

Research on the Impact Mechanism of Digital Transformation on the High-quality Development of Enterprises

Huanhuan Xu, Xingxing Xu

School of Anhui University of Finance and Economics, Anhui 233030, China

Abstract

As we all know, digital development has gradually become the main tone and important engine of China's economic development, and China has entered the digital era. Based on this, this paper takes the data of China's A-share listed companies from 2010 to 2020 as a sample, studies the impact and mechanism of digital transformation on the high-quality development of enterprises, and finds that: (1) Digital transformation promotes the high-quality development of enterprises. (2) Internal control and media attention are the impact factors of digital transformation on the high-quality development of enterprises, that is, digital transformation promotes the high-quality development of enterprises by improving the internal control level of enterprises and the attention of external media.

Keywords

High-quality Development; Digital Transformation; Internal Controls; Media Attention.

1. Introduction

Since entering the new era, China has made major breakthroughs in many aspects, such as emerging technologies, 5G communications, cloud computing, big data, Internet of Things, artificial intelligence, etc. The digital economy relies on network infrastructure and emerging information technology, which will promote the economic development of enterprises and society by guiding the rapid and optimal allocation of factor resources, and achieve sustained and rapid growth, and the digital economy is leading China's economy into a high-quality stage. In March 2021, the 14th Five-Year Plan pointed out that it is necessary to accelerate China's digital development, build a digital China, and create new advantages in the digital economy. Give full play to the advantages of China's rich application scenarios and massive data, promote the deep integration of the real economy and digital technology, promote the digital transformation and upgrading of traditional industries, give birth to new industries, new formats and new models, and expand new engines of economic development. During the "14th Five-Year Plan" period, China's digital economy has gradually shifted to a new stage, which is characterized by standardized development, deepening application, and inclusive sharing. To promote the healthy development of China's digital economy, we must pay attention to the digital transformation of enterprises. On October 16, 2022, the 20th National Congress of the Communist Party of China was held, marking that China has entered a new era of digital economy, which will promote China's digital development and become an important engine for driving the high-quality development of China's economy. With the continuous development of data information, digital technology is gradually changing the current economic pattern we are facing, and digital transformation has become a global consensus as a new driving force for enterprises to achieve high-quality development. As a result, more and more companies are putting digital transformation at the heart of their strategy. So, how does digital transformation play a role in the high-quality development of micro enterprises? This is a question worth exploring.

There is some in the literature on digital transformation driving business development. For example, Chenyu Zhao et al. [1] pointed out that the digital transformation of enterprises is conducive to accelerating the flow of information and other elements within the enterprise, enabling the sharing of elements by enterprises, and this also improves the ability of enterprises to process information, greatly reducing the cost of enterprises in aggregating information, developing products, production and operation [2], which is conducive to the promotion and operation of enterprise production and operation processes and the upgrading and optimization of enterprise structure [3]. For example, in the process of production and operation management, digital technology can achieve accurate and efficient processing and intelligent utilization of complex and difficult data, which can break the barriers between different industries and fundamentally improve enterprise performance. Li L [4] pointed out that digital technology can optimize the collaborative management between enterprises, bring accurate and efficient operational advantages, and can use business data to optimize business processes, thereby reducing enterprise operating costs, improving economic efficiency and operational efficiency. Fan He et al. [5] pointed out that in the process of digital transformation, enterprises can use digital technology to upgrade existing products and services, so that on the one hand, services and products can be intelligentized and innovation of products and services can be realized; On the other hand, it can seek new market orientation, develop new business projects of enterprises, and achieve the goal of high-quality performance level. Chunhua Chen et al. [6] pointed out that the digital transformation of enterprises accelerates enterprise innovation and change and improves their economic performance with its unique operation locus.

But there are also some doubts. According to the actual relevant data, there are only a few companies that have successfully transformed, and some scholars have pointed out that there are still some difficulties in the transformation of most enterprises. As Chenggang zhang [7] pointed out, the current digital transformation of domestic enterprises is still in the basic application stage, and there are still some obstacles in the deep integration of traditional business and digital technology. Fei Wu et al. [8] believe that the current stage of enterprise organizational system and digital adaptation is low, which makes the transformation of enterprises take too long and the cost is too high, hindering the smooth transformation of enterprises' digitalization. Jiangtao Dong [9] conducted research from the perspective of auditing, and found that the current digitalization of enterprises lacks perfect institutional guarantees, and some enterprises carry out digital transformation out of the motive of "chasing profits", which is easy to affect the ability of enterprises to continue operation and increase audit risks.

