



Research on the Impact Mechanism of Enterprise Digital Transformation on Enterprise Value Based on Data from Guangdong Province

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Abstract. Enterprise digital transformation can benefit enterprises to enhance their competitive strength and is an important driving force for high-quality development. As a highly active region in terms of science and technology factors, digital transformation in Guangdong Province has become an important driving force and direction for the province's economic development. By collecting relevant data from 338 listed companies in Guangdong Province from 2017 to 2022 and using empirical analysis, this paper finds that Enterprise Digital Transformation Can Significantly Increase Enterprise Value, and finds that digital transformation has a more obvious enterprise value enhancement effect on non-state-owned enterprises, high-tech enterprises, and enterprises in the Pearl River Delta (PRD) region, and that, after adding the moderating variable financing constraints, the After adding the moderator variable financing constraints, it is found that financing constraints can weaken this enhancement relationship, and it is also found that the digital transformation of enterprises can improve the level of R&D and innovation and operational efficiency of enterprises, thus promoting the enhancement of enterprise value, based on which this paper puts forward suggestions to help promote the digital transformation of enterprises and boost enterprises to achieve a higher-quality development.

Keywords: digital transformation; enterprise value; fixed effects model; heterogeneity analysis.

1 Introduction

With the rapid development of digital technology and the rapid changes in the global economy, the scale of China's digital economy continues to grow, and the trend of industrial digitisation is becoming more and more obvious. The country has also introduced corresponding policies to promote digital transformation and upgrading, such as in Vision 2035, which explicitly states that the digital economy is an important frontier of scientific and technological innovation, which is related to the overall situation of the country's development, and is of great significance for achieving high-quality development and comprehensively building a modern socialist country. Guangdong Province, as a national economic development highland, to seize the first opportunity and

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K. Zhang et al. (eds.), *Proceedings of the 4th International Conference on Management Science and Software Engineering (ICMSSE 2024)*, Advances in Engineering Research 244,

https://doi.org/10.2991/978-94-6463-552-2_6

win the initiative in the development, we must make the digital economy to empower high-quality development. The development of enterprises plays a key role in the quality of the social economy, and the transformation and upgrading of enterprises to digital technology for business can not only establish their own digital competitive advantage and obtain more investment resources, but also optimize the governance structure of enterprises [1]. However, at present, the digital transformation of enterprises in China has also encountered some problems, such as the existence of a weak foundation for digital transformation, the fear that digital transformation may bring risks and thus unwillingness and fear of transformation [2]. For this reason, it is valuable to study the relationship between enterprise value and the degree of enterprise digital transformation.

Combing through the relevant literature in recent years, it can be seen that many scholars study the relationship between enterprise digital transformation and enterprise value and the influence mechanism. Zoran Dragičević suggests that digital transformation can quickly have an impact on the business entity and its organizational structure, on business strategy, value streams, operating models and on the internal relationships of business people [3]. T. Abiodun proposes that enterprise digital transformation can promote the intelligent development of enterprises and enhance their integration capabilities, which is also an enabler for improving organizational performance in the context of Industry 4.0 [4]. Li Zhihong proposed that the moderating effects of industry competition and firm nature on digital transformation and firm value are significantly different, and digital transformation of firms can improve internal control and operational efficiency [5]. Based on the difference of enterprise life cycle, Wang Tianli found an inverted U-shaped relationship between digital transformation and enterprise value, and digital transformation did not significantly enhance the value of enterprises in the decline period [6]. Wang Ronglu empirically found that digital transformation has a positive relationship with enterprise value and can improve enterprise value by reducing supply chain costs of listed companies [7]. It can be found that most of the literature does not focus on specific regional enterprises, Based on this, this paper focuses on whether the digital transformation of enterprises in Guangdong Province can bring value growth for enterprises.

2 Theoretical Analysis and Research Hypothesis

2.1 Enterprise Digital Transformation and Enterprise Value

Enterprises choose digital transformation as a corporate strategy to utilize digital technology for more efficient production and management, and digital quantitative data for decision-making analysis, so as to achieve enterprise value-added and development [8]. Specifically, enterprises apply digital technology to enhance corporate innovation capacity improvement, optimize internal control and resource allocation, thus promoting the improvement of the operational efficiency of corporate organizational structure [9]. Accordingly, the first hypothesis is formulated in this paper.

