DOI: 10.54254/2754-1169/159/2025.19690

Digital Transition, Audit Quality, and Quality-Driven Enterprise Development

Xudong Tang[1,a,*]

[1]*School of Accounting, Tianjin University of Finance and Economics, No. 25 Zhujiang Road, Hexi District, Tianjin, China*

a. 15122969660@163.com

**corresponding author*

Abstract: Technology-driven economy is leading the way in the global technological and industrial revolution, emerging as a significant catalyst for the growth of new productive forces. The Central Economic Work Conference emphasized the need to actively foster new industrialization, advance technology-driven economy, and accelerate the development of artificial intelligence. Additionally, technology-driven economy considerably alters the green transformation and upgrading of high-pollution industries. In this context, quality-driven audits offer essential oversight and management throughout this transition. The research focuses on listed firms in high-emission industries over the period 2012 to 2022, analyzing how digital transition contributes to the advancement of enterprise quality. The findings demonstrate that digital transition significantly fosters quality-driven growth, with audit quality serving as a positive moderating factor between digital transition and corporate development. These results not only provide valuable insights into improving total factor productivity and leveraging digitalization's multiplicative and additive effects on economic progress but also offer important guidance for traditional enterprises aiming to balance economic growth with environmental sustainability during their digital transition journeys.

Keywords: Digital transition, quality-driven enterprise development, total factor productivity, environmental performance, audit quality.

1. Introduction

The 20th National Congress emphasized that promoting a technology-oriented economy is central to China's overall development strategy. Quality-driven growth is the key goal in the pursuit of a socialist modern society, with the "dual carbon targets" — carbon peak and neutrality — providing the green impetus for China's progress [1]. As the main force in advancing Chinese modernization, enterprises must actively assume the mission entrusted by the times, injecting strong momentum into achieving economic quality-driven growth and creating a new paradigm for the coordinated development of digitalization and greening. Currently, there is limited literature that incorporates both digital transition and quality-driven enterprise development into a unified framework for analysis. Meanwhile, the reduction of emissions and improvement of efficiency, as well as quality-driven growth in highly polluting industries, are key development goals for China at the present stage. Therefore, research on the quality-driven growth of heavily polluting enterprises, and how to comprehensively and effectively measure it, is critical to providing correct strategies for addressing current issues. Furthermore, the introduction of the "dual carbon" goals implies that China will implement a relatively strict environmental audit strategy for a long period of time [2]. Therefore, when studying the impact of digital transition on the quality-driven growth of enterprises, the moderating role of audit quality cannot be overlooked. It is evident that there exists a close relationship between digital transition, quality-driven enterprise development, and audit quality. Discussing these issues can better answer how digital transition influences the quality-driven growth of enterprises and the role that audit quality plays in this mechanism. This has significant theoretical value and practical significance in cultivating new development momentum and constructing a new pattern of green, quality-driven growth.

2. Theoretical Analysis and Research Hypotheses

2.1. Digital Transition and Quality-Driven Enterprise Development

2.1.1. Digital Transition and Total Factor Productivity of Enterprises

Currently, technology-driven economy, driving the digital transition and upgrading of enterprises, has rapidly integrated into various aspects of production, daily life, and social service management. It is becoming an important source of value creation and a key guarantee for the sustained and healthy development of the economy and society. Digital transition plays a significant role in promoting the quality-driven growth of enterprises. By leveraging data elements, enterprises can transition from independent development to collaborative innovation across departments [3], which helps to improve total factor productivity and propel quality-driven growth.

Hypothesis 1: Digital transition can improve the total factor productivity of enterprises.

2.1.2. Digital Transition and Environmental Performance of Enterprises

The essence of digital transition lies in optimizing the internal information processing capabilities of enterprises, utilizing the Internet and digital technologies to improve the enterprise's operational governance model, thereby enhancing environmental performance and promoting quality-driven growth. Digital transition improves the enterprise's intelligent monitoring capabilities, helping enterprises to accurately collect real-time data on clean energy and sustainable development, fostering the creation of a new paradigm for the coordinated development of digitalization and greening, and achieving improvements in environmental performance. Therefore, digital transition can promote environmental performance by enhancing environmental governance capabilities, improving resource utilization, and strengthening collaborative efforts in environmental information across enterprises.