Through combing, we can know that high-quality development is the only way for China's economic transformation and upgrading, but there are many studies on the impact of existing literature on the high-quality development of regional economy, and there are few studies on the high-quality development of enterprises, and there is little empirical exploration of its impact path. Therefore, this paper studies the impact of digital transformation on the high-quality development of enterprises at the micro level, and discusses the research path.

2. Theoretical Analysis and Research Hypotheses

2.1. Digital Transformation and High-quality Enterprise Development

Digital transformation is an innovative and changing process in which enterprises promote enterprise management and operation through digital means, such as big data and Internet of Things [10] Digital technology can optimize the collaboration lationship between various entities of enterprises, bring efficient and accurate operational advantages, and improve the efficiency of enterprises in cost management, resource allocation and business optimization

[11], thereby enhancing enterprises' ability to create value. One of the indicators commonly used to measure high-quality development and technological progress is total factor productivity. Regarding whether digital transformation can promote the improvement of total factor productivity, in the early stage of informatization, Solo questioned and proposed the "ICT productivity paradox". In fact, China's digital transformation already has a certain management foundation and technology, therefore, this paper believes that the degree of digital transformation will promote the high-quality development of enterprises. Specifically, it is manifested in the following aspects:

First, enterprise digital transformation has improved information asymmetry. In the process of enterprise production and operation, there will always be the problem of information asymmetry, which will lead to the information dividend cannot be effectively released and remain within the enterprise [10]. Digital transformation can excavate useful information in massive databases, improve the efficiency of information processing, stimulate enterprises to process efficiently, and improve the availability of information. For consumers and manufacturers, enterprises can obtain their feedback in a timely manner, timely and accurately understand the changing trend of the market, and then make efficient and accurate business decisions and strategic layout [12]; For the market, digital transformation can transmit information to market entities while improving the efficiency of information interaction between internal and external entities of enterprises, so that external market entities can grasp more comprehensive enterprise information, thereby reducing information asymmetry and realizing rapid response to resource allocation [13].

Second, digital transformation can enhance the internal control capabilities of enterprises. Digital transformation not only improves the information asymmetry outside the enterprise, but also improves the efficiency of internal information transmission within the enterprise, can solve the problem of "entrustment-agency", strengthens the internal control ability of the enterprise, and is conducive to creating a digital internal governance environment [14]. It enables enterprises to gradually improve in terms of financial stability, asset safety and reliable statements, effectively improves the quality of enterprise financial information, fully enhances the informativity and orderliness of enterprise business behavior, improves organizational management efficiency, and promotes the growth of total factor productivity of enterprises [15]. Based on this, this paper proposes hypotheses:

H1: Digital transformation promotes high-quality development of enterprises.

2.2. The Mediating Effect of Internal Controls and Media Attention

2.2.1. The Mediating Effect of Internal Control Quality

Internal control is an effective supervision and risk control mechanism for enterprise internal governance. Internal control is the impact factor of digital transformation on the high-quality development of enterprises, that is, digital transformation promotes the high-quality development of enterprises through internal control of enterprises. The improvement of internal control quality provides the internal basic conditions required for enterprises to achieve high-quality development[16]. With the development and optimization of digital technology, the flow of information within enterprises is smoother, enhancing the internal control capabilities of enterprises, and the stronger the internal control capabilities of enterprises, the more effective they can integrate their own resources, so as to achieve the dual progress of "efficiency improvement" and "risk reduction", thereby promoting the high-quality development of enterprises [17]. Based on this, hypothesis 2 is proposed:

H2: Digital transformation promotes the high-quality development of enterprises by improving the level of internal control.