H1: Digital transformation can have an uplifting effect on enterprise value, which means that the value of an enterprise increases as it becomes more digitally transformed.

2.2 Enterprise Digital Transformation, Enterprise Value and Financing Constraints

When the enterprise faces higher financing constraints, digital transformation will take up part of the enterprise cash flow, and digital transformation faces a greater risk of revenue, which will affect the enterprise's allocation of funds, which may lead to the enterprise to suspend the enterprise digital transformation [10]. Based on this, the second hypothesis is proposed in this paper.

H2: When firms have strong financing constraints, the value-enhancing effect of digital transformation on firms is made significantly smaller.

2.3 Enterprise Digital Transformation, Enterprise R&D Innovation and Enterprise Operational Efficiency

Digital transformation brings more efficient and intelligent production methods and business models for enterprises, on the one hand, it can help enterprises to improve the efficiency of enterprise operations, streamline costs, optimize management, on the other hand, it is conducive to the convergence of innovative elements, reduce the search costs and transaction costs in economic activities, and then promote the efficiency of R & D innovation and enhance the strength of R & D innovation, and there are more ways to carry out the iteration of driven product innovation, thus promoting the enterprise value enhancement [11]. Accordingly, this paper proposes hypotheses 3 and 4.

H3: Enterprise digital transformation can improve cost management and enhance the efficiency of business operations, thus contributing to the value of the enterprise.

H4: Enterprises undergoing digital transformation can promote enterprises to carry out R&D innovation, which is conducive to the enhancement of enterprise value.

Combining the above assumptions, the transmission mechanism of enterprise digital transformation affecting enterprise value can be derived as shown in Fig. 1:

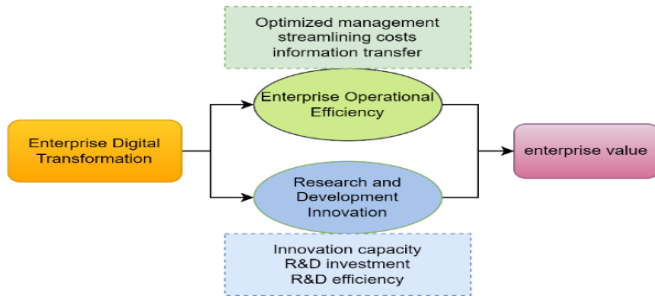


Fig. 1. Digital transformation mechanism diagram

2.4 Enterprise Digital Transformation and Enterprise Resource Heterogeneity

Heterogeneous resources have greater differentiation, which can bring enterprises including technology, manpower, management mode and other obvious differences in resources, other enterprises want to utilize these resources, must pay more additional costs, so this makes the enterprise itself more competitive advantage in the market, so as to enhance enterprise value [12]. This shows that it is important to consider the relationship between enterprise digital transformation and enterprise value from the perspective of heterogeneity. From the perspective of whether the enterprise is state-owned or not, state-owned enterprises have a better risk-taking ability compared to non-state-owned enterprises because of the special social responsibility and controller, so the internal structure is usually more complete. Non-state-owned enterprises will be more receptive to new models, but usually have to bear more transition costs. In terms of whether the enterprise is a high-tech industry enterprise, high-tech industry enterprises usually have a better technological base and are more likely to take advantage of digital transformation, while non-high-tech industry enterprises may have technological barriers that make transformation difficult. In terms of the region where the enterprise is located, the Pearl River Delta region in Guangdong Province is obviously stronger economically than other regions in Guangdong Province, with more complete digital transformation infrastructure and stronger policy support. Therefore, this paper analyzes the heterogeneity from the nature of enterprise property rights, whether the enterprise belongs to high-tech industry and whether the region where the enterprise is located belongs to the Pearl River Delta. Based on the above analysis, the research idea of this paper is shown in Fig. 2:

