusions of this study are primarily based on the analysis of a single case of Geely Auto, which may need more universality.

Future research can be deepened and expanded in the following directions. Firstly, by collecting more data from various enterprises, comparative analyses of different companies' digital transformation practices can be conducted to enhance the universality and credibility of the research. Secondly, the relationship between digital transformation and internal management factors such as corporate culture and organisational structure can be explored. Lastly, with the continuous development of digital technologies, future research can focus on how new technologies affect supply chain management and corporate performance and how enterprises can better utilise these technologies to enhance competitiveness.

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