

Does Digital Transformation Promote Enterprise Development? Evidence From Chinese A-Share Listed Enterprises

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ABSTRACT

With the aim of exploring how digital transformation impacts enterprise development in China, this study takes Chinese A-share listed enterprises from 2007 to 2020 as the research sample and constructs a digital transformation index and an enterprise development index. The impact of digital transformation on enterprise development and its mechanisms are investigated. The empirical results show the following findings. First, digital transformation can significantly promote enterprise development. Second, the effect of digital transformation on enterprise development is stronger in enterprises located in inland regions compared to in coastal regions and is more powerful in enterprises with high levels of development than in those lagging in development. Third, digital transformation can benefit enterprise development by alleviating financing constraints, effectively reducing business risks and driving technological innovation. Fourth, China's economic policy uncertainty is an important external factor weakening the role of digital transformation in driving enterprise development.

KEYWORDS:

Digitization, Business Risks, Financing Constraints, Technological Innovation, Mediation, Moderation, Principal Component Analysis, Text Analysis

INTRODUCTION

Informatization, characterized by digitization, networking, and intelligence, has swept the world (Horoshko et al., 2021). The digital economy has, therefore, become a critical area of competition between major economies (Zhao & Zhou, 2022). At the same time, developing the digital economy has become a strategic choice for China in efforts to access the benefits of the latest iteration of the technological and industrial revolution (Pan et al., 2022). As an essential component of the digital economy, the digital transformation of enterprises can lead to the creation of higher value-added products and services, as well as momentum for development (Popkova et al., 2022). This, thereby, expands the development space of enterprises. Moreover, COVID-19 has forced enterprises to drive the digital transformation, which has improved traditional business models (Guo & Xu, 2021).

The relationship between digital transformation and enterprises has attracted widespread attention from scholars and policymakers (Daradkeh, 2021; Vu & Hartley, 2022). However, as the digital transformation of some Chinese enterprises remains in its early stages, they may struggle

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with financial constraints, high business risks, and low technological innovation (Li & Yang, 2021). Uncertainty from frequent changes in economic policy can reduce the accuracy of enterprise decisions. These factors will present challenges to enterprise development. Therefore, research should explore and identify transmission mechanisms between digital transformation and enterprise development to address with the many challenges.

To explore how digital transformation impacts enterprise development in China, this study investigates the direct impact of digital transformation on enterprise development and varying degrees of development. It then analyzes the mediating and moderating effects. By doing so, the study makes several contributions to the literature. First, it constructs a comprehensive index of enterprise development based on profitability, growth capacity, asset utilization efficiency, and debt-paying ability. These provide a reference for accurate assessment of enterprise development. Second, based on the perspective of cash flow, the mechanisms of digital transformation on enterprise development are investigated. It considers an enterprise's financial constraints, business risks, and technological innovation. Third, this study incorporates China's economic policy uncertainty into the research framework to show the impact of digital transformation on enterprise development in the face of uncertainty.

This study, therefore, is of great theoretical importance to fully reveal the internal transmission mechanism and external influence mechanism of digital transformation on enterprise development. It can also provide a reference for enterprises to deploy digital transformation projects according to their unique characteristics.

The remainder of the article is organized as follows. The following section includes a literature review of theoretical mechanisms and research hypotheses. This is followed by a description of the research design and descriptive statistics. The subsequent section depicts the basic empirical findings, followed by the investigation of the effect of digital transformation on enterprise development at various stages. After that, the article explores mechanisms for digital transformation that impact enterprise development. Finally, the study provides a discussion and conclusion.

THEORETICAL MECHANISM AND RESEARCH HYPOTHESES

Relationship Between Digital Transformation and Enterprise Development

The digital transformation of enterprises has attracted attention from both policymakers and scholars. In recent years, the digital transformation of enterprises has been driven by cloud computing, blockchain, virtual reality, and other digital technologies. These technologies ultimately contribute to enterprise development by promoting innovation of an organization's business model and reconfiguration of the business ecosystem (Sebastian et al., 2017). Scholars have defined the digital transformation of enterprises as a process that uses a combination of information, computation, communication, and connection technologies to improve itself by enabling major changes in its attributes (George & Schillebeeckx, 2022; Vial, 2019; Zhu et al., 2021).