Hypothesis 2: Digital transition can improve the environmental performance of enterprises.

2.2. Digital Transition, Audit Quality, and Quality-Driven Enterprise Development

2.2.1. The Moderating Role of Audit Quality in the Relationship Between Digital Transition and Quality-Driven Enterprise Development

In recent years, national audit departments have innovated their approach to auditing natural resources and ecological protection, strengthened environmental audit supervision, and actively promoted national ecological civilization construction. Therefore, improving audit quality can contribute to achieving the "dual carbon" goals. According to the research by Yanyan Yang [4] et al., digital transition can serve as an effective means to collaborate with environmental audit departments to plan and build a nationwide integrated and shared application platform, creating a data resource

DOI: 10.54254/2754-1169/159/2025.19690

management system to improve audit quality. As a result, the direct impact of digital transition on quality-driven enterprise development will be moderated by audit quality.

Hypothesis 3: Audit quality plays an important positive moderating role in the process of digital transition influencing quality-driven enterprise development.

3. Research Design

3.1. Selection and Explanation of Variables

3.1.1. Dependent Variable: Quality-Driven Enterprise Development

Quality-driven enterprise development encompasses not only a company's strong economic performance but also its ability to embrace the principles of green development and foster long-term, sustainable growth. In this study, the level of quality-driven growth is assessed through two key dimensions: total factor productivity (TFP) and environmental performance (EP). The OP method is employed to compute TFP for the firms.

For measuring environmental performance, an Environmental Performance Index (EPI) is developed. Additionally, the emission levels of corporate waste and pollutants are analyzed to compute the pollution fees per unit of revenue, serving as a robustness check. A higher EPI score indicates superior performance in environmental [5], social, and governance (ESG) practices and environmental outcomes.

3.1.2. Independent Variable: Digital Transition (DT)

The degree of digital transition within enterprises is evaluated using text analysis techniques [6]. A custom dictionary, developed based on the national policy framework, is used to identify key terms related to digital transition in businesses. The Jie-ba word segmentation tool in Python is then employed to calculate the frequency of these digital-related keywords within corporate annual reports. This frequency is normalized by dividing it by the frequency of the Management Discussion & Analysis (MD&A) section, and the result is multiplied by 100. After adding 1 to the frequency, the data is logged to quantify the level of digital transition in each company.

3.1.3. Moderating Variable: Audit Quality (AQ)

Audit quality plays a crucial role in facilitating the quality-driven growth of enterprises [7]. Building on previous research, audit quality (AQ) is treated as a moderating variable in this study. The modified Jones model is employed to calculate the absolute value of discretionary accruals as a proxy for audit quality. A lower absolute value of discretionary accruals is indicative of higher audit quality.

3.1.4. Control Variables

The control variables in this study include factors such as company size (Size), company age (Age), asset turnover ratio (GDZ), capital intensity (Capital), firm growth (Growth), and financial leverage (Lev). Additionally, variables for year (Year) and industry (Industry) are also included as controls.

3.2. Model Construction

3.2.1. Benchmark Regression Model

To examine the impact of digital transition on the quality-driven growth of enterprises, this paper employs the fixed-effects benchmark model (Model 1) for analysis:

$$Y_{i,t} = \alpha_0 + \alpha_1 DT_{i,t} + \sum Controls_{i,t} + \sum Industry_i + \sum Year_t + \varepsilon_{i,t} \quad (1)$$

Where:

The dependent variable $Y_{i,t}$ represents the total factor productivity and environmental performance of enterprise i in year t; $DT_{i,t}$, represents the degree of digital transition of enterprise i in year t; $Controls$ denotes the control variables; Industry and Year are dummy variables for industry and year; ε_{it} is the random error term.

