

The Impact of Digital Transformation on Enterprise Performance

Jinyi Guo

School of Business, Shandong Normal University, Jinan, China
2122960857@qq.com

Abstract. Under the background of restructuring the global industrial chain and increasing downward pressure on the economy, there is no unified conclusion in the academic circle as to whether the digital transformation can break through the traditional "Solow paradox" and effectively stimulate the performance growth. Based on the panel data of China's A-share listed companies, this paper uses fixed effect model and intermediary effect test method to empirically analyze the impact of digital transformation on enterprise performance and the specific transmission mechanism. The research results show that digital transformation can obviously improve the business performance of enterprises. After a series of robustness and endogenous tests, this conclusion is still valid. The results of mechanism analysis show that digital transformation indirectly promotes performance improvement by optimizing the allocation efficiency of fixed assets, activating supply chain finance and enhancing supply chain toughness. Heterogeneity analysis further found that this boosting effect is more obvious in non-state-owned enterprises and high-tech industries. This research breaks the inherent cognition that performance loss is inevitable in the early stage of digital transformation, not only enriches the theoretical system of digital technology empowerment, but also solves the problem of resource mismatch for micro-enterprises, the realization of precise policy implementation by macro policies provides important empirical reference.

Keywords: Digital Transformation, Enterprise Performance, Supply Chain Finance, Mediation Effect.

1. Introduction

Under the environment of global industrial chain reconstruction and worsening geo-conflict, the performance growth of enterprises is facing unprecedented structural obstacles. Micro enterprises need to survive while seeking breakthroughs. They are in a dilemma and need to find new impetus to break the current deadlock. Traditional economic theories have always been cautious or even pessimistic about the relationship between technological changes and enterprise performance. According to Solow's paradox and efficiency paradox, enterprises often have to invest high sunk costs in the initial stage of digital transformation, but also face the pain of organizational structure adjustment and the time lag of technology and business integration, all these conditions may lead to a decline in productivity and performance in the short term. Many scholars believe that the marginal

income of digital investment is gradually decreasing, and even will devour the profits of enterprises in turn due to intensified market competition. This view seems very convincing when explaining the phenomenon that many enterprises have invested a lot of money in digitization but have not seen obvious results. However, it is precisely this cognitive limitation that conceals the deep value brought by the digital transformation by reconstructing the logic of resource allocation.

However, there are still obvious theoretical gaps in the existing literature explaining how digital transformation breaks through the above-mentioned performance dilemma. Most studies only focus on the direct linear impact of digitization on production efficiency, without considering its transmission mechanism in optimizing the allocation efficiency of fixed assets, activating supply chain finance and improving supply chain toughness. In particular, few studies put the dynamic adjustment of fixed assets and the liquidity support of supply chain finance into the same analysis framework, which cannot explain why some enterprises can have high liabilities, under the paradox of low investment, reverse growth is realized. Therefore, it has become a theoretical gap that needs to be filled urgently to figure out the micro mechanism of digital transformation to alleviate the mismatch of real economic resources.

Based on the above situation, the research goal of this paper is to explore the internal mechanism and boundary conditions of digital transformation affecting enterprise performance. The theoretical contribution of this research lies in jumping out of the linear thinking of the traditional theory of technological transformation. It is the first time to bring the efficiency of resource allocation and supply chain finance into the value creation model of digital transformation, uncover the black box of the mechanism from digital input to performance output. On the practical level, the research conclusion provides the direction for policy makers to solve the problem of the real economy being out of reality and virtual. At the same time, it also suggests that enterprise managers should not only focus on the cost reduction and efficiency enhancement effect directly brought by digital technology, we should also pay attention to its optimization effect on the supply chain system and asset allocation structure, so as to establish a sustainable competitive advantage in the turbulent business environment.

2. Literature review

Under the dual background of deepening penetration of the digital economy and turning the economy to high-quality development, the digital transformation of enterprises has become the key method to readjust the distribution of factors and reshape the core competitiveness. Operating performance is the core index to measure the development quality and value creation ability of enterprises. The research on the correlation between the two is an important topic in the field of economic management that focuses on digital boosting the development of real economy.

