

The Impact of Digital Transformation on Enterprise Market Value: Evidence from Listed Manufacturing Companies

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Abstract

In the context of the rapid development of the current digital economy, digital transformation has become a key factor affecting corporate market value. This study used empirical analysis methods to explore the specific impact of digital transformation on corporate market value by taking A-shares listed manufacturing companies in Shanghai and Shenzhen from 2011 to 2022 as samples. We selected *ESG* as the intermediary variable and internal control as the moderating variable to reveal their intermediary and moderating effects between digital transformation and corporate market value. To ensure the robustness of the research results and eliminate, we also conducted corresponding robustness tests. After careful research, the following conclusions were drawn: There is a significant positive correlation between the degree of digital transformation and corporate market value, that is, the higher the degree of digital transformation, the higher the market value of manufacturing companies. In addition, the study found that manufacturing companies can improve their *ESG level* through digital transformation, which in turn has a positive impact on their market value. At the same time, internal control plays an important moderating role in this process. This study provides useful reference for enterprise decision makers, helping them better understand the impact mechanism of digital transformation on corporate market value, thus providing decision support for enterprises in formulating and implementing digital transformation strategies.

Keywords: digital transformation, enterprise market, value manufacturing industry

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1. Introduction

In recent years, the digital economy has exhibited rapid growth worldwide, fueled by technological advancements and the widespread adoption of the Internet. Digital transformation has emerged as a pivotal driving force for the development of various industries, fostering economic growth and ushering in unprecedented societal changes. In this context, General Secretary Xi Jinping has advocated for the "deep integration of the digital economy with the real economy" to ensure sustainable and healthy economic development in China. The real economy, as the cornerstone and backbone of China's economic growth, holds paramount importance. Manufacturing, as a core component of the real economy, plays a crucial role in national development. In response to the burgeoning digital economy, manufacturing enterprises must actively embrace digital transformation to adapt to contemporary demands and inject new vitality into China's economic landscape. For these enterprises, the utilization of data networks has significantly facilitated enterprise management, enhancing manufacturing efficiency. Furthermore, digital transformation not only boosts production efficiency but also optimizes resource allocation. Given the intensifying competition in the manufacturing industry, digital transformation has become a vital strategy for fostering innovative development in traditional industries and



bolstering corporate core competitiveness. By integrating information and platform technologies, we can effectively streamline production processes and elevate production efficiency, thereby promoting sustained and steady corporate growth.

Based on current research, studies on the digital transformation of enterprises primarily concentrate on various aspects, including different types of digital transformation, key factors initiating it, its outcomes and impacts, the dynamic evolutionary process, the specific contents and dimensions it encompasses, and the specific pathways to achieving it. Furthermore, research also examines the economic and innovative impacts of digital transformation. Collectively, these research areas form a comprehensive framework for studying enterprise digital transformation. Notably, the topic of how digital transformation influences the market value of enterprises remains underexplored in existing research. Therefore, this paper offers insights into the impact of digital transformation on firms' market value and examines the role of *ESG* performance and internal controls in this context.

This paper conducts an in-depth investigation of the impact of digital transformation on firms' market value, with a balanced examination of the roles of ESG ratings and internal controls in this process. It integrates four key factors: digital transformation, ESG performance, internal control, and enterprise market value, to study the influence of ESG on digital transformation and enterprise market value, as well as the moderating effect of internal control. The research findings offer novel perspectives and strategies for enterprises to enhance their market value and contribute to a comprehensive understanding of the intrinsic relationships among digital transformation, enterprise market value, ESG, and internal control. Furthermore, the results of this paper have significant guiding value and practical implications for governments and policymakers in optimizing the development environment of the digital economy and advancing the implementation of digital transformation as a national strategy.