Further, to test the moderating effect of audit quality on the relationship between digital transition and quality-driven enterprise development, the following panel model is constructed:

$$Y_{i,t} = \alpha_0 + \alpha_1 DT_{i,t} \times I(AQ_{i,t} \leq \gamma_1) + \alpha_2 DT_{i,t} \times I(\gamma_1 < AQ_{i,t} \leq \gamma_2) + \cdots + a_n DT_{i,t} \times I\big(\gamma_{n-1} < AQ_{i,t} \leq \gamma_n\big) + a_{n+1} DT_{i,t} \times I(AQ_{i,t} > \gamma_n) + \sum Controls_{i,t} + \sum Industry_i + \sum Year_t + \varepsilon_{it} \quad (2)$$

Where: $AQ_{i,t}$ is the audit quality threshold variable; γ represents the estimated threshold values; I(·)is the indicator function, which takes the value of 1 if the condition holds, and 0 otherwise.

This chapter follows relevant research methods and uses the residual sum of squares as a key indicator to preliminarily determine the presence of a threshold effect [8]. Additionally, the Bootstrap method is used for 1,000 resampling tests to determine the final threshold value.

3.3. Sample Selection and Data Sources

The sampled for this study are selected based on the China Securities Regulatory Commission (CSRC) industry classification, along with the "Guidelines for Environmental Information Disclosure by Listed Companies" and the 2008 "Industry Classification Management Directory for Environmental Protection Verification." The focus is on companies listed on the Shanghai and Shenzhen A-share markets. Firms with missing data, as well as those classified as financial institutions or designated as ST and *ST, are excluded. After applying these criteria, a total of 6,426 company-year observations remain, with data extending up to 2022, reflecting the limitations of data availability. Additionally, continuous variables are subjected to before and after 1% indentation.

The financial data for the selected enterprises are sourced from their annual reports and the Guotai An Securities Database (CSMAR), while emissions data are primarily obtained from the China National Research Data Service Platform (CNRDS). Environmental investment data are extracted from the "Construction Projects" and "Management Expenses" sections of the companies' annual report notes.

4. Empirical Analysis

4.1. Descriptive Statistics

Table 1: presents the descriptive statistics.

Variable	Variable Name	Obs	Mean	Std. Dev.	Min	Max
TFP	Total Factor Productivity	6426	6.841	0.806	5.200	8.900
EP	Environmental Performance	6426	62.275	6.796	46.120	81.500
DT	Degree of Digital Transition	6426	2.409	1.036	0	4.745
EAU	Audit Quality	6276	5.565	12.024	.009	82.254
Size	Firm Size	6426	4.074	1.390	1.739	8.076

DOI: 10.54254/2754-1169/159/2025.19690

Table 1: (continued).

Age	Firm Age	6426	2.991	0.269	2.197	3.611
Gdz	Fixed Asset Turnover Rate	6426	3.166	3.336	0.251	21.893
Capital	Capital Intensity	6426	-3.816	0.759	-5.435	-1.499
Growth	Firm Growth	6426	12.506	28.264	-44.357	135.668
Lev	Financial Leverage	6426	0.433	0.198	0.063	0.902

From Table 1, it can be seen that the mean total factor productivity (TFP) of the enterprises is 6.841, with a minimum value of 5.200 and a maximum value of 8.900, indicating that the overall total factor productivity level of the sample enterprises is good. The sample mean of environmental performance (EP) is 62.275, with a large difference between the maximum and minimum values, suggesting a significant disparity in the environmental governance levels among enterprises. Therefore, improving the environmental performance of heavily polluting enterprises remains a top priority. There are certain differences in the degree of digital transition (DT) among the enterprises, with the maximum value being 4.745 and the minimum value being 0 (indicating that some enterprises have not undergone digital transition). This suggests the existence of a digital divide among enterprises, and further efforts are needed to enhance the innovation and application of digital technologies within enterprises.

4.2. Benchmark Regression

Table 2: Benchmark Regression Analysis.