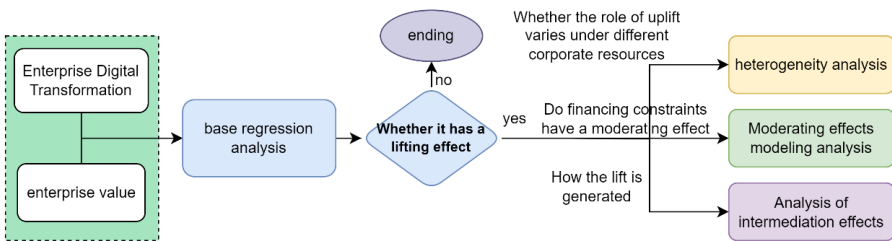


Fig. 2. Research idea framework

3 Model Design

3.1 Variable Description and Model Setting

3.1.1 Explanation of Variables.

According to the findings of this paper with reference to the mainstream literature, the explanatory variable is enterprise value, and this paper selects the TQA value to define this variable, and a larger TQA means a larger enterprise value as well. The explanatory variable is the digital transformation of the enterprise, which is measured by the degree of digitization (DIG), which is obtained by logarithmic sum of digitized

word frequency. To ensure the validity of the model, return on equity (ROE), firm size (size), age of establishment (age), gearing ratio (lev), net profit growth rate (growth), equity concentration (gq), and nature of property rights (soe) are selected as control variables, and financing constraints (SA) are used as moderating variables, The SA index is absolute-valued for ease of understanding. Individual (sym) and year (year) are set as dummy variables.

3.1.2 Empirical Model Setting.

This study fixes individual and time, and adopts the double fixed effect model, which is based on the research hypotheses and variable settings in the previous section:

$$TQA_{i,y} = \mu_0 + \mu_1 * DIG_{i,y} + \mu_j * Controls_{i,y} + sym_y + year_i + \omega_{i,y} \quad (1)$$

μ_0, μ_1, μ_j are all constant terms, if the result of μ_1 coefficient is positive, it indicates that the degree of enterprise digitisation has a positive impact on enterprise value, and a negative coefficient indicates a negative impact. $Controls_{i,y}$ are the control variables, sym and year indicate that individual and time effects are controlled, and finally $\omega_{i,y}$ indicates the random interference term.

To further test Hypothesis 2, the moderating effect of financing constraints (SA) on the relationship between digital transformation and firm value, this paper sets up a cross term M and constructs the following moderating effect model:

$$M = SA_{i,y} * DIG_{i,y} \quad (2)$$

$$TQA_{i,y} = \mu_0 + \mu_1 * DIG_{i,y} + \rho_1 * SA_{i,y} + \gamma_1 * M + \mu_j * Controls_{i,y} + sym_y + year_i + \omega_{i,y} \quad (3)$$

In order to carry out the test of the influence mechanism, referring to the approach of Zhonglin Wen et al, this paper adopts the three-step regression method to analyze, and the analysis idea is shown in Fig.3. This paper chooses R&D innovation (CX) and operational efficiency (XL) as mediating variables. Where CX uses the ratio of enterprise R&D expenses to operating income, and XL uses the enterprise operating cost ratio, the constructed model is as follows, where (4) (5) (6) model is to carry out the mediating effect of R&D innovation, and (7) (8) (9) is to carry out the mediating effect of the enterprise operating efficiency:

$$TQA_{i,y} = \partial_0 + \partial_1 * DIG_{i,y} + \partial_j * Controls_{i,y} + sym_y + year_i + \omega_{i,y} \quad (4)$$

$$CX_{i,y} = \theta_0 + \theta_1 * DIG_{i,y} + \theta_j * Controls_{i,y} + sym_y + year_i + \omega_{i,y} \quad (5)$$

$$TQA_{i,y} = \varepsilon_0 + \varepsilon_1 * CX_{i,y} + \varepsilon_2 * DIG_{i,y} + \varepsilon_j * Controls_{i,y} + sym_y + year_i + \omega_{i,y} \quad (6)$$

$$TQA_{i,y} = C_0 + C_1 * DIG_{i,y} + C_j * Controls_{i,y} + sym_y + year_i + \omega_{i,y} \quad (7)$$

$$XL_{i,y} = \beta_0 + \beta_1 * DIG_{i,y} + \beta_j * Controls_{i,y} + sym_y + year_i + \omega_{i,y} \quad (8)$$

$$TQA_{i,y} = \alpha_0 + \alpha_1 * XL_{i,y} + \alpha_2 * DIG_{i,y} + \alpha_j * Controls_{i,y} + sym_y + year_i + \omega_{i,y} \quad (9)$$