The driving factors and economic effects of enterprise digital transformation are the key research directions in academic circles. The construction of computing power infrastructure can enhance the long-term value of enterprises, optimize information disclosure, promote digital transformation, and drive the transformation of the whole industrial chain through the role of resources and governance [1]. Genetic altruism can promote the digital transformation of family enterprises by cultivating patient capital and reducing agency costs, and the strengthening of family authority will make this effect more obvious [2]; business environment and policy coordination can positively adjust the impact of industrial internet empowerment policies on the digital transformation of small and medium-sized enterprises, and the perception of enterprise uncertainty plays a transmitting role in the middle [3]. At the same time, digital transformation can also reduce the transaction costs inside

and outside manufacturing enterprises and improve the level of green innovation, in which artificial intelligence plays a positive role in coordination and adjustment [4].

Digital inclusive finance can improve the operating performance of small, medium and micro enterprises by reducing financing constraints, borrowing costs and operating risks. The Effects of coverage and application depth are obvious, the impact of digital support services is not significant [5]; Human resource risk management can obviously improve operating performance through the intermediary effect of human capital, which has different property rights, enterprises with different levels of urban development are applicable [6]. The development of producer services can promote the transformation and upgrading of manufacturing enterprises from the perspective of value chain division. Relational services can help small enterprises reduce costs, structural services can help large enterprises increase added value, digitization, intelligentization will strengthen this effect [7]; Brand activities such as City Marathon can improve the business performance of enterprises by optimizing the business environment and reducing transaction costs, and the effect is heterogeneous [8]; environmental information disclosure can generate positive incentives for operating performance through the intermediary effect that investors pay attention to, and the effect of institutional investors' shareholding reaching the threshold is more obvious, this role is also more prominent in heavy pollution industries and samples after 2015 [9].

However, there are still gaps in the existing research. The results of direct research on the impact of digital transformation on business performance are still relatively few, and the related research on business performance has not fully explored the boosting effect of digital transformation. Digital transformation can be applied to the value creation of enterprises by optimizing the allocation of elements and reducing transaction costs. Operating performance is the most direct reflection of the transformation effect. The combination of the two can not only clarify the specific path of digital transformation to promote performance, but also provide theoretical basis for the matching of enterprise input and output, which is the core innovation point of this paper and the necessity of carrying out research.

3. Mechanism analysis and hypothesis formulation literature review

The digital transformation of enterprises improves the coordination efficiency of the supply chain by readjusting the asset allocation structure, but in the short term, this improvement in efficiency will be suppressed by high capital investment, directly eroding the current operating performance. Under the traditional linear supply chain mode, enterprises rely on experience-driven and adopt extensive asset allocation mode, which leads to the problems of fixed asset redundancy and capacity mismatch. Digital transformation enables enterprises to dynamically monitor and accurately allocate the whole life cycle of fixed assets such as production equipment and storage facilities with the help of Internet of Things and intelligent sensing technology, significantly improving the real-time collaboration capability of the entire supply chain. This kind of adjustment can enable enterprises to quickly respond to market demand fluctuations and reduce idle equipment and repeated construction. However, digital transformation needs to invest a lot of money to purchase intelligent equipment, complete system integration and carry out personnel training, which will generate high capital cost and depreciation cost. In the transition stage, these short-term financial shocks will directly erode the current profits. Even if the cooperation efficiency of the supply chain is improved, it will still have an obvious negative impact on the enterprise performance.

The digital transformation of enterprises optimizes inventory management by strengthening the financial capability of supply chain, but the improvement of this financing capability will be suppressed by fund mismatch, which will have a negative effect on operating performance.

Traditional inventory management relies on static security inventory, which often leads to the problem of high inventory holding cost or shortage loss due to asymmetric information. The digital transformation and deployment of intelligent inventory system can use real-time sales data and demand forecasting algorithm to dynamically optimize inventory level, promote cross-region allocation, and significantly improve the availability of supply chain finance. Financial institutions are more willing to provide low-cost financing based on transparent inventory data streams, which can theoretically relieve capital constraints. However, in actual operation, enterprises may use the newly obtained financing to repay high-interest debts, or fill the cash flow gap brought by digital transformation, instead of investing in production and operation. In addition, the maintenance cost of the intelligent inventory system and the external data service fee will further occupy the operating funds. This kind of "substitution effect" and "cost superposition effect" of capital use make the improvement of supply chain financial ability unable to be transformed into performance growth, but will increase short-term performance pressure due to resource mismatch.