Enterprise development refers to the process of further operating a business, allowing the business model and products to continue to improve and enhance enterprise competitiveness. These efforts result in higher operational efficiency and revenue. Studies have assessed the quality of enterprise development from various perspectives. Enterprise development can be reflected in increased profitability, such as higher net margin and return on equity (Musah et al., 2018), or asset utilization efficiency, such as an increased total asset turnover ratio (Dong et al., 2021). The ability to pay debts is an essential factor affecting enterprise development, as reflected by the debt-to-asset ratio (Jiang et al., 2021). Moreover, development potential in areas like the self-sustainable growth rate and economic value added should be considered (He et al., 2021).

Digital transformation is an inevitable task faced by every enterprise in the high-quality developmental stage of China's economy (Li & Yang, 2021). The new digital technologies are

revolutionizing innovation models, organizational performance, and production efficiency (Kwilinski, 2018). Such aspects should be reflected in the level of enterprise development. Digital transformation improves communication and monitoring capacities while cutting search costs; therefore, it facilitates coordination and management for multinational enterprises (George & Schillebeeckx, 2022). Moreover, digital transformation helps enterprises achieve higher business performance by disrupting industry and regional monopolies (Guo et al., 2022). Finally, digital transformation can change marketing activities in small- and medium-sized enterprises, which encourages digital marketing (Ziółkowska, 2021). Based on previous studies, it can be inferred that digital transformation is beneficial to enterprises in many ways. Therefore, the following hypothesis is proposed:

H1: Digital transformation of enterprises can greatly promote their development.

Mechanisms Underlying the Impact of Digital Transformation on Enterprise Development

Implementing a digital transformation can have a heavy impact on enterprise financing, operating, and investing, which serve as main sources of cash flow. First, digital transformation could enhance the capability of enterprises to obtain funds and ease financial constraints. In China, the national strategy of digital economy enables digital transformation enterprises to access policy support (Luo et al., 2021). Therefore, enterprises can obtain more resources and preferential policies from the government to relieve internal capital pressure (Hinings et al., 2018). Additionally, digital transformation can reduce information asymmetry and alleviate credit resource mismatches (Reddy & Reinartz, 2017; Yao & Yang, 2022). Adopting digital technologies can help credit institutions gather information and obtain transparency, which enables enterprises to access finance within an acceptable cost range (Ozili, 2018). The deep integration of technology and finance provides enterprises with diversified financing products and channels (Li et al., 2022). Thus, digital transformation can ease enterprises' external financing limitations as they obtain more financial support.

Second, enterprises that have completed digital transformations tend to have lower fixed operating costs and higher sales (Zhai et al., 2022), leading to lower operating leverage and business risks. On the one hand, digital transformation empowers enterprise assets, equipment, and human resources. It facilitates interactions between departments within the enterprise, lowering fixed operating costs and reducing operating leverage (Li et al., 2020). On the other hand, digital transformation helps enterprises reduce their operating leverage by increasing their market share and enhancing enterprise competitiveness (Mbama et al., 2018). This is because digital technology can improve the ability of an enterprise to search for and digest external information. Various enterprises can be integrated into the business network, which strengthens horizontal and vertical cooperation. Additionally, digital transformation can help enterprises understand the differentiated needs of customers, which will increase customer retention through personalized services (Guo & Xu, 2021). Overall, enterprises can increase their market share and reduce their operating leverage.

Third, digitalization assists enterprises in enhancing their technological innovation capabilities from both the supply and demand sides. From the supply perspective, digital transformation has prompted enterprises to take the initiative to innovate development models based on information technology (Tang et al., 2022; Wu et al., 2020). By integrating into the industrial technology chain, data factors give rise to new intelligent production models (Li et al., 2022). As a cutting-edge transformation model in the new era, digital transformation attracts enterprises to increase their investment in research and development, as well as improve their core technologies to fit the market orientation. From the demand perspective, digital transformation has given rise to a customer-centric innovation model (Gomber et al., 2018). In the digital economy, consumption and production are highly interconnected; therefore, enterprises access heterogeneous innovation resources from customers (Matarazzo et al.,

2021). This forces enterprises to accelerate supply chain innovation and offer personalized customer service (Paunov & Rollo, 2016).

Thus, the following hypothesis is proposed:

H2: Digital transformation can promote enterprise development by alleviating financial constraints, reducing business risks, and improving technological innovation capabilities.