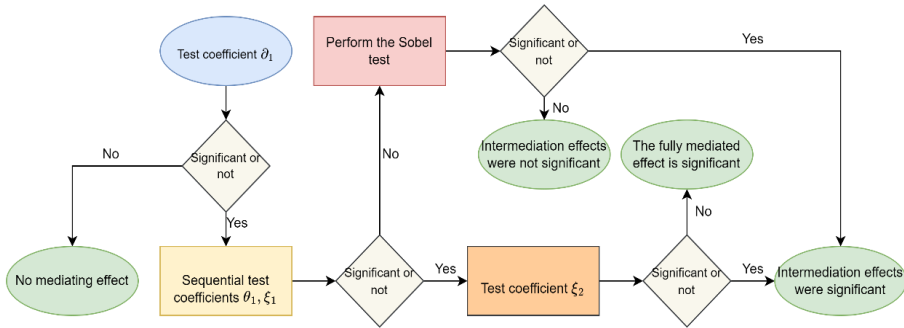


Fig. 3. Ideas for analyzing intermediary effects (using the example of intermediary effects from R&D innovation)

3.2 Data Description

In 2020, the National Development and Reform Commission (NDRC) explicitly listed "accelerating digitalization development" as an important guideline, and the digital transformation of enterprises has been on the rise, and Guangdong Province, as a region with high activity of scientific and technological factors, has a typical and pioneering nature of the development and transformation of enterprises. Based on this situation, this paper takes enterprises in Guangdong Province as the research object, and selects the data of A-share listed companies in Guangdong Province in the five years before and after 2020 (2017-2022) as the sample for research and analysis, and the relevant data used is from CSMAR database. In order to test the model more scientifically, the companies that were ST and ST* during the sample period were excluded, and the samples of the financial industry, the monetary service industry and some listed companies that do not carry out digital transformation were removed, and continuous variables were subjected to an upward and downward 5% shrinkage, and finally 1,364 observations were obtained. And, the data processing of empirical analysis is carried out using stata software to get the results of empirical analysis.

4 Analysis of Empirical Results

4.1 Descriptive Statistics

According to the results in Table 1, it can be seen that the minimum value of TQA is 1.087, the maximum value is 4.423, the overall difference is not particularly large, the minimum value of DIG is 0, the maximum value is 5.037, the mean is 2.456, the overall is not particularly high, and the standard deviation is more than 1, which indicates that the overall difference is large. And other control variables from the standard deviation, the overall difference is relatively small.

Table 1. Descriptive statistics

VARIABLES	N	mean	sd	min	max
DIG	1,364	2.456	1.500	0	5.037
ROE	1,364	0.0239	0.0344	-0.0245	0.116
TQA	1,364	2.019	0.891	1.087	4.423
lev	1,364	0.354	0.183	0.0815	0.701
size	1,364	21.68	0.984	20.13	23.66
age	1,364	2.935	0.277	2.398	3.367
soe	1,364	0.175	0.380	0	1
gq	1,364	0.309	0.126	0.126	0.567
SA	1,364	3.899	0.241	3.510	4.396

4.2 Benchmark Regression Analysis and Robustness Test

As can be seen from Table 2, Column (1) is the regression result, the estimated coefficient of enterprise digital transformation is 0.084 and significant, indicating that hypothesis 1 is verified, i.e., the higher the degree of enterprise digital transformation, the greater its enterprise value. In order to test the robustness of the model, this paper adopts the method of replacing the dependent variable, that is, using TQB as a measure of enterprise value, and then conducts regression analysis again, and the regression results are shown in Column (2), and the coefficient of the enterprise's digital transformation becomes larger to 0.104, and it is still significant, which indicates that Hypothesis 1 still holds.

Table 2. Benchmark regression and robustness tests

VARIABLES	TQA	TQB
DIG	0.084*** (2.68)	0.104*** (2.97)
growth	-0.018 (-0.90)	-0.024 (-1.04)
ROE	2.372** (2.51)	2.442** (2.30)
lev	0.100 (0.40)	-0.370 (-1.23)
size	-0.340*** (-4.50)	-0.111 (-1.24)
age	-0.456 (-0.71)	-0.536 (-0.76)
soe	-0.203* (-1.73)	-0.389*** (-3.04)
gq	-1.604** (-2.53)	-2.299*** (-3.08)
Constant	10.980*** (4.49)	6.847** (2.43)
Observations	1,328	1,328
R-squared	0.733	0.743
sym FE	year FE	year FE