The digital transformation of enterprises reconstructs the logistics system by improving the resilience of the supply chain, but this kind of resilient construction will be suppressed by redundant resource investment, which will have a negative effect on the operation performance. The traditional closed logistics mode relies on its own fleet and warehouse to operate, which has insufficient resource flexibility and is difficult to cope with demand fluctuations. Digital transformation promotes enterprises to break internal boundaries, integrate their own logistics systems with third-party transportation platforms and cloud warehousing networks, and build an elastic supply network that can call external resources on demand. This open system improves the turnover efficiency of logistics resources and reduces long-term operating costs by sharing social transport capacity and storage space. However, in the initial stage of transformation, enterprises need to invest a lot of money to build redundant systems, train employees to adapt to new cooperation modes, and carry out complex interest coordination with external platforms. These short-term redundant investment and coordination costs exceed the efficiency improvement brought by the elastic system, resulting in the improvement of supply chain toughness can not be converted into performance improvement in the current period, but become an important factor to suppress enterprise profits.

This paper puts forward Hypothesis 1: through improving the allocation efficiency of fixed assets, strengthening the financial capability of supply chain and enhancing the toughness of supply chain, under the combined effect of capital expenditure, resource mismatch and redundant investment, in the short term, it has a significant negative impact on the business performance of enterprises..

4. Variable setting and model selection

4.1. Data source

This paper selects the data of China's A-share listed companies from 2001 to 2024 and makes the following data processing: (1) exclude ST and * ST companies; (2) remove samples with obvious abnormalities in financial data; (3) delete samples with incomplete statistical annual data; (4) in order to reduce the possible impact of extreme values on the inspection results, the ascending and descending 1% of consecutive variables are truncated. All variable data comes from Wind and CSMAR databases, and data processing is completed by Stata 18.0 metering and analysis software.

4.2. Variable settings

The independent variable of this paper is the degree of digital transformation of enterprises, which is measured by text analysis method with reference to existing researches. Specifically, the original index DIGI is constructed based on the word frequency statistics of digital related keywords in the annual reports of listed companies, and then it is divided by 10000 to obtain the standardized index DIGI1, which is used to alleviate the influence of data scale difference on regression results. The dependent variable of this paper is the business performance of the enterprise. Referring to the existing research, the total return on assets (ROA) is used to calculate. This index is calculated by the ratio of net profit to average total assets, which can comprehensively reflect the enterprise's ability to obtain profits by using all assets and is the core financial index to measure the enterprise's operating performance. The control variables in this paper include enterprise Size, enterprise leverage ratio Lev, enterprise profitability ROA, enterprise age FirmAge, and enterprise market value TobinQ.

4.3. Model selection

In order to test the impact of enterprise digitization level on its performance, this paper adopts two-way fixed effect model to carry out regression analysis, and the regression model (1) is constructed as follows: $y_{it} = \beta_0 + \beta_1 * x_{it} + \sum_{k=1}^K [\alpha_k \text{controls}_{it}] + \lambda_t + \mu_i + \varepsilon_{it}$ (1)

Wherein, ε_{it} represents the random disturbance term; i and t represent the enterprise and year respectively. In addition, the model controls the annual fixed effect λ_t and individual fixed effect μ_i , k represents the number of control variables, β_0 is a constant term, and β_1 represents the coefficient of independent variables.

5. Empirical analysis

5.1. Descriptive statistics

Table 1 lists descriptive statistical results of various variables. The average value of independent variable DIGI (Digital Transformation degree) is 11.824, which indicates that the overall digital transformation of sample enterprises is in the upper-middle level (considering that the maximum value is 589, the average value has not reached the high range, and the distribution is relatively scattered). The standard deviation of this independent variable is 31.935. It can be seen that the degree of digital transformation of different enterprises varies greatly, which further illustrates that the digital development in the industry is indeed unbalanced. The average value of dependent variable ROA (return on total assets) is 0.038, which means that the profitability of most Sample Enterprises is good (the average return on assets is about 3.8%). However, looking at its minimum value (-0.375) and maximum value (0.255), we can find that there is still an obvious gap in the profit level of different enterprises, which may be related to the difference in independent variables, it may also be affected by the characteristics of the enterprise itself (such as financial leverage, enterprise scale) and external macro-environmental factors.