China's economy and society have been affected by unanticipated factors like the pandemic and trade frictions (Liu & Zhang, 2022). Accordingly, the Chinese government has adjusted several of its economic policies to keep the economy in working order. These changes have been accompanied by an increase in economic policy uncertainty. Therefore, the digital transformation of enterprises is impacted by internal financing ability, business risks, and technology innovation. It is also influenced by the uncertainty of the business environment and the resulting external economic policy uncertainty (Chen & Tian, 2022).

Specifically, economic policy uncertainty reduces the accuracy of management's expectations and decisions. Such uncertainty makes it difficult for management to derive accurate expectations about the future economic situation and enterprise development. Enterprises are more cautious when making investments, such as investing in digitalization (Chen et al., 2019; Tabash et al., 2022). Economic policy uncertainty may also hinder the coordination of supply chain components, increasing the risk of supply chain disruption. The risk-averse and short-sighted behavior of enterprise managers prevents them from making additional investments, such as in digital construction. In turn, they may wait for the economy to stabilize before making investment decisions (Baker et al., 2016). This type of decision will affect the development of the enterprise.

Furthermore, against the background of economic policy uncertainty, enterprises tend to increase their earnings management or adjust their accounting standards to enable the disclosure of quality appraisal results. These actions reduce the comparability of a company's financial information, bringing new challenges for decisions related to investments (Lei et al., 2022). Therefore, the following hypothesis is proposed:

H3: In the context of economic policy uncertainty, the role of digital transformation in driving enterprise development will be weakened.

RESEARCH DESIGN AND DESCRIPTIVE STATISTICS

Data Sources

The initial sample consisted of data from A-share enterprises listed on the Shanghai and Shenzhen stock exchanges between 2007 and 2020. First, the study excluded special treatment (ST) enterprises and financial enterprises in the China Stock Market Accounting Research (CSMAR) database to date (Qin et al., 2020). This is because the accounting system of financial enterprises differs from general enterprises; the operating conditions of ST enterprises are poor, so their financial indicators are not comparable to those of general enterprises. Second, only samples with no missing data for at least three consecutive years were retained. Third, the continuous variables were winsorized to reduce the influence of outliers. Finally, 3,275 (67%) enterprises out of 4,854 A-share-listed enterprises were selected as the sample. Data on corporate digital transformation were obtained from the annual reports of A-share-listed enterprises on the Shanghai and Shenzhen stock exchanges. Data on China's economic policy uncertainty were taken from <http://www.policyuncertainty.com/> (Baker et al., 2016). The remainder of the data were collected from the CSMAR database.

Measures

The *dependent variable: enterprise development (Dev)* was based on the summary of existing research on the measurement of enterprise development. This study selected original indicators related to enterprise development in profitability, growth capacity, asset utilization efficiency, and debt-paying ability. It adopted a principal component analysis to reduce the dimensionality of the original indicators. Net margin and return on equity were selected to measure the profitability of enterprises. Self-sustainable growth rate and economic value added were chosen to denote the growth capacity of enterprises. The total asset turnover ratio was selected to measure asset utilization efficiency of enterprises. Finally, debt-to-asset ratio was chosen to measure the enterprise debt-paying ability.

The *independent variable: digital transformation (DT)* in this study followed F. Wu et al. (2021) by applying a text analysis method to count the number of keywords related to digital transformation in the annual reports of A-share-listed enterprises. It used the natural logarithm of the number of keywords plus one and divided by 100 as a measure of an enterprise's degree of digital transformation. The selected keywords were listed as shown in the appendix. They were divided into "underlying technology usage" and "practical application of technology."

The *mediators: financing constraints (FC), business risks (Lev), and technology innovation (R&D)* were chosen as mediating variables in this study. This study used the FC index to measure the financing constraints of enterprises (Zhang et al., 2017). Besides, it used operating leverage to measure business risk, which described the phenomenon in which the rate of change in earnings before interest and tax is greater than the rate of change in turnover due to fixed costs in business operations. The amount of research and development (R&D) investment was selected to measure the capability of enterprise technological innovation.

This study used the *moderator: economic policy uncertainty for China (CEPU)* as measured by economic policy uncertainty for China divided by 100.