2. Literature Review

2.1 Literature Review on Digital Transformation

Digital transformation is crucial for the transformation of Chinese enterprises. By 2022, the scale of China's digital economy had reached 50 trillion, accounting for over 40% of the country's GDP. Research indicates that digital transformation can effectively enhance procurement, production, and other business processes, thereby reducing operating costs and improving corporate governance. This not only optimizes internal enterprise processes but also establishes a solid foundation for sustainable development (Liu et al. 2023). In addition, enterprise digital transformation has the potential to significantly mitigate audit risks and decrease associated costs, ultimately leading to a reduction in overall audit expenses (Leng & Zhang 2024). It also improves enterprise performance and has a substantial impact on supply chain integration. As a result of the study, digital transformation positively influences business development, which is crucial for enhancing organizational effectiveness, optimizing resource allocation, and fostering innovation. Therefore, enterprises should leverage digital technology to promote digital transformation and achieve efficient, sustainable development (Korsen et al. 2022). However, some foreign researchers have expressed doubts about the view that digital transformation can directly promote the economic consequences of enterprises (Nwankpa & Datta 2017). A study of annual reports from listed manufacturing companies between 2008 and 2020 reveals that sustained efforts in digital transformation have significantly contributed to enterprises' deep understanding and exploration of innovative thinking and results, further enhancing their innovative performance. Notably, for state-owned enterprises, participation in global innovation networks has an even more pronounced effect on enhancing innovation performance (Bai et al. 2022). Additionally, the study also finds that firms in regions with relatively limited innovation resources experience particularly significant improvements in innovation performance during the transformation and integration process. These findings offer valuable insights for enterprises seeking to realize digital transformation and innovative development within global innovation networks.

2.2 Review of Literature Related to Market Value of Firms

The market value of an enterprise reflects the inherent worth of the organization. Currently, recognized methods for assessing this value can be broadly categorized into quantitative and qualitative indicators. Quantitative indicators are quantifiable data, such as financial statements and stock market prices. qualitative indicators, on the other hand, focus on many elements other than the economic value of the enterprise, including but not limited to human capital, technological prospects, geographic location, customer base, and market status. Currently, most researchers tend to use quantitative indicators for research and analysis, such as many researchers (Ishaq *et al.* 2021) use Tobin's Q to measure the market value of enterprises. The research results show that there is a positive correlation between the degree of financialization of an enterprise and its market



value. However, this positive correlation diminishes as the *level* of regional marketization rises (Su & Liu 2021). In addition, domestic studies have also shown that the percentage of R&D personnel and the number of invention patents positively impact market value. However, the intensity of R&D investment does not significantly *elevate* the market value of science-based enterprises as anticipated. Further analysis reveals that high R&D investment intensity may have negative short-term effects on market value due to the long-term nature and delayed benefits of R&D in sci-tech firms (Deng & Zhao 2022). Sci-tech attributes are crucial in attracting investors' attention, and enterprises with numerous R&D personnel and substantial invention patent output send positive signals to the market, drawing more investors and enhancing market value.

3. Theoretical analysis and research hypothesis

3.1Digital Transformation and Enterprise Market Value

The digital transformation discussed in this paper represents a series of change measures with digital technology as the core driver. These changes are particularly focused on the application and implementation in actual production, R&D and other core business processes, which affects the market value of the enterprise by continuously improving operational efficiency.

Based on the theory of dynamic capabilities, digital transformation enhances an enterprise's responsiveness to market changes. Enterprises undergoing digital transformation must undergo a process of enhancing, integrating, protecting, and, if necessary, reconfiguring their resources. This poses significant challenges to their ability to build, integrate, reconfigure, and optimize their operations. However, these challenges also present valuable opportunities for organizations to exercise and demonstrate their dynamic capabilities. As technology rapidly evolves, the significance of dynamic capabilities in the digital transformation process becomes increasingly prominent. The primary objective of enterprise digital transformation is to effectively reduce operating costs, increase enterprise value, and better adapt to external environmental changes through the utilization of digital technology. Additionally, enterprises must continuously engage in technological innovation to achieve sustained economic growth. To accomplish this, enterprises must possess a robust and dynamic technological innovation capability, encompassing the ability to invest in technological innovation and the capacity to effectively convert technological innovation into tangible output and value creation.