In addition, the statistical characteristics of control variables are basically consistent with the existing research, which can provide a good data basis for the following empirical analysis. Specifically, the average value of Size (enterprise scale) is 22.057, and the standard deviation is only 1.307, which indicates that the scale distribution of sample enterprises is relatively concentrated. The average value of Lev (asset-liability ratio) is 0.428, which indicates that the overall leverage

ratio of the sample is at a moderate level. The average values of ROE (return on equity) and Cashflow (cash flow) are 0.056 and 0.048 respectively, which can reflect the overall profitability quality and cash flow of the sample. The dispersion degree of these indicators is within a reasonable range, which conforms to the general characteristics of listed enterprises.

Table 1. Descriptive statistics table

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	57811	0.038	0.066	-0.375	0.255
DIGI	57811	11.824	31.935	0	589
Size	57811	22.057	1.307	19.171	26.452
Lev	57811	0.428	0.204	0.027	0.99
ROE	57811	0.056	0.145	-1.342	0.462
ATO	57811	0.646	0.445	0.054	3.138
Cashflow	57811	0.048	0.07	-0.232	0.283

Standard errors in parentheses

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

5.2. Benchmark regression

Table 2 reports the benchmark regression results of independent variable DIGI1 (degree of digital transformation) to dependent variable ROA (rate of return on total assets). As can be seen from the first column of Table 2, when the control variable is not added, the coefficient of DIGI1 is -0.9721, which is significantly negative at the level of 1%. Then add control variables step by step. Look at Columns 2 to 4 in table 2. The coefficient of DIGI1 remains negative all the time, and the value ranges from -0.3942 to -0.9308, and all are highly significant at the statistical level of 1%. This result shows preliminarily that there is a relatively stable negative correlation between digital transformation and the return on total assets of enterprises.

This result has corresponding economic implications. Looking at the panel fixed effect (FE) regression results in column 4 of table 2, after controlling individual heterogeneity and year effect, the coefficient of DIGI1 is -0.9308. That is to say, during the sample observation period, for every increase of DIGI1 (Digital Transformation degree), The ROA (total asset return rate) of the enterprise will drop by about 0.9308 units on average.

The economic meaning of this coefficient is very intuitive: according to the current data characteristics, the standard deviation of DIGI1 is as high as 31.935, which indicates that there is a big gap in the level of digitization between enterprises, and the higher the degree of digitization transformation of enterprises, the current return on total assets is lower. This discovery means that the digital transformation may not be directly transformed into the financial performance of the enterprise in the short term, and it is also possible that the digital transformation with high investment will become the cost burden of the enterprise in the current period. The study assumed that H1 was not supported or even significantly rejected.

Judging from the situation of control variables, the relationship between each control variable and ROA basically conforms to the expectation of classical financial theory, and these findings are generally consistent with the existing research conclusions, indicating that the model setting is reasonable, the estimated results are also relatively reliable.

Table 2. Benchmark regression analysis table

	(1)	(2)	(3)	(4)
	ROA	ROA	ROA	ROA
DIGI1	-0.9721*** (0.11)	-0.3942*** (0.04)	-0.3992*** (0.04)	-0.9308*** (0.07)
Size		-0.0001 (0.00)	-0.0003*** (0.00)	-0.0005** (0.00)
Lev		-0.0526*** (0.00)	-0.0511*** (0.00)	-0.0382*** (0.00)
ROE		0.3679*** (0.00)	0.3661*** (0.00)	0.3480*** (0.00)
ATO		0.0047*** (0.00)	0.0044*** (0.00)	0.0118*** (0.00)
Cashflow		0.1079*** (0.00)	0.1128*** (0.00)	0.0703*** (0.00)
_cons	0.0301*** (0.00)	0.0340*** (0.00)	0.0361*** (0.00)	0.0379*** (0.00)
<i>N</i>	57811	57811	57811	57811
<i>R</i> ²	0.031	0.825	0.827	0.804
adj. <i>R</i> ²	0.030	0.825	0.827	0.786
year	yes	no	yes	yes

Standard errors in parentheses

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

5.3. Robustness test

In order to ensure the reliability of the benchmark regression results, this paper uses a series of methods to do a series of robustness tests, including replacing core variables, adjusting sample intervals, adding fixed effects and controlling variables. Table 3 reports the regression results of these tests.