	(1) TFP	(2) TFP	(3) EP	(4) EP
DT	0.0553^{***}	0.0115^{**}	0.5476^{***}	0.5246^{***}
	(0.0066)	(0.0048)	(0.1074)	(0.1087)
Size		0.2425^{***}		0.9408^{***}
		(0.0094)		(0.2121)
Age		0.4252^{***}		6.5222^{***}
		(0.0838)		(1.8920)
Gdz		0.0793^{***}		-0.1254^{***}
		(0.0018)		(0.0398)
Capital		0.1899^{***}		-0.0991
		(0.0111)		(0.2512)
Growth		0.0024^{***}		-0.0018
		(0.0001)		(0.0026)
Lev		-0.2355^{***}		-0.8136
		(0.0310)		(0.6998)
Time Fixed	Yes	Yes	Yes	Yes
Industry Fixed	Yes	Yes	Yes	Yes
Constant Term	6.8366^{***}	5.2409^{***}	58.1655^{***}	36.2325^{***}
	(0.0994)	(0.2390)	(1.6242)	(5.3964)
N	6426	6426	6426	6426
within R^2	0.4031	0.6905	0.0648	0.0738

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

DOI: 10.54254/2754-1169/159/2025.19690

To assess the impact of digital transition on the quality-driven growth of enterprises, non-linear tests were first conducted between the independent and dependent variables. The results indicate a linear relationship between digital transition and quality-driven growth. Following this, a two-way fixed-effects model, which controls for both year and industry effects, was used for multiple regression analysis (Model 1). The benchmark regression results are shown in Table 2.

Columns (2) and (4) display the regression outcomes after controlling for various factors. The coefficient for digital transition with respect to total factor productivity remains significantly positive at the 1% level, indicating that digital transition has contributed to the improvement of total factor productivity, thereby supporting Hypothesis 1. Similarly, the coefficient for digital transition and environmental performance is significantly positive at the 5% level, after controlling for potential confounding factors. This suggests that digital transition has a positive effect on environmental performance, thus supporting Hypothesis 2.

Overall, the benchmark regression results indicate that a higher degree of digital transition is positively associated with the quality-driven growth of enterprises.

4.3. Robustness Test

Table 3: Robustness Test

	Replace Dependent Variable		Replace Independent Variable	
	(1)	(2)	(3)	(4)
	TFP_GMM	ΔEPIN	TFP	EP
DT	0.0129***	-0.0752**		
	(0.0047)	(0.0333)		
L.DT			0.0183***	0.6868***
			(0.0052)	(0.1248)
Control Variables	Yes	Yes	Yes	Yes
Time Fixed	Yes	Yes	Yes	Yes
Industry Fixed	Yes	Yes	Yes	Yes
Constant Term	4.4291***	0.6013	4.9632***	35.2845***
	(0.2333)	(1.7193)	(0.2817)	(6.7978)
N	6426	5969	5351	5351
within R^2	0.6755	0.0063	0.7023	0.0735

This study employs two methods for robustness testing. First, the dependent variable is replaced to verify the robustness of the results. The Generalized Method of Moments (GMM) is applied to further assess total factor productivity, and a new regression analysis is performed using the change in the ratio of annual pollution fees to annual operating revenue. A higher ratio indicates greater pollution emissions and, consequently, lower environmental performance. The regression results, presented in Columns (1) and (2) of Table 3, remain significantly positive at the 1% level, confirming the validity of the original conclusions.

Second, an endogeneity test is conducted, as shown in Table 4. To address potential endogeneity, the instrumental variable method is employed, using lagged one-period and lagged two-period digital transition as instruments for the dependent variable.The lagged one-period digital transition has a positive effect on total factor productivity and environmental performance at the 1% significance level, and the lagged two-period digital transition shows a positive effect on total factor productivity and environmental performance at the 1% and 10% significance levels, respectively. This result is

DOI: 10.54254/2754-1169/159/2025.19690

similar to the benchmark regression results, indicating that the model remains robust even after addressing endogeneity.