The theory of information asymmetry suggests that enterprises will inevitably encounter information asymmetry issues in the market. However, digital transformation can effectively mitigate these problems. In practical economic activities, complete information remains an unattainable ideal state. Digital transformation not only integrates traditional real economy with digital technology but also provides enterprises with robust digital empowerment support, facilitating their development towards greater efficiency and intelligence. As the foundation of digital transformation, digital empowerment focuses on integrating and applying digital technologies to fully optimize enterprise operation and management processes. The extensive use of these technologies enables enterprises to acquire, process, and analyze various data more swiftly, allowing them to accurately capture market demand, formulate more scientific development strategies, and optimize their internal value chains. By utilizing digital technology, enterprises can store and manage information in structured data formats. This data-driven management significantly enhances the transparency of production, sales, and internal control processes. Additionally, digital technology allows companies to track and monitor data from various business processes in real-time, enabling timely identification of issues and adjustments. This not only reduces information confusion but also increases the transparency of various business and management processes within the enterprise. Consequently, this transformation offers enterprises new perspectives and solutions for improving governance, enhancing market competitiveness, and ultimately boosting the overall efficiency of economic operations.

Based on the theory of value creation, digital transformation significantly enhances the value creation capabilities of enterprises. By producing and supplying products or services that meet customer needs, enterprises can achieve a return on capital investment that exceeds capital expenditure, thereby obtaining residual profits from business activities—value creation. In this process, digital transformation offers enterprises more favorable conditions for value creation. In the digital economy era, digital technologies such as big data, cloud computing, and the Internet have emerged as the core avenues for internal and external enterprise development. By *leveraging* these technologies, enterprises can substantially improve efficiency, productivity, and the benefits associated with physical value creation.

Hypothesis 1 is proposed based on the above analysis:



H1: The extent of digital transformation is positively related to the market value of the firm.

3.2 Digital Transformation, ESG and Corporate Market Value

Companies have traditionally prioritized factors influencing their market value, but digital transformation and ESG (Environmental, Social, and Corporate Governance) have recently emerged as focal points for the global business community. In June 2004, the ESG theory was formally introduced, representing a commitment by companies to broader social responsibilities and sustainable development across the economy, society, and environment. The positive impact of digital transformation on ESG performance drives the increase in companies' market value. By leveraging digital transformation, companies can enhance their ESG performance more efficiently and manage implementation processes with greater detail, fostering transparency in corporate information. This transformation not only alleviates financing constraints faced by enterprises but also significantly boosts their financial performance and innovation levels, thereby establishing a solid foundation for their healthy development (Wang & Esperança 2023). ESG performance holds significant potential for value creation, positively influencing both the book and market values of enterprises (Yoon et al. 2018).

Hypothesis 2 is proposed based on the above analysis:

H2: Digital transformation has an impact on ESG performance, which in turn enhances corporate market value.

3.3 Digital Transformation, Internal Controls and Enterprise Market Value

Internal control is a pivotal aspect of enterprise operation and management, significantly enhancing operational efficiency, optimizing governance structures, and establishing a comprehensive and efficient internal control system is essential for all enterprises. The structure of internal control differs among enterprises and its influence not only pertains to digital transformation but also directly correlates with the enterprise's market value. Consequently, this paper delves into internal control as a moderating variable. High-quality internal control enables managers to make decisions aligned with the enterprise's overall interests, effectively mitigating risks, aiding in scientific cost planning, and ultimately bolstering digital transformation. Therefore, internal control is recognized as a vital contractual tool for balancing stakeholders' interests and mitigating information asymmetry (Li 2020). In the burgeoning digital economy, the quality of an enterprise's internal control directly corresponds to its capacity to withstand risks and counteract adverse factors. Specifically, higher-quality internal control fortifies enterprises' defense and response capabilities against economic or market fluctuations, effectively dampening the impact of external shocks and substantially reducing systemic risk *levels* (Li, Y., Li, X., & Diajadikerta, H. G. 2020).

Hypothesis 3 is proposed based on the above analysis:

H3: Internal control quality plays a positive moderating role between digital transformation and firm market value.

4. Research Design

4.1 Data sources and sample selection

In the course of this paper, referring to the existing academic research results, the financial annual report data of manufacturing companies listed on the A-share market in China's Shanghai and Shenzhen cities during the period from 2011 to 2022 are selected as the research sample. In terms of data collection, this paper mainly relies on the Cathay Pacific (CSMAR) database. The selection and use of these data ensures the rigour and accuracy of the study and provides solid data support for the subsequent analysis and conclusions. In order to ensure the rigour of the empirical results, the following adjustments were made to the data collected in this paper: (1) data from ST, *ST, PT, and delisted companies during the period 2011-2022 were excluded; (2) data from companies that had initial public offerings (IPOs) during the period of the study were excluded; (3) data from companies that had missing key variables were removed; (4) only companies that had continuous data for three or more years; (5) a 1 per cent and 99 per cent reduction of the continuous variables was implemented.