Control variables in this study controlled for the following nine generally accepted enterprise characteristics:

1. Nature of ownership (*State*, where state-owned enterprises were recorded as 1 and non-state-owned enterprises were recorded as 0)
2. Dual role of the board chairman (*Dual*, if the president and general manager are the same person, dual is 1, otherwise it is 0)
3. Management fee rate (*Mer*, management fee divided by operating income)
4. Cash flow (*Cash*, net cash flows from operating activities divided by total assets less monetary funds)
5. Herfindahl index (*H*, the sum of the squares of the shares held by the first largest shareholder)
6. Capital expenditures (*Cap*, cash paid for operating leases and the acquisition of long-term assets divided by total assets)
7. Enterprise scale (*Scale*, the natural logarithm of the number of employees)
8. Age of enterprise (*Age*, the natural logarithm of the number of years of operation)
9. Factor intensities (*Fac*, the natural logarithm of the value of net fixed assets divided by the number of employees).

Table 1 reports the descriptive statistics for the main variables.

Table 1. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min.	Max.
Dev	31484	-0.007	0.281	-0.500	1.144
DT	31484	0.011	0.013	0	0.050
State	31484	0.401	0.490	0	1
Dual	31484	0.260	0.439	0	1
Mer	31484	0.090	0.070	0.009	0.427
Cash	31484	0.085	0.254	-0.663	0.897
H	31484	0.147	0.118	0.009	0.560
Cap	31484	0.065	0.063	0.000	0.303
Scale	31484	7.622	1.273	4.304	11.075
Age	31484	2.744	0.396	1.386	3.434
Fac	31484	12.516	1.153	9.367	15.746

MODEL SPECIFICATION

Basic Regression Model

This study constructed the following basic model (two-way fixed-effect model) to verify the impact of digital transformation on enterprise development.

$$Dev_{it} = \alpha + \beta DT_{it} + \gamma CVs_{it} + \delta_i + \lambda_t + \varepsilon_{it}, (i = 1, \dots, N; t = 1, \dots, T). \quad (1)$$

where i and t represent the enterprise and year, respectively. Dev_{it} is the dependent variable. The coefficient β measures the impact of an enterprise's degree of digital transformation on its development. DT_{it} is the core explanatory variable; CVs_{it} is the control variable. The model includes individual fixed effects δ_i and year fixed effects λ_t , while ε_{it} is the random disturbance term.

Time-Varying Differences-in-Differences (DID) Model

This study wanted to examine whether the adoption of digital transformation by enterprises affects their development. Therefore, before performing the basic regression analysis, it constructed a time-varying DID model, as shown in equation (2). It should be noted that the DID model requires sufficient observations for several years before and after the policy change. Thus, the sample of companies that had implemented digital transformation for less than two years was categorized in the control group ($D_{it} = 0$). Enterprises for which digital transformation keywords were present in all sample periods were excluded (F. Wu et al., 2021).

$$Dev_{it} = \alpha_0 + \beta_0 D_{it} + \gamma_0 CVs_{it} + \delta_i + \lambda_t + \varepsilon_{it}. \quad (2)$$

where the core explanatory variable is D_{it} , a dummy variable that equals 1 in the year t after the enterprise i implements digital transformation and equals 0 otherwise. Unlike β , the coefficient β_0 represents the impact of implementing digital transformation on the development of an enterprise. The model includes individual and year-fixed effects.

Quantile Regression Model

The effects of transformation may differ for enterprises at various stages of development. To investigate the difference, this study adopted the following quantile regression model:

$$Dev_{\tau} = Q_{Dev_{it}}(\tau | \cdot) = \beta(\tau)DT_{it} + \gamma(\tau)CVS_{it} + \delta_i + \lambda_t + \varepsilon_{it}. \quad (3)$$

where τ denotes the quantile and $\tau \in (0,1)$. This study used the instrumental variables quantile regression for panel data (QRPD) with non-additive fixed effects to estimate the distribution of Dev_{it} , as proposed by Powell (2022).

Mediation Model

Based on the research method of Wen et al. (2004), this study constructed the following mediation models and used the Sobel test to explore the mechanisms inherent in the digital transformation affecting enterprise development.

$$Dev_{it} = a_0 + a_1DT_{it} + a_2CVS_{it} + \delta_i + \lambda_t + \varepsilon_{it},$$

$$Med_{it} = b_0 + b_1DT_{it} + b_2CVS_{it} + \delta_i + \lambda_t + \varepsilon_{it},$$

$$Dev_{it} = c_0 + c_1Med_{it} + c_2DT_{it} + c_3CVS_{it} + \delta_i + \lambda_t + \varepsilon_{it}. \quad (4)$$

where Med_{it} denotes the mediators (FC, Lev, and R&D).