Table 4: Endogeneity Test

	Instrumental Variable: Lagged One Period DT			Instrumental Variable: Lagged Two Periods DT		
	Stage1	Stage2	Stage2	Stage1	Stage2	Stage2
	DT	TFP	EP	DT	TFP	EP
DT		0.0466^{***} (0.0132)	1.7490^{***} (0.3210)		0.0811^{**} (0.0401)	1.8810^{*} (1.0090)
L1.DT	0.3927 (0.1349)					
L2.DT				0.1389 (0.1535)		
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed	Yes	Yes	Yes	Yes	Yes	Yes
Industry Fixed	Yes	Yes	Yes	Yes	Yes	Yes
Cragg-Donald Wald F		847.853	847.853		81.850	81.850
N	5253	5253	5253	4498	4498	4498

4.4. Moderating Effect Analysis

Table 5: Threshold Effect Bootstrap Resampling Test

5-1 Threshold Value Test When the Dependent Variable is Total Factor Productivity

Threshold Variable	Threshold Number	Threshold Value	F-value	P-value	Critical Value 10%	5%	1%	Bootstrap Samples
AQ	Single Threshold Effect	9.1261	28.28	0.000	9.646	12.730	17.902	1000
	Double Threshold Effect	0.8770 10.5890	19.93	0.000	8.689	11.003	16.076	1000
	Triple Threshold Effect	3.3406	6.29	0.061	16.346	18.519	22.223	1000

This paper uses the Hansen panel threshold model to examine the dynamic impact mechanism of audit quality on the quality-driven growth of enterprises. The Bootstrap resampling method is applied to test whether audit quality exhibits threshold characteristics. Observations in the extreme value range (1% of all variables) are removed, and 1,000 repeated trials are conducted to derive the p-value for the threshold effect test of audit quality. The regression results are shown in Table 5. Audit quality (AQ) passes the significance test and exhibits a single threshold effect, with a threshold value of 9.1261.

Table 6: Regression Results of the Threshold Panel Model

VARIABLES	TFP		EP	
	Single Threshold	Double Threshold	Single Threshold	Double Threshold
Size	0.265***	0.262***	0.839***	0.747***
	(27.921)	(27.440)	(4.019)	(3.546)
Age	0.433***	0.427***	2.406***	2.301***
	(15.301)	(15.062)	(3.833)	(3.663)
Gdz	0.085***	0.085***	-0.069*	-0.072*
	(45.587)	(45.524)	(-1.678)	(-1.735)
Capital	0.180***	0.181***	-0.055	-0.040
	(15.559)	(15.607)	(-0.215)	(-0.155)
Growth	0.002***	0.002***	-0.007***	-0.007***
	(20.330)	(20.300)	(-2.634)	(-2.628)
Lev_	-0.173***	-0.176***	-0.274	-0.287
	(-5.417)	(-5.512)	(-0.388)	(-0.406)
DT×I($AQ_{i,t} \leq \gamma_1$)	0.014***		0.516***	
	(2.764)		(4.699)	
DT× $I(\gamma_1 < AQ_{i,t})$	0.029***		1.517***	
	(4.782)		(6.975)	
DT×I($AQ_{i,t} \leq \gamma_1$)		0.009*		0.441***
		(1.680)		(3.921)
DT× $I(\gamma_1 < AQ_{i,t} \leq \gamma_2)$		0.018***		0.644***
		(3.472)		(5.496)
DT× $I(\gamma_2 < AQ_{i,t})$		0.033***		1.625***
		(5.363)		(7.384)
Constant	4.898***	4.931***	50.634***	51.380***
	(46.210)	(46.295)	(21.584)	(21.807)
N	6,030	6,030	5,980	5,980
R-squared	0.665	0.665	0.049	744
FE	YES	YES	YES	0.051