4.2 Variable Definition and Measurement

(1) Explained variable: enterprise market value

Currently, Tobin's Q is mainly used as a proxy for the assessment of enterprise market value. In this paper, based



on the research method of Zhang Yeqing et al. (2021), the sum of the total market value and total liabilities is divided by the total assets of the company, which is used as the basis for the definition of enterprise market value. Tobin's Q is more relevant to the topic of this paper than other measures of corporate market value. Most of the other indicators are financial indicators, which reflect the operating conditions and book value of the enterprise, and are relatively weak in reflecting the market value of the enterprise. Tobin's Q can reflect the market value of the enterprise in a comprehensive way, so it is more in line with the research needs of this paper.

(2) Core explanatory variable: digital transformation

The measurement of digital transformation (DT) in enterprises continues to garner significant attention in contemporary academic research. Despite the introduction of various measurement methods, most are primarily grounded in theoretical constructs and encounter numerous practical challenges. Previous studies primarily rely on questionnaire survey sampling and text analysis methods for measuring DT. However, the questionnaire analysis method is limited in precision and comprehensiveness, prompting the text analysis method to emerge as the preferred choice (Brunetti et al. 2020). In this study, DT is measured by summarizing relevant terms and utilizing Python to count their occurrences in corporate annual reports. Based on Wu Fei's (2021) measurement method, an index system for assessing the digitization level of manufacturing enterprises is established using the word spectrum of their structured feature words related to DT. We employ Python software to scrape annual reports of listed manufacturing companies from 2011 to 2022. Relevant text content is extracted from these reports to construct a text database, and in-depth analyses are conducted based on specific key terms. By precisely matching and counting the DT feature word spectrum, the text data pool is meticulously classified and aggregated to count the DT word frequency. The summed word frequency is then calculated to develop a comprehensive and rigorous DT measurement system for manufacturing enterprises. Considering the 'rightbiased' nature of the aggregated results, the final results are log-transformed to form an indicator, enhancing the stability and accuracy of data analysis.

(3) Control Variable

In order to ensure the accuracy of the findings and to minimise the impact of disturbing elements, the following control variables are introduced in this paper: firm size (SIZE), nature of ownership (SOE), return on equity (ROE), financial leverage (LEV), equity concentration (CONCEN), and firm growth (GROWTH).

(4) Metavariable

On the basis of existing research, this paper selects the CSI ESG Index as a metric for assessing ESG performance. The CSI index combines China's specific market conditions to construct a rating system that is more suitable for China's current situation. The system evaluates the performance of companies in energy saving and emission reduction based on various aspects, and systematically assesses the comprehensive effectiveness of companies in promoting the process of carbon neutrality.

(5) Regulated Variable

In this paper, we use the data provided by the Dibble database as a variable to represent the internal control of enterprises, and explore and study the moderating role of the quality of internal control in the relationship between digital transformation and the market value of enterprises through the index of internal control in the database as an indicator. The specific definitions and descriptions of the variables are shown in Table 1.

Table 1 Definition of variables

Variable Symbol	Variable names	Variable Comments	
VALUE	Enterprise market value	the sum of the company's total market capitalisation and total liabilities divided by the company's total assets	
DT	Enterprise Digital Transformation	natural logarithmic value of the frequency of digital transformation keywords in the text of the annual report plus 1	
SIZE	Enterprise Scale	natural logarithm of total assets	
GROWTH	Company Growth	annual revenue growth rate	
LEV	Financial Leverage	asset-liability ratio	
SOE	Nature of property rights	State-owned enterprises take the value of 1; the rest take the value of 0.	
CONCEN	Shareholding Concentration	number of shares held by the largest shareholder/total number of shares	



Variable Symbol	Variable names	Variable Comments	
ROE	Rate of Return on Common Stockholders' Equity	net assets divided by average net assets	
ESG REPRESENTANTION	ESG	CSI ESG Index	
IC	Quality of internal control	Dibble database 'Index of internal control'	