Moderation Model

The following moderation model was used to examine the moderating effect of economic policy uncertainty.

$$Dev_{it} = d_0 + d_1DT_{it} + d_2CEPU_{it} + d_3DT_{it} \times CEPU_{it} + d_4CVS_{it} + \delta_i + \lambda_t + \varepsilon_{it}. \quad (5)$$

where $CEPU_{it}$ is the moderator. If hypothesis three is correct, the coefficient d_3 will be negative.

EMPIRICAL ANALYSIS

Basic Empirical Results

The effect of digital transformation on enterprise development was studied. M(1) of Table 2 shows the regression results of equation (2). The regression coefficient of D is 0.006 ($p < 0.01$), which indicates a significant improvement in the level of business development after enterprises have implemented digital transformation. M(2) reports the regression results of equation (1). The coefficient of DT is positive (0.597) at the 1% significance level, which implies that a higher degree of digital transformation will promote enterprise development. Therefore, hypothesis one is supported.

Table 2. Basic empirical results

	M (1)	M (2)
	Dev	Dev
DT		0.597*** (2.74)
D	0.006*** (1.80)	
Mer	-1.086*** (-47.01)	-1.038*** (-23.91)
Age	0.140*** (11.23)	0.162*** (7.45)
Scale	0.027*** (13.55)	0.029*** (5.94)
State	-0.020*** (-2.88)	-0.019 (-1.60)
Cash	0.074*** (15.33)	0.074*** (10.40)
Dual	-0.002 (-0.48)	-0.006 (-1.38)
H	0.078*** (4.19)	0.095** (2.45)
Cap	-0.110*** (-5.35)	-0.087*** (-3.29)
Fac	-0.012*** (-7.31)	-0.011*** (2.84)
_Cons	-0.213*** (-5.55)	-0.305*** (-3.98)
Year/Ind	Yes	
N	26052	31484
R-squared	0.149	0.146

Note: (1) ***, **, and * represent significance levels at 1%, 5%, and 10%, respectively; (2) t-values are in parentheses.

ROBUSTNESS TEST

Changing Dependent and Independent Variables

This study aimed to precisely analyze the influence of digital transformation on enterprise development. It decomposed the indicators of enterprise digital transformation into an underlying technology usage (*Tech*) category and practical application of technology (*Appli*) category (F. Wu et al., 2021). The data processing was the same as that applied for the DT index. Furthermore, this study selected Tobin's Q (*Tobinq*) as a measure of enterprise development to reflect market performance. This can be a valuable proxy for a firm's development potential (Valls Martínez et al., 2019). The basic regression was conducted again based on the changed variables (M(1) and M(2) of Table 3). The regression coefficients for both digital transformation sub-indicators are positive and significant ($p < 0.05$). This indicates the robustness of the core findings.

Table 3. Robustness test

	M (1)	M (2)	M (3)
	Tobinq	Tobinq	Dev
DT			11.606*** (5.84)
Tech	0.033** (2.34)		
Appli		0.037*** (2.92)	
CVs/Year/Ind	Yes		
N	30806	30806	31460
R-squared	0.228	0.228	-

Note: (1) ***, **, and * represent significance levels at 1%, 5%, and 10%, respectively; (2) t-values are in parentheses in the columns M(1)–M(2). z-values are in parentheses in the column M(3).

Endogeneity Test

In this study, an endogeneity problem may have arisen due to reverse causality. Therefore, referring to Zhao et al. (2021), this study used the natural logarithm of the number of cell phone subscribers, Internet broadband access ports, and total postal business in the province where the enterprise was registered as instrumental variables. Next, it performed the endogeneity test. The instrumental variable regression model M(3) passes the weak instrumental variable test (F statistic is 52.44). The results in Table 3 show that digital transformation is significantly correlated with enterprise development ($\beta = 11.606, p < 0.01$), which again demonstrates that the instrumental variables are effectively selected. The results are reliable and robust.

Parallel Trend and Placebo Tests

This study also validated the robustness of the time-varying DID model as seen in equation (2). The results show that the model passed the parallel trend test and a placebo test that considered the unobserved factors (La Ferrara et al., 2012; Liu & Lu, 2015; Zhou et al., 2018). This implied that the previous estimation results are robust.