t statistics in parentheses*** p<0.01, ** p<0.05, * p<0.1

4.3 Heterogeneity Analysis

In this paper, we choose the nature of property rights, whether the enterprise belongs to the high-tech industry and the region where the enterprise is located to analyze the heterogeneity. The data results are shown in Table 3 and Table 4. As the data in Table 3 shows, in column (1) shows the results of the sample data of state-owned enterprises, the coefficient of enterprise digital transformation is -0.018, with no obvious positive correlation, but the sign of the coefficient becomes negative, which indicates that the digital transformation of the state-owned enterprises has no obvious positive impact on the value of the enterprise, but it may be inhibited; and in column (2), the coefficient of digital transformation of the non-state enterprises is 0.112, the coefficient becomes larger and significant, which indicates that the digital transformation of the non-state enterprises plays a more important role in enhancing the value of enterprises. In column (2), the coefficient of digital transformation in non-state-owned enterprises is 0.112, the coefficient becomes larger and significant, which indicates that digital transformation in non-state-owned enterprises plays a more enhancing role on enterprise value. This may be due to the fact that state-owned enterprises have a large number of talented people and financial and technological resources, with financial support from the government, less competitive pressure, less urgency to open up the market, and the demand for digital transformation is not particularly sufficient, while non-state-owned enterprises are more sensitive to the policies implemented by the government and the market environment, and there is a greater pressure on the market competition, and they will be more active in adjusting their production methods.

Table 3. Heterogeneity analysis of the nature of property rights

VARIABLES	(1)	(2)
DIG	-0.018 (-0.28)	0.112*** (3.02)
Constant	14.475*** (3.12)	9.804*** (3.33)
Observations	236	1,086
R-squared	0.837	0.722
sym FE	year FE	year FE

t statistics in parentheses*** p<0.01, ** p<0.05, * p<0.1

Combined with the results of the data in Table 4, for enterprises in the Pearl River Delta (PRD) region, the coefficient of the impact of digital transformation on enterprise value is 0.084 and the level of significance is two stars; for enterprises in the non-PRD region, the impact of digital transformation on enterprise value is not significant. The coefficient of the impact of digital transformation on firm value for firms in the high-tech industry is 0.096 and is significant at the 5% level; while the impact of digital transformation on firm value is not significant for firms in the non-high-tech industry sample. This may be due to the fact that enterprises in the Pearl River Delta (PRD)

region are located in more developed economic environments and more competitive markets compared to non-PRD enterprises, all digital transformation technologies are more mature and have more experiences to follow, in addition, government policies are more supportive of enterprise reforms, so enterprises in these regions have a better opportunity and foundation to undergo digital transformation. As for the high-tech industry enterprises themselves, they are highly technology-intensive, with stronger R&D capabilities and higher innovation awareness, and have better internal organizational structures to promote enterprise digital transformation, while non-high-tech industry enterprises usually have lower willingness to innovate and relatively weaker ability to apply technology, and may have difficulties in digital transformation.

Table 4. Heterogeneity analysis of the nature of regions and industries

VARIABLES	(1)	(2)	(3)	(4)
DIG	0.084** (2.56)	0.082 (0.85)	0.096** (2.28)	0.055 (1.20)
Constant	11.508*** (4.35)	-4.911 (-0.73)	11.850*** (3.64)	9.014*** (2.66)
Observations	1,217	111	876	451
R-squared	0.736	0.591	0.678	0.821
sym FE	year FE	year FE	year FE	year FE

t statistics in parentheses*** p<0.01, ** p<0.05, * p<0.1

4.4 Moderating Effect Analysis

In the Table 5, it can be seen that adding the moderating variable SA to the regression model, its coefficient on the dependent variable is significant, and after continuing to add the cross term M in column (2), the coefficient of the cross term is still significant, which indicates that there is a moderating effect of financing constraints, and it can be found that the coefficient of M is -0.315, which suggests that the financing constraints significantly weakened the role of the promotion of the digital transformation on the enterprise's value, which supports the hypothesis 2 of the Conclusion.