4.3 Model Specification

To test hypotheses H1, H2, this paper constructs models (1) to (3):

$$\begin{split} VALUE_{i,t} &= \alpha_0 + \alpha_1 DT_{i,t} + \sum Controls + \sum Years + \sum Industry + \varepsilon_{i,t} \# (1) \\ ESG_{i,t} &= \beta_0 + \beta_1 DT_{i,t} + \sum Controls + \sum Year + \sum Industry + \varepsilon_{i,t} \# (2) \\ VALUE_{i,t} &= \gamma_0 + \gamma_1 DT_{i,t} + \gamma_2 ESG_{i,t} + \sum Controls + \sum Year + \sum Industry + \varepsilon_{i,t} \# (3) \end{split}$$

To test hypothesis H3 and explore the moderating effect of internal control, this paper constructs the following model:

$$IC_{i,t} = \delta_0 + \delta_1 DT_{i,t} + \delta_2 \times IC_{i,t} + \delta_3 DT_{i,t} \times IC_{i,t} + \sum Controls + \sum Year + \sum Industry + \varepsilon_{i,t} \#(4)$$

In the above models, i represents firms, while t represents years, Controls in Models 1, 2 and 3 are a series of control variables, and Industry and Year represent industry and year fixed effects.

5. Empirical results and analyses

5.1 Descriptive Statistics

Table 2 reports the results of the descriptive statistics performed on the key variables.

Table 2 Descriptive statistics

Variable	Sample Capacity	Averages	Standard deviation	Minimum	Median	Max
VALUE	10443	2.121	1.375	0.802	1.683	15.61
DT	10443	1.282	1.268	0.000	1.099	5.011
SIZE	10443	22.25	1.164	19.59	22.11	26.45
CONCEN	10443	34.43	14.11	8.020	32.37	75.78
ROE	10443	0.072	0.122	-0.926	0.073	0.437
GROWTH	10443	0.404	9.601	-3.095	0.108	865.9
LEV	10443	0.408	0.186	0.032	0.403	0.908
SOE	10443	0.359	0.480	0.000	0.000	1.000
IC	10443	638.7	131.5	0.000	664.8	977.7
ESG	10443	73.03	5.259	48.92	73.27	90.40

5.2 Multivariate Regression Analysis

Table 3 presents the empirical test results for hypotheses H1, H2, and H3. Column (1) shows the benchmark regression results, revealing a significant positive correlation between digital transformation (DT) and enterprise market value (VALUE) at the 1% significance level, after controlling for year, industry, and other variables such as enterprise size. This finding supports H1, indicating that digital transformation positively influences firm market value. To examine the potential mediating role of ESG between DT and VALUE, this paper investigates the relationship following the pathway of 'digital transformation-ESG performance-enterprise market value.' Column (2) of Table 3 indicates that DT has a significantly positive effect on ESG performance at



the 1% level. This suggests that digital transformation enhances ESG performance. Column (3) shows that ESG positively correlates with VALUE when both ESG and DT are included, validating H2, which posits the mediating role of ESG. Finally, column (4) reveals that the interaction term between DT and internal management is significantly positive at the 1% level, indicating that internal management quality augments the positive impact of DT on firm market value. Hence, H3 is empirically supported.

Table 3 Regression results of digital transformation, ESG, internal control and firm market value

	(1) VALUE	(2) <i>ESG</i>	(3) VALUE	(4) VALUE
DT	0.102***	0.353***	0.108***	-0.041
	(9.988)	(8.953)	(10.492)	(-0.841)
ESG			0.0153***	
			(6.013)	
IC				-0.001***
				(-9.861)
DT*IC				0.000***
				(3.047)
SIZE	-0.342***	1.030***	-0.326***	-0.330***
	(-26.137)	(20.494)	(-24.487)	(-25.235)
CONCEN	-0.001**	0.014***	-0.001*	-0.001
	(-2.143)	(4.182)	(-1.899)	(-1.479)
ROE	2.059***	6.676***	2.161***	2.460***
	(18.671)	(15.749)	(19.400)	(20.986)
GROWTH	-0.001	-0.025***	-0.001	-0.001
	(-0.746)	(-5.150)	(-1.049)	(-0.891)
LEV	-0.654***	-5.030***	-0.731***	-0.710***
	(-8.154)	(-16.304)	(-9.014)	(-8.878)
SOE	0.166***	0.590***	0.175***	0.167***
	(5.943)	(5.491)	(6.267)	(6.026)
CONSTANT TERM	9.728***	50.503***	10.500***	10.277***
	(35.803)	(48.363)	(34.987)	(36.844)
TEAR	control	control	control	control
SECTOR	control	control	control	control
N	10443	10443	10443	10443
R2	0.126	0.118	0.129	0.136