Heterogeneity Test

The digital economy in China’s eastern coastal regions is more prosperous compared to noncoastal regions. Digital transformation tends to exhibit heterogeneous effects with regional characteristics. To investigate, this study separated the sample into coastal and noncoastal regional samples based on the registration location of enterprises. The results in M(1) and M(2) of Table 4 show that the coefficient of DT in the noncoastal group is 0.734 ($p < 0.05$). The coastal group coefficient of DT does not pass the significance test. The reason may be that the degree of digitalization and informatization of industries in coastal areas has reached a relatively high level. In addition, the motivation for the further transformation of enterprises is slowly increasing. However, with late-mover advantages and policy support, enterprises in inland areas have huge potentials to promote enterprise development by digital means in recent years.

Table 4. Heterogeneity test

	M (1) coastal	M (2) noncoastal
	Dev	Dev
DT	0.451 (1.63)	0.734** (2.23)
CVs/Year/Ind	Yes	
N	19088	12396
R-squared	0.172	0.136

Note: (1) ***, **, and * represent significance levels at 1%, 5%, and 10%, respectively; (2) t-values are in parentheses.

EFFECT OF DIGITAL TRANSFORMATION ON ENTERPRISE DEVELOPMENT AT VARIOUS STAGES

Digital transformation relies on an enterprise’s capabilities, such as capital and technology, which are related to their development stage. To further explore the effect of digital transformation on enterprise development at various stages, this study conducted quantile regression using the same instrumental variables as those in the endogeneity test. The results in Table 5 show that $\beta(\tau)$ is positive and significant at most (30th–90th) percentiles, which confirms hypothesis one. Furthermore, as τ increases, so does $\beta(\tau)$ ($\beta(0.9) = 1.915$). This suggests that enterprises with a high level of development benefit more from digital transformation compared to those lagging in development. The reason for this may be that enterprises with a high level of development have advantages in human capital and resource allocation. This may strongly support digital transformation. They are also more skilled at embedding digital technologies into their business models.

Table 5. Panel quantile regression results

Quantile	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
DT	-0.227*** (-401.21)	-0.057*** (-251.30)	0.090*** (45.09)	0.194*** (166.18)	0.354*** (385.27)	0.670*** (256.19)	1.070*** (626.82)	1.370*** (879.04)	1.915*** (379.80)
CVs/Year/Ind	Yes								
N	31484								

Note: (1) ***, **, and * represent significance levels at 1%, 5%, and 10%, respectively; (2) z-values are in parentheses.

MECHANISMS UNDERLYING THE EFFECT OF DIGITAL TRANSFORMATION ON ENTERPRISE DEVELOPMENT

Mediating Effects

This study further examined the mediating effects of financing constraints, business risks, and technology innovation on the relationship between digital transformation and enterprise development. All results passed the Sobel test ($p < 0.01$), indicating that mediating effects are significant.

Table 6. Mediating effect of financing constraints

	M (1)	M (2)	M (3)
	Dev	FC	Dev
DT	0.477***	-1.277***	0.387***
	(3.63)	(-10.84)	(2.94)
FC			-0.070***
			(-9.98)
CVs/Year/Ind	Yes		
N	28150	28150	28150
R-squared	0.779	0.816	0.780
Sobel	0.090***		

Note: (1) ***, **, and * represent significance levels at 1%, 5%, and 10%, respectively; (2) t-values are in parentheses.

The results in Table 6 reveal that digital transformation alleviates the financing constraints of enterprises ($b_1 = -1.277, p < 0.01$), and financing constraints have an inhibitory effect on enterprise development ($c_1 = -0.070, p < 0.01$). The effect of DT is still positive and significant. It can be concluded that financing constraints play a significant partial intermediary role between digital transformation and enterprise development, as shown in the following mechanism: digital transformation facilitates enterprise development by alleviating financing constraints. It indicates that digital transformation enables enterprises to make optimal business decisions by easing their financing constraints and optimizing their financing structure, thereby, promoting enterprise development.

Table 7. Mediating effect of business risks

	M (1)	M (2)	M (3)
	Dev	Lev	Dev
DT	0.550***	-0.021***	0.440***
	(4.34)	(-6.58)	(3.50)
Lev			-5.082***
			(-21.72)
CVs/Year/Ind	Yes		
N	30423	30423	30423
R-squared	0.767	0.397	0.771
Sobel	0.109***		

Note: (1) ***, **, and * represent significance levels at 1%, 5%, and 10%, respectively; (2) t-values are in parentheses.