2.2.2. The Mediating Effect of Internal Media Attention

As part of the external governance environment of enterprises, media attention has a certain impact on the high-quality development of enterprises. With the development of society, governments at all levels vigorously advocate the digital transformation of enterprises, hoping to promote the improvement of total factor productivity and industrial transformation and upgrading through the application of digital technology. On the one hand, media attention can play an information transmission function and reduce information asymmetry among stakeholders such as shareholders and external investors [18]; On the other hand, it can increase the attention of external investors to the company's strategy and supervise management to correct its own risk-taking behavior. Under the pressure of media supervision, enterprises will carefully formulate strategies to improve the quality of factor input, optimize production organization, increase management efficiency, etc., and maximize the purpose of achieving high-quality development of enterprises. Based on this, hypothesis 3 is proposed:

H3: Digital transformation promotes the high-quality development of enterprises by promoting media attention.

3. Study Design

3.1. Sample Selection and Data Sources

This paper takes the A-share listed companies in Shanghai and Shenzhen from 2010 to 2020 as research samples, empirically examines the impact of digital transformation on the high-quality development of enterprises, and processes the sample data as follows: (1) the sample of financial listed companies is excluded; (2) exclude samples of ST, *ST and listed companies that are about to be delisted; (3) Samples with missing values of relevant indicators during the study were excluded; (4) 1% tail reduction treatment before and after all continuous variables. The degree of digital transformation is obtained through crawler data aggregation, the region-level data is mainly from the "China Urban Statistical Yearbook", the internal control index is derived from the Dibo database, the media attention data is from CNRDS, and the rest of the data is from the Guotai An database and the Wind database. Collate your analysis with Stata software

3.2. Variable Selection and Definition

3.2.1. The Variable Being Explained

High-quality development of enterprises. This paper draws on the practice of Zenglian Zhang [19] and takes the total factor productivity of enterprises as a proxy variable for the high-quality development of enterprises. There are generally three methods for estimating total factor productivity at the enterprise level: OLS method, OP (Olley-Pakes) method and LP (Levinsohn-Petrin) method. The LP method not only has the OP method to better solve the problem of sample selection bias and endogenousness, but also can further solve the problem of data loss on the basis of the OP method, so this paper chooses the LP method to calculate the total factor productivity of enterprises, and the robustness test is measured by the OP method. Total factor productivity refers to the increase in output efficiency caused by factors such as management skills and technological progress, and is the part of input production factors that cannot be explained. Calculate total factor productivity with reference to the ideas of Lu Xiaodong and Yujun Lian[20].

3.2.2. Explanatory Variables

Digital Transformation (DCG). At present, most of the research on the digital transformation of enterprises is based on theoretical qualitative analysis, such as Chunhua Chen et al. [6], Jinghua Xiao [21], etc. In contrast, quantitative research based on the digital transformation of enterprises is rare. To empirically test the economic consequences of enterprise digital transformation, it is first necessary to highly condense the behavioral variable of "digital

transformation". Therefore, this paper draws on the practice of Fei Wu[8] as a proxy indicator of the degree of digital transformation of enterprises through the corresponding keyword word frequency measurement in the annual reports published by listed enterprises. Through the Python crawler function, the annual reports of all A-share listed companies on the Shanghai Stock Exchange and Shenzhen Stock Exchange are collected and organized. According to the characteristic word map of Fei Wu [8], search, match and word frequency count are carried out, and then the word frequency of key technical directions is classified and aggregated and the final word frequency is formed, so as to build an indicator system for enterprise digital transformation. Due to the typical "right-biased" characteristics of such data, this paper takes natural logarithmic processing to obtain the overall index that characterizes the digital transformation of enterprises.

3.2.3. Mediation Variables

Internal controls. There are two main ways to measure internal control, one is to see whether there are major deficiencies in the internal control self-evaluation report released, and the other is to select relevant indicators to construct an internal control index. However, the former is subject to the standardization of enterprise information disclosure; Secondly, it is difficult for the internal control self-evaluation report to fully contain all information related to the internal control of the enterprise, and it is affected by the subjective initiative of the enterprise, which is flawed in objectivity, and it is difficult to adopt it in empirical research, and lacks practicality. The latter usually examines the various factors of internal control by constructing indicators, and then comprehensively evaluates, which is more reliable. Based on this, this paper takes the Dibo internal control index as the index IC to evaluate the effectiveness of enterprise internal control, and divides it by 100. The index comprehensively and scientifically evaluates the effectiveness of internal control in the five aspects of strategy, compliance, reporting, asset safety and business results, and corrects internal control deficiencies, which is relatively accepted in the academic field [22]. The larger the internal control index, the higher the quality of internal control of the enterprise.