This paper uses a grouped regression method to further explore the moderating effect of audit quality on the two dimensions of corporate quality-driven growth. The specific grouping results are shown in Table 6. Column (1) of Table 6 reports the dynamic moderating effect of audit quality (AQ). According to the test results, audit quality exhibits dynamic evolutionary characteristics in the process of digital transition's impact on corporate quality-driven growth, with a moderating effect that increases progressively. This means that under the moderation of audit quality, the impact of digital transition on corporate quality-driven growth follows a nonlinear pattern of increasing marginal efficiency. A detailed analysis is as follows: when audit quality is below the threshold value of 9.1261, the coefficient of the impact of digital transition on corporate quality-driven growth is 0.014, significant at the 1% level; when audit quality exceeds the threshold value of 9.1261, the impact coefficient increases to 0.029, also significant at the 1% level. This suggests that improving audit quality can enhance corporate environmental performance, facilitate green economic development, and promote corporate quality-driven growth.

The results in Columns (1) and (2) indicate that in the group with higher audit quality, the significance level of the relationship between digital transition and corporate total factor productivity increases to 1%. This means that the higher the audit quality, the stronger its positive effect on corporate total factor productivity. The results in Columns (3) and (4) show that in the group with higher audit quality, the improvement in corporate environmental performance reaches nearly 1% significance, and the R-squared value increases significantly, indicating a better model fit. This suggests that higher audit quality has a stronger positive effect on corporate environmental performance. In summary, with the continuous improvement of corporate audit quality, the positive driving effect of digital transition on corporate quality-driven growth is further promoted. Audit quality plays a positive moderating role, and Hypothesis 3 is confirmed.

5. Research Conclusions and Policy Recommendations

5.1. Research Conclusions

This paper empirically tests the impact and mechanisms of digital transition on corporate quality-driven growth using a sample of listed companies in heavily polluting industries from 2012 to 2022. The conclusions are as follows:

First, in the context of technology-driven economy, digital transition can better promote the positive development of corporate total factor productivity and environmental performance, thereby facilitating corporate quality-driven growth.

Second, through standardized audit supervision procedures, audit quality can be further improved, ensuring the reliability of digital transition, thereby playing a positive moderating role in corporate quality-driven growth.

5.2. Policy Recommendations

First, government departments should formulate relevant policies to promote the deep integration of digital transition and quality-driven enterprise development, accelerating the green transformation and upgrading of development models. Localized initiatives should be implemented to establish digital transition talent training programs, promote inter-industry collaboration, better serve national policies, and effectively implement the green new development concept.

Second, environmental auditors should enhance their learning and application of new technologies, improving their professional capabilities and information literacy. The rise of emerging fields like artificial intelligence can effectively assist environmental auditors in conducting audit supervision and risk assessments, thus reducing audit risks and improving audit quality.

Third, enterprises should tailor their strategies based on their own circumstances, focusing on the national requirements for quality-driven growth. Digital transition should be considered an essential evaluation criterion for promoting quality-driven enterprise development. Enterprises should combine qualitative and quantitative approaches, balance commonality and individuality, weigh both incentives and constraints, and align these efforts with the main objectives, leveraging the extensive advantages of digital economy to foster quality-driven growth.

References

[1] *Dongsheng Yu. ESG performance and corporate environmental performance: Effect assessment and mechanism testing. Modern Economic Exploration, 2024, (10): 91-103+132.*

[2] *Quying Hu, Liting Zhang. Corporate environmental investment and auditor pricing strategies. Finance and Accounting Monthly, 2024, 45(18): 92-98.*

[3] *Cai Wang. Research on the mechanism of digital transition's impact on corporate innovation performance. Contemporary Economic Management, 2021, 43(03): 34-42.*

[4] *Yanyan Yang, Xiuqi Yang, Jin Yu Zhu. Dynamic impact of data elements on regional green and low-carbon development under government environmental audit regulation. Journal of Kunming University of Science and Technology (Natural Science Edition), 2024, 49(04): 297-307.*

DOI: 10.54254/2754-1169/159/2025.19690

[5] *Hongtao