Table 7 shows the regression results of using business risks as the mediating variable. High operating leverage might hinder enterprise development ($c_1 = -5.082, p < 0.01$). Digital transformation can promote enterprise deleveraging and provide a strong guarantee for their development ($b_1 = -0.021, p < 0.01$). Therefore, the following mechanism can be proposed: digital transformation facilitates enterprise development by reducing business risks. This may be because digital transformation helps enterprises realize intelligent operations, which helps reduce fixed costs in human resources and

supply chains, increase sales, and reduce operating leverage. Ultimately, it mitigates business risks and promotes enterprise development.

Table 8. Mediating effect of technological innovation

	M (1)	M (2)	M (3)
	Dev	R&D	Dev
DT	0.315**	1.141***	0.258*
	(2.27)	(7.01)	(1.86)
R&D			0.050***
			(8.39)
CVs/Year/Ind	Yes		
N	23270	23270	23270
R-squared	0.783	0.829	0.784
Sobel	0.057***		

Note: (1) ***, **, and * represent significance levels at 1%, 5%, and 10%, respectively; (2) t-values are in parentheses.

Using technological innovation as a mediating variable, the regression results are shown in Table 8. The results reveal that the digital transformation of enterprises contributes to their technological innovation ($b_1 = 1.141, p < 0.01$). Technological innovation benefits enterprise development significantly ($c_1 = 0.050, p < 0.01$). Therefore, the following mechanism can be proposed: digital transformation facilitates enterprise development by promoting technological innovation. That is, digital transformation gives rise to an active innovation atmosphere, increasing enterprises' technological innovation output with R&D investment. That helps enterprises to enhance their core competitiveness and accelerate their development. Thus, the results of the mediating effects support hypothesis two.

MODERATING EFFECT OF CHINA'S ECONOMIC POLICY UNCERTAINTY

Flexible economic policies are often used to deal with adverse factors, which inevitably lead to uncertainty. This might affect decision making on digital transformation and enterprise development. Table 9 shows the moderating effect of China's economic policy uncertainty.

China's economic policy uncertainty plays a negative moderating role in the relationship between digital transformation and enterprise development ($d_3 = -0.128, p < 0.01$). In other words, the positive promoting effect of digital transformation on enterprise development weakens with the increasing uncertainty of economic policy. Hypothesis three is supported.

When economic policy uncertainty rises, enterprises exercise greater caution in their investment decisions regarding digital transformation. This hinders digital transformation processes like smart production operations and digital technology systems. As a result, the high-quality development of enterprises will be negatively affected.

Table 9. Moderating effect of China's economic policy uncertainty

	M (1)
	Dev
DT	1.131*** (6.26)
CEPU	-0.035*** (-21.00)
DT × CEPU	-0.128*** (-4.15)
CVs/Year/Ind	Yes
N	31484
R-squared	0.146

Note: (1) ***, **, and * represent significance levels at 1%, 5%, and 10%, respectively; (2) t-values are in parentheses.

CONCLUSION

Digital transformation has brought about many opportunities for enterprise development. This study took A-share enterprises listed on the Shanghai and Shenzhen stock exchanges from 2007 to 2020 as its sample. It used text analysis to construct digital transformation indicators. Then, it applied principal component analysis to construct enterprise development indicators. In this way, the influence of digital transformation on enterprise development, as well as its mechanisms, were considered.

First, digital transformation can significantly promote enterprise development. Second, the effect of digital transformation on enterprise development is stronger in enterprises in inland regions compared to coastal regions. It is more powerful in enterprises with high levels of development than low levels of development. Third, in terms of mechanisms, digital transformation promotes enterprise development by alleviating financing constraints, reducing business risks, and driving technological innovation. Fourth, China's economic policy uncertainty is an important external factor that affects the role of digital transformation in promoting enterprise development. When the uncertainty related to economic policy is lower, the impact of digital transformation on enterprise development increases.

Theoretical Implications

This study has several theoretical implications. First, it constructs a composite index of enterprise development across multiple aspects, including profitability, growth capacity, asset utilization efficiency, and debt-paying ability. Previous studies tended to consider only the specific indicators related to enterprise development, such as corporate financial performance (Daradkeh, 2021; Zhai et al., 2022), continuing professional development (Marx et al., 2021), and growth (Vu & Hartley, 2022). There is limited research on measuring enterprise development comprehensively. Therefore, this study provides a useful reference for assessing enterprise development.