Media attention. For the measurement of media attention, some studies have chosen to use the number of reports that appear in books and newspapers, but with the development of the Internet, people are more and more inclined to obtain necessary information from the Internet, and online reports have gradually become an intermediary for people to understand corporate information.

3.2.4. Control Variables

To improve the accuracy of the study, a series of control variables were added to this paper. Including enterprise size (Size), asset-liability ratio (Lev), total net asset margin (Roa), cash flow ratio (Cashflow), enterprise growth (Growth), property rights (Soe), listing age (Listage) and equity concentration (Top1), and also control industry and year dummy variables, detailed variable structure description is shown in Table 1.

Table 1. Table of variable definitions

Type	Name	Abbreviation	Description
The variable being explained	High-quality development of enterprises	TFP	Measured by the LP method proposed by Levinsohn and Petrin (2003); The robustness test uses the OP method to measure TFP.
Explanatory variables	Digital transformation	DCG	According to the characteristic word map of Fei Wu (2021), search, matching and word frequency counting were carried out, and the final sum word frequency was formed by classification and aggregation, and the natural logarithm was processed.

Mediation variables	Internal controls	IC	Dibo's internal control index divided by 100
	Media attention	Media	The number of online media reports is added by one logarithm
Control variables	Enterprise size	Size	The natural logarithm of the total annual assets
	Gearing ratio	Lev	Total year-end liabilities divided by year-end total assets
	Net interest rate on total assets	Roa	Net profit divided by the average balance of total assets
	Cash flow ratio	Cashflow	Net cash flows from operating activities divided by total assets
	Business growth	Growth	The operating income of the current year is subtracted by one in addition to the operating income of the previous year
	Nature of Property	Soe	The value of state-controlled enterprises is 1, and the others are 0
	Years on the market	Listage	The current year minus the listing year plus 1 and then go to the natural logarithm
	Equity concentration	Top1	The number of shares held by the largest shareholder divided by the total number of shares
	Industry effect	Industry	Industry dummy variables
Year effect	Year	Year dummy variable	

3.3. Model Design

This paper constructs a model (1) to verify the relationship between digital transformation and total factor productivity of real enterprises:

$$TFP_{i,t} = \partial_0 + \partial_1 DCG_{i,t} + \partial_2 Control_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (1)$$

Among them, $TFP_{i,t}$ indicates the high-quality development level of the enterprise, $DCG_{i,t}$ indicates the digital transformation of the enterprise, and $Control_{i,t}$ is a series of control variables that may affect the high-quality development, and the industry effect and the year effect are controlled here, ε is random interference items. When ∂_1 is significantly positive, it indicates that digital transformation will promote the high-quality development of enterprises, otherwise it will inhibit high-quality development of enterprises.

This paper constructs the following model to examine the mediating role of internal control and media attention:

$$TFP_{i,t} = \partial_0 + \partial_1 DCG_{i,t} + \partial_2 Controls_{i,t} + \varepsilon_{i,t} \quad (2)$$

$$IC_{i,t}/Media_{i,t} = \partial_0 + \partial_1 DCG_{i,t} + \partial_2 Controls_{i,t} + \varepsilon_{i,t} \quad (3)$$

$$TFP_{i,t} = \partial_0 + \partial_1 DCG_{i,t} + \partial_2 IC_{i,t}/Media_{i,t} + \partial_3 Controls_{i,t} + \varepsilon_{i,t} \tag{4}$$

Among them, model (2) can provide the impact of digital transformation on the high-quality development of enterprises, which is also the previous model (1), model (3), IC represents the level of internal control of the enterprise, Media represents the degree of enterprise media attention. Model (4) examines the mediating role of internal control and media attention.

4. Empirical Results and Analysis

4.1. Descriptive Statistics

Table 2 is the descriptive statistical results of the main variables, and it can be seen from the table that in the sample, the standard deviation of digital transformation indicators is 1.364, and the mean value is 1.252, which indicates that the degree of digital transformation varies greatly between different enterprises, which is conducive to discovering valuable research results. The average value of total factor productivity is 9.032, indicating that the high-quality development of enterprises is good in the sample interval. The descriptive statistics for the other control variables are within the normal range.