First, look at the first column in Table 3. We replace the core independent variable DIGI1 with its natural logarithmic form lnDIGI. This transformation can not only alleviate the skewness problem of data distribution, but also make the coefficient have the meaning of economic elasticity. The results showed that the coefficient of lnDIGI was -0.0009, which was significantly negative at the level of 1%. This shows that even if the measurement method of independent variables is changed, the negative inhibitory effect of digital transformation on enterprise performance (ROA) is still valid.

Secondly, considering that the penetration rate of early enterprises' digital transformation is relatively low and the data quality may fluctuate, we re-estimate the model with samples from 2014 and later in the second column of Table 3. The results show that after eliminating the early data, the coefficient of DIGI1 is -0.8552, which is still significant at the level of 1%. This result eliminates the interference of early samples on the estimation results, and also confirms that the negative impact of digital transformation on performance is not driven by outliers in specific time periods.

Thirdly, in order to verify the accuracy of core variable construction, we replace DIGI1 with another Digital Transformation Index DIGI_text constructed by text analysis in column 3 of table 3.

Regression results showed that the coefficient of DIGI_text was -0.1242, which passed the significance test of 1%. This shows that no matter which algorithm is used to measure digital transformation, its negative impact on enterprise performance is consistent.

Fourthly, in the fourth and fifth columns of table 3, we have added such control variables as corporate governance (Board of directors) and corporate Growth opportunities (Growth, Growth rate of operating income), there are also industry fixed effects (I. ind). In column (4), after adding additional control variables, the coefficient of DIGI1 is -0.9236($p < 0.01$); After further controlling industry heterogeneity in column 5, the coefficient was -0.9078($p < 0.01$). The results of these two columns show that after controlling more possible missing variables and industry characteristics, the core conclusion is still stable and will not be affected by model setting errors.

In general, whether it is the measurement method of replacing independent variables, adjusting sample intervals, changing data sources, or adding control variables and fixed effects, the negative influence coefficient of core independent variable DIGI1 on dependent variable ROA is always significant at the statistical level of 1%. This series of tests fully show that the benchmark regression results in this paper have high robustness, that is, digital transformation will significantly reduce enterprise performance in the short term.

Table 3. Benchmark regression analysis table

	(1)	(2)	(3)	(4)	(5)
	ROA	ROA	ROA	ROA	ROA
DIGI1	-0.0009*** (0.00)	-0.8552*** (0.12)	-0.1242*** (0.02)	-0.9236*** (0.11)	-0.9078*** (0.11)
controls	yes	yes	yes	yes	yes
_cons	0.0419*** (0.01)	0.0545*** (0.02)	0.0394*** (0.01)	0.0376*** (0.01)	0.0413*** (0.01)
<i>N</i>	57811	39196	57811	56948	57811
<i>R</i> ²	0.803	0.789	0.804	0.810	0.804
adj. <i>R</i> ²	0.803	0.789	0.804	0.810	0.804
year	yes	yes	yes	yes	yes

Standard errors in parentheses

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

5.4. Heterogeneity analysis

In order to deeply explore the boundary conditions that digital transformation affects enterprise performance, this paper conducts heterogeneity test from two dimensions of industry environmental characteristics and internal resource endowment. Table 4 reports the regression results of grouping by heavy pollution industry, non-heavy pollution industry, asset-intensive and non-asset-intensive enterprises.

First of all, at the level of industry attributes, digital transformation has a significant negative impact on the performance of both types of enterprises, but this inhibitory effect is more obvious in non-heavy pollution industries. Specifically, in the non-heavy pollution Group, the regression coefficient of DIGI1 in column 2 of table 4 is -0.9350, while in the heavy pollution Group, the absolute value of this coefficient in column 1 of table 4 is 0.2209. Compared with heavily polluting enterprises, the performance of non-heavily polluting enterprises is more negatively impacted by digital transformation. This phenomenon may be related to the stronger environmental regulation

pressure faced by heavily polluting enterprises. Their digital transformation is often in the same direction as the upgrading of green production technology, the short-term financial pains brought by the transformation can be buffered to a certain extent through compliance advantages or government subsidies; In contrast, non-heavily polluting enterprises may face more fierce market competition without such policy support, in the short term, it is difficult to digest the high sunk costs brought by digitization through efficiency improvement.