Note: t-values in parentheses; ***, ** and * indicate significant at the 1 per cent, 5 per cent and 10 per cent *levels*, respectively. Same table below.

6. Robustness Check

To enhance the validity of this paper, we replace the measures of both the explained variables and the core explanatory variables. Specifically, for the market value of enterprises, we adopt a revised assessment method for manufacturing enterprises based on the research findings of Adiputra & Hermawan (2020). We reflect the market value of these firms by calculating the logarithm of their market value. For the measurement of digital transformation, we utilize the research of Zhang & Bu (2024) and define it as the ratio of digital intangible assets to total intangible assets in the financial statements of listed manufacturing companies, calculated using the formula: total digital transformation intangible assets at the end of the year divided by total intangible assets at the end of the year. These revised measures have been implemented in specific empirical analyses and are presented in Table 4. Column (1) of Table 4 shows the results of replacing the digital transformation measure, column (2) displays the analyzed data after adjusting the enterprise market value measure, and column (3)



presents the empirical results after replacing both measures. By analyzing the data in Table 4, we find that the regression coefficients exhibit significant positive values regardless of the measurement method used. This finding supports the paper's core conclusion: a higher degree of digital transformation in manufacturing enterprises leads to a higher market value.

Table 4 Robustness analysis

	(1) VALUE (2) MADVETVALUE (2) MADVETVALUE		
	(1) VALUE	(2) MARKETVALUE	(3) MARKETVALUE
DT		0.041***	
		(12.002)	
DCG	0.669***		0.297***
	(5.844)		(7.691)
SIZE	-0.304***	0.854***	0.869***
	(-23.769)	(193.552)	(200.741)
CONCEN	-0.002**	-0.000*	-0.000**
	(-2.442)	(-1.677)	(-2.048)
ROE	2.066***	0.875***	0.879***
	(18.654)	(23.426)	(23.376)
GROWTH	-0.001	-0.000	-0.000
	(-0.870)	(-0.819)	(-0.970)
LEV	-0.672***	-0.283***	-0.290***
	(-8.354)	(-10.466)	(-10.688)
SOE	0.115***	0.060***	0.040***
	(4.149)	(6.409)	(4.279)
CONSTANT TERM	9.025***	3.858***	3.580***
	(33.583)	(42.102)	(39.446)
SECTOR	control	control	control
YEAR	control	control	control
N	10443	10443	10443
R2	0.120	0.845	0.844

7. Conclusion

Using a combination of textual and empirical analysis, this paper explores in depth the relationship between digital transformation, *ESG* performance, internal control quality and corporate market value. Through systematic research, this paper draws the following conclusions: (1) The degree of digital transformation is positively related to enterprise market value. (2) *ESG* has a mediating role in the impact of digital transformation on firm market value. (3) Internal control quality plays a positive moderating role between digital transformation and enterprise market value.

Through the above analysis, this paper puts forward the following suggestions: first, in the current era of the rapid rise of the digital economy, enterprises should closely follow the guidelines of the national policy, combine the internal environment of the enterprise to formulate a targeted digital transformation strategy, and enhance the management's attention to digital transformation, so as to enhance the effectiveness of the enterprise's internal control. Second, especially for manufacturing enterprises, accelerating the pace of digital transformation is particularly critical, which will effectively improve the operational efficiency of enterprises. Third, enterprises should widely integrate digital applications into various business areas and continuously upgrade their technology and digital capabilities to adapt to the increasingly competitive market environment. For the long-term development of enterprises, business managers must firmly support and encourage digital transformation to inject new vitality into their economic growth.

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