Table 2. Descriptive statistics

Nane	Number	Mean	Median	SD	Minimum	Maximum
TFP_LP	27634.000	9.032	8.926	1.109	6.693	12.015
DCG	27634.000	1.252	0.693	1.364	0.000	4.956
Size	27634.000	22.190	22.013	1.287	19.812	26.179
Lev	27634.000	0.433	0.426	0.207	0.056	0.904
Roa	27633.000	0.038	0.037	0.064	-0.253	0.211
Cashflow	27634.000	0.045	0.045	0.070	-0.168	0.240
Growth	27627.000	0.173	0.104	0.432	-0.588	2.789
Soe	27615.000	0.360	0.000	0.480	0.000	1.000
Listage	27634.000	2.187	2.303	0.759	0.693	3.296
Top1	27634.000	0.343	0.321	0.148	0.087	0.743

4.2. Correlation Analysis

Table 3. Correlation analysis

	TFP_LP	DCG	Size	Lev	Roa	Cashflow	Growth	Soe	Listage	Top1
TFP_LP	1									
DCG	0.116***	1								
Size	0.816***	0.051***	1							
Lev	0.469***	-0.076***	0.494***	1						
Roa	0.122***	0.004	0.017***	-0.354***	1					
Cashflow	0.096***	-0.005	0.054***	-0.171***	0.377***	1				
Growth	0.111***	0.026***	0.037***	0.027***	0.240***	0.010	1			

Soe	0.281***	-0.163***	0.341***	0.281***	-0.074***	-0.006	-0.061***	1		
Listage	0.296***	-0.050***	0.380***	0.364***	-0.200***	-0.029***	-0.066***	0.427***	1	
Top1	0.206***	-0.113***	0.209***	0.063***	0.135***	0.086***	0.006	0.245***	-0.070***	1

p-values in parentheses

* *p* < 0.1, ** *p* < 0.05, *** *p* < 0.01 (Ibid)

Table 3 reports the Pearson correlation analysis results between the main variables, and the coefficient between digital transformation and high-quality development of enterprises is 0.116, which is significant at the level of 1%, indicating that the digital transformation of enterprises will promote the high-quality development of enterprises, which preliminarily confirms the hypothesis (1) of this paper, which is consistent with the previous theoretical analysis results. In addition, the correlation coefficient between the selected variables is small, and the variance inflation factor test results show that the maximum VIF value is 1.37, which is significantly less than 10, so there is no multicollinearity problem in the selection of variables.

4.3. Regression Result Analysis

Table 4. Main effect regression

	(1) TFP_LP
DCG	0.0561*** (0.0000)
_cons	-5.9446*** (0.0000)
size	0.6356*** (0.0000)
lev	0.8436*** (0.0000)
roa	2.2270*** (0.0000)
cashflow	0.6840*** (0.0000)
growth	0.1360*** (0.0000)
soe	0.0669*** (0.0000)
listage	0.0011 (0.8482)
top1	0.2692*** (0.0000)
Industry effect	Yes
Year effect	Yes
<i>N</i>	27607
adj. <i>R</i> ²	0.7551

Table 4 shows the regression results analysis for each variable.

Digital transformation and high-quality enterprise development. Multiple linear regression is performed on model (1), and the results are shown in Table 4, the correlation coefficient

between digital transformation and high-quality development of enterprises is 0.0561, which is significant at the level of 1%, indicating that digital transformation will promote the high-quality development of enterprises. Therefore, hypothesis 1 is validated.

Table 5 shows the test of the mediating role of internal control and media attention

Table 5. Mechanism of action test

	(1) TFP LP	(2) ic	(3) TFP LP	(4) TFP LP	(5) media	(6) TFP LP
DCG	0.0570*** (0.0000)	0.0460*** (0.0000)	0.0549*** (0.0000)	0.0570*** (0.0000)	0.0661*** (0.0000)	0.0563*** (0.0000)
ic			0.0451*** (0.0000)			
media						0.0107** (0.0232)
_cons	-5.3937*** (0.0000)	2.1330*** (0.0000)	-5.4899*** (0.0000)	-5.3937*** (0.0000)	-2.4124*** (0.0000)	-5.3680*** (0.0000)
Control	Yes	Yes	Yes	Yes	Yes	Yes
Industry effect	Yes	Yes	Yes	Yes	Yes	Yes
Year effect	Yes	Yes	Yes	Yes	Yes	Yes
N	27546	27546	27546	27546	27546	27546
adj. R ²	0.7451	0.2371	0.7475	0.7451	0.3572	0.7451