Second, based on the perspective of cash flows that arise from financing, operating, and investing (Ni et al., 2019), this study identifies three internal mechanisms of digital transformation's impact on enterprise development: (1) financing constraints; (2) business risks; and (3) technological innovation. Accordingly, this study provides new insights into the mechanisms underlying the impact of digital transformation on enterprise development. Furthermore, unlike the research that has focused on the effect of various factors on the "mean" of enterprise development (Guo & Xu, 2021; Zhang et al., 2022), this study segregates enterprise development into high, medium, and low levels of development. It, thereby, widens and deepens the extant research into digital transformation and enterprise development.

Third, this study incorporates China's economic policy uncertainty into the research framework. It investigates the external impact of uncertainty that digital transformation must address to facilitate enterprise development. This area has typically been neglected in previous studies (Guo & Xu, 2021; Wang et al., 2020). The present research also sets a theoretical foundation for exploring the path of digital transformation affecting enterprise development against the realistic background of policy uncertainty. As a result, this study provides a theoretical framework to comprehensively reveal the internal transmission mechanism and external influence mechanism of digital transformation acting on enterprise development.

Practical Implications

The findings have significant practical implications for policymakers, enterprises, and other economic participants. First, the Chinese government should try to maintain long-term consistency of economic policies to improve enterprises' trust in the government and reduce their expectations of economic policy uncertainty (Yuan et al., 2022). Furthermore, digital transformation should be used as a tool to eliminate the regional development divide. The government should implement differentiated digital strategies according to enterprises' geographical environment and development environment. For lower development level enterprises in inland regions, the government should increase the construction of new digital infrastructure, improve the government service system (ElMassah & Mohieldin, 2020), and increase the funding for digital transformation. Enterprises with high levels of development and in coastal regions should be encouraged to integrate digital technology into their established industry chain (Li & Zhang, 2021). They should also work to redevelop traditional resources through digital transformation.

Second, enterprises should stimulate their dynamic capabilities (Warner & Wäger, 2019) by reestablishing business models and organizational frameworks adapted to the digital context. This can help actively broaden their financing channels and reduce their operating leverage. In addition, digital transformation has become a driving force for technological innovation (Pflaum & Gölzer, 2018). Therefore, with the aim of fully realizing the benefits of digital transformation, enterprises should make full use of new generation technologies (W. Wu et al., 2021) and build digital platforms by increasing R&D investment.

Third, economic participants like regulators and financial service institutions should be encouraged to integrate digital technology into their products and organizational structure. This can create a good environment and service for enterprise digitalization. Regulators need to apply modern information technology tools to reform the regulatory system and strengthen international regulatory cooperation on cross-border data flows. The monitoring and early warning mechanisms for digital risks should also be improved (Manita et al., 2020). In addition, financial service institutions need to employ new generation technologies to optimize loan approval mechanisms and refine the fund transfer pricing system. This helps to improve credit allocation and alleviate the financing difficulties of enterprises (Li et al., 2022).

CONFLICT OF INTEREST

The authors of this publication declare there is no conflict of interest.

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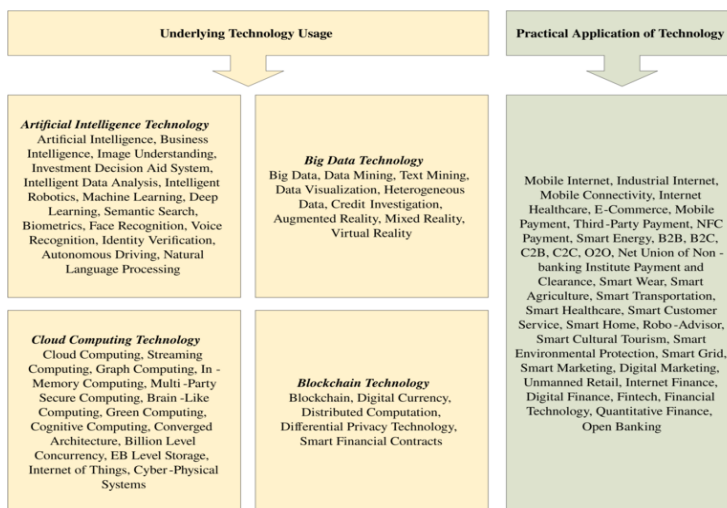
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APPENDIX A.

Referring to F. Wu et al. (2021), this study selected the keywords in Figure 1 to count the word frequency as the original measure of digital transformation. They were separated into two categories: underlying technology usage and practical application of technology. This emphasized the mainstream of digital technology and its application scenarios, respectively.

Figure 1. Keywords about digital transformation



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