Table 5. Results of moderating effects

VARIABLES	(1) TQA	(2) TQA
DIG	0.090*** (2.90)	0.088*** (2.86)
SA	-1.882** (-2.50)	-1.957*** (-2.62)

M		-0.315***
		(-3.14)
Constant	15.216***	15.582***
	(4.99)	(5.14)
Observations	1,328	1,328
R-squared	0.735	0.738
sym FE	year FE	year FE

t statistics in parentheses*** p<0.01, ** p<0.05, * p<0.1

4.5 Analysis of Mediating Effects

Column (1) in Table 6 below shows the impact of the degree of digital transformation of listed companies on their enterprise value, and the results are in line with Hypothesis 1, as can be seen from the previous analysis. Column (2) is the regression result after adding enterprise operating efficiency as a test of its relationship with enterprise digital transformation, the coefficient is -0.008 and the significant level is 1%, which can indicate that digital transformation can effectively reduce enterprise operating costs and improve operating efficiency. Column (4) for the enterprise operating efficiency and digital transformation at the same time to join the main regression model results, can be seen that the coefficient of digital transformation on enterprise value and the coefficient of enterprise operating efficiency on enterprise value has decreased, but still significant, thus proving that hypothesis 3 is valid, the enterprise digital transformation can indeed promote the improvement of the enterprise operating efficiency and thus enhance the value of the enterprise. Similarly, can column (3) shows that enterprise digital transformation can benefit enterprise R & D innovation, combined with column (5) can be found in the coefficient of digital transformation on enterprise value and enterprise R & D innovation on enterprise value of the coefficient are significant, it can be judged that the hypothesis 4 is also established.

Table 6. Results of the analysis of intermediary effects

VARIABLES	(1) TQA	(2) XL	(3) CX	(4) TQA	(5) TQA
DIG	0.084*** (2.68)	-0.008*** (-2.64)	0.002* (1.81)	0.078** (2.52)	0.080** (2.57)
XL				-0.684* (-1.88)	
CX					1.738** (2.03)
Constant	10.980*** (4.49)	0.360* (1.73)	-0.035 (-0.33)	11.226*** (4.60)	11.041*** (4.55)
Observations	1,328	1,328	1,328	1,328	1,328
R-squared	0.733	0.752	0.853	0.734	0.734
sym FE	year FE	year FE	year FE	year FE	year FE

t statistics in parentheses*** p<0.01, ** p<0.05, * p<0.1

5 Conclusion

This paper investigates the relationship between digital transformation and enterprise value in Guangdong Province, and finds that digital transformation can promote the enhancement of enterprise value. And after heterogeneity analysis, it is found that the effect of digital transformation on the enhancement of enterprise value is not obvious in state-owned enterprises and more obvious in non-state-owned enterprises; the effect of digital transformation on the enhancement of enterprise value is more obvious for enterprises in the Pearl River Delta (PRD) region and less obvious for non-PRD enterprises; this difference also exists between enterprises in high-tech industries and those in non-high-tech industries, and the effect of digital transformation is more obvious for high-tech enterprises and less obvious for enterprises in non-high-tech industries. This difference also exists between high-tech and non-high-tech industry enterprises, with a more obvious role in high-tech industry enterprises and a less obvious role in non-high-tech industry enterprises. Meanwhile, after the mechanism analysis, it is found that digital transformation achieves the result of enhancing enterprise value by improving the operational efficiency and innovation level of enterprises. And financing constraints can play a moderating function in the role of digital transformation in the enhancement of enterprise value. Therefore, this paper puts forward the following suggestions for enterprises in Guangdong Province to carry out digital transformation: first of all, the government needs to reflect the regional differences in the policy guidance of digital transformation of enterprises, and should tilt towards the regions with insufficient resources in terms of finance, technology and talents, strengthen the infrastructure construction and technical guidance of digital transformation in non-Pearl River Delta (PRD) regions, and reduce the risks and costs of enterprise transformation. For enterprises, they should continue to implement the digital transformation strategy, keep up with the trend of digital economic development, enhance the awareness of technological innovation, actively introduce mature digital talents and improve the talent management system. Enterprises in different industries can carry out digital transformation experience exchange, through resource sharing to expand the overall level of digital transformation of enterprises. At the same time, in promoting enterprises to accelerate the process of digital transformation, we need to pay attention to the financing environment, enterprises and the government should focus on improving the financing environment, through the implementation of relevant policies to accelerate the improvement of the construction of enterprise credit guarantee system.

Acknowledgment

Supported by Social Sciences Project of Guangdong University of Science and Technology (GKY-2023KYQNW-8).

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