First, we focus on the regression results of internal controls, and as can be seen from Table 5, the estimated coefficient for the IC pair of the variables in column (2) is positive (estimated coefficient = 0.046) and significantly positive at the level of 1%. The estimated coefficients for the ICs of column (3) were all positive (estimated coefficient = 0.0451) and were significant at the 1% level. These results show that internal control is the mediating factor of digital transformation for the high-quality development of enterprises, that is, digital transformation promotes the high-quality development of enterprises by promoting the quality of internal control of enterprises, so hypothesis 2 is verified.

Secondly, the regression results of media attention, whether it is the estimation coefficient of variable CDG for variable Media or the estimation coefficient of variable Media for TFP_LP, are positive (estimated coefficient = 0.0661, 0.0563), and both are significant at the level of 1%, which indicates that media attention is the mediating factor of digital transformation for the high-quality development of enterprises. That is, digital transformation promotes high-quality development of enterprises by increasing media attention. Therefore, hypothesis 3 is validated.

5. Robustness Test

In order to ensure the reliability of the results, this paper uses the following methods to test the above results:

5.1. Replace the Explanatory Variable

In this paper, the LP method is used to estimate the total factor productivity in the benchmark test, and the OP method is used to re-measure the total factor productivity for robustness testing. The definitions of output variables, capital inputs, and labor input variables required by the OP method to estimate total factor productivity are consistent with the data under the LP method above, and the investment variables are consistent with the calculation methods of Lu Xiaodong and Lian Yujun[20]. The regression results are shown in column (1) of Table 5, the

coefficient of digital transformation is significant at the level of 1%, and the conclusion is consistent with the original regression results.

5.2. Replace Explanatory Variables

In the benchmark regression section, this paper draws on Fei Wu's [8] word frequency measure to construct proxy variables to measure the degree of digital transformation of enterprises. Drawing on the practice of Chun Yuan[23], a relatively complete digital dictionary is established with the help of the semantic expression of national policies related to the digital economy, and a text analysis method based on machine learning is used to construct an index that comprehensively reflects the digitalization degree of Chinese listed enterprises. The regression results are shown in column (2) of Table 5, and the coefficient of digital transformation is significant at the level of 1%, indicating that the main regression is robust.

5.3. Lagging Explanatory Variables

Considering that the impact of digital transformation on the high-quality development of enterprises may have a lagging effect, and in order to reduce the problem of two-way causation, this paper will explain the lag of digital transformation of variables, and the regression results are shown in column (3) of Table 5, and the conclusions are consistent with the original regression results.

Table 6. Robustness test

	(1)	(2)	(3)
	TFP_OP	TFP_LP	TFP_LP
DCG	0.0103*** (0.0007)		
Dig		0.0999*** (0.0000)	
L.DCG			0.0584*** (0.0000)
_Cons	-4.2228*** (0.0000)	-5.7042*** (0.0000)	-5.5827*** (0.0000)
Control	Yes	Yes	Yes
Industry effect	Yes	Yes	Yes
Year effect	Yes	Yes	Yes
<i>N</i>	26210	26210	21976
adj. <i>R</i> ²	0.7018	0.7444	0.7420

6. Conclusion

In summary, the high-quality development of enterprises is a conformance to the high-quality development of China's economy, and digital transformation is the development concept of enterprises, as well as the development strategy and direction. Intuitively speaking, the digital technology of enterprises promotes the improvement of internal control capabilities of enterprises and creates a more effective internal management system for enterprises; At the same time, it also enhances the attention of the outside world to enterprises, and realizes the social supervision responsibility of media supervision for the high-quality development of enterprises. Through digital transformation, enterprises need to combine their own development with the development of the market industry chain, strengthen their connection with the market, and gain advantages in the macro environment competition.

Acknowledgments

Fund projects; Anhui University of Finance and Economics Graduate Research and Innovation Fund Project "Development Path and Risk Analysis of Carbon Financial Products from the Perspective of 'Dual Carbon Goals'" (ACYC20211465).

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