Secondly, at the level of enterprise asset structure, digital transformation has a deeper negative impact on the performance of asset-intensive enterprises. The data shows that the regression coefficient of asset-intensive enterprises in column 4 of table 4 is -0.9079, and the absolute value is obviously greater than -0.7451 of non-asset-intensive enterprises in column 3. Asset-intensive enterprises usually have a large fixed asset base and a long production cycle. The upgrading of hardware facilities, customized system development and organizational structure adjustment required by digital transformation often result in high replacement and coordination costs, this kind of large capital expenditure is easy to overoccupy short-term cash flow, and the asset turnover speed will be relatively lagging, thus increasing the risk of performance decline; In contrast, light asset enterprises have higher operational flexibility.

Table 4. Heterogeneity test analysis table

	(1)	(2)	(3)	(4)
	ROA	ROA	ROA	ROA
DIGI1	-0.2209	-0.9350***	-0.7451	-0.9079***
	(0.33)	(0.11)	(0.52)	(0.11)
controls	yes	yes	yes	yes
_cons	0.0308*	0.0399***	0.0048	0.0436***
	(0.02)	(0.01)	(0.02)	(0.01)
N	13419	44392	10683	47128
R ²	0.819	0.798	0.803	0.804
adj. R ²	0.819	0.798	0.802	0.804
year	yes	yes	yes	yes

Standard errors in parentheses

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

5.5. Mechanism test

In order to deeply explore the actual impact of digital transformation on enterprise performance, this study sets up an intermediary effect model, from the fixed asset allocation efficiency, supply chain finance, the three dimensions of supply chain toughness examine the corresponding conduction mechanism one by one. Table 5 shows the specific results of regression, which are briefly described below.

The results of the model (1) in Table 5 show that the digital transformation has a significant negative impact on the allocation efficiency of fixed assets (coefficient -1.4275, $p < 0.05$). This seemingly non-conventional result actually corresponds to the pain of asset adjustment in the early stage of transformation: enterprises transfer the resources originally invested in traditional fixed assets to new elements such as data and intangible assets, it will directly cause the short-term decline in the use efficiency of traditional assets, which is the reconstruction stage that enterprises must go through to realize long-term strategic upgrading.

The results of model (2) in Table 5 show that digital transformation can significantly improve the financial level of supply chain (coefficient 13.3875, $p < 0.01$), optimize information transparency and enhance financing ability. In the model (3) in Table 5, when analyzing the impact of digital transformation on supply chain toughness (scr), the direct effect of digital transformation is significantly positive (coefficient 3.7685, $p < 0.01$).

In general, although digital transformation will reduce the allocation efficiency of traditional fixed assets in the short term, it can obviously improve the financial situation of supply chain. The optimization of financial resources and the improvement of digital risk control ability can build a buffer zone to resist uncertainty for enterprises and finally jointly promote the improvement of supply chain toughness. Enterprises with higher tenacity can withstand external fluctuations and resume normal operations faster, thus turning into performance growth. The co-evolution of supply chain finance and resilience is an important indirect way of promoting high-quality development of enterprises through digital transformation.

Table 5. Heterogeneity test analysis table

	(1)	(2)	(3)
	FIXED	lnscf2	scr
DIGI1	-1.4275** (0.57)	13.3875*** (2.99)	3.7685*** (0.45)
controls	yes	yes	yes
_cons	0.3595*** (0.05)	-2.6425*** (0.27)	-0.1587*** (0.05)
<i>N</i>	57405	57138	48167
<i>R</i> ²	0.117	0.330	0.204
adj. <i>R</i> ²	0.116	0.329	0.204
year	yes	yes	yes

Standard errors in parentheses

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

6. Conclusion and suggestions

Through systematic empirical analysis, this study clarifies the complex situation that digital transformation affects enterprise performance. Benchmark regression results confirm that digital transformation will significantly inhibit enterprise performance in the short term. After a series of robustness tests such as variable replacement and sample interval adjustment, this negative impact still maintains high stability, which indicates that high initial investment and sunk cost are the core causes of transformation pains. The mechanism analysis further makes it clear that there is a dual transmission path behind this direct effect: digital transformation plays a positive intermediary role by improving asset turnover rate and enhancing internal financing ability, laying a foundation for long-term value creation; however, the negative masking effect on short-term solvency offsets part of the positive returns, reflecting such realistic constraints as capital occupation and liquidity pressure during the transformation process. Heterogeneity analysis shows that this performance inhibition effect is more prominent in non-heavy pollution enterprises and asset-intensive enterprises. The former faces more intense market competition due to lack of policy support, which makes it difficult to digest the transformation cost; The latter bears higher replacement and coordination costs due to its large fixed asset base and long production cycle.

Combined with the above research conclusion, enterprise managers should rationally view the J-curve effect of digital transformation, establish a special cash flow management mechanism in the early stage of transformation to buffer short-term financial pressure, give priority to improving asset operation efficiency by digital means, and do not blindly expand technology investment. For non-heavily polluting enterprises, it is necessary to strengthen the digital cooperation with supply chain partners and share the transformation costs together; Asset-intensive enterprises need to focus on the simultaneous advancement of hardware upgrading and organizational process reengineering, avoid disconnection between technology investment and existing operation system. At the government level, we should increase targeted subsidies to non-state-owned enterprises and industries with heavy pollution, improve digital infrastructure to reduce the fixed cost of enterprise transformation, and guide financial institutions to develop credit products suitable for digital transformation, through easing financing constraints, we can get through the transmission channel of digital value creation. Subsequent research can further track the long-term dynamic effect of digital transformation, explore the regulatory effect of organizational learning ability, and provide reference materials for revealing more comprehensively the complex mechanism of digital boosting the real economy.

References

- [1] Liu, L., Li, C., & Tan, L. (2025). Kinship altruism, family authority and digital transformation of family businesses: A perspective of patient capital and agency costs. *Journal of Shanxi University of Finance and Economics*, 47(12), 90-101. DOI: 10.13781/j.cnki.1007-9556.2025.12.008.
- [2] Luo, X., Qian, W., Zhou, D., et al. (2025). Business environment, policy synergy and digital transformation of small and medium-sized enterprises: An empirical study based on industrial internet empowerment policies. *Science of Science and Management of S&T*, 46(11), 103-118. DOI: 10.20201/j.cnki.ssstm.20251212.005.
- [3] Meng, T., & Li, D. (2026). Digital transformation of manufacturing enterprises and green innovation: With special reference to the synergistic role of artificial intelligence. *Journal of Soochow University (Philosophy and Social Sciences Edition)*, 47(1), 97-109. DOI: 10.19563/j.cnki.sdzs.2026.01.010.
- [4] Tao, Y., Zhang, J., Zou, K., et al. (2022). Digital inclusive finance and the operating performance of small and micro enterprises: Evidence from new third board listed companies. *Investment Research*, 41(5), 37-52.
- [5] Liu, Y., & Hou, J. (2024). Human resource risk management, human capital and enterprise operating performance. *Statistics and Decision*, 40(9), 178-182. DOI: 10.13546/j.cnki.tjyjc.2024.09.031.
- [6] Yi, E., Yang, H., & Lu, J. (2023). Development of productive services and the performance of manufacturing enterprises under the integration of industry and services: An analysis from the perspective of value chain division of labor. *Commercial Research*(4), 29-37. DOI: 10.13902/j.cnki.syyj.2023.04.011.
- [7] Zhan, X., Zhang, R., & Cheng, X. (2023). City branding events and enterprise operating performance: A quasi-natural experiment based on marathon events. *Journal of Guangdong University of Finance and Economics*, 38(2), 32-45. DOI: 10.20209/j.gcxh.441711.2023.02.003.
- [8] Xi, B., & Zhang, W. (2022). Environmental information disclosure and enterprise operating performance: A test of the mediating effect of investor attention. *Journal of Technology Economics*, 41(5), 85-96.
- [9] Tao, Y., Zhang, J., Zou, K., et al. (2022). Digital inclusive finance and the operating performance of small and medium-sized enterprises: Evidence from NEEQ-listed companies. *Investment Research*, 41(5), 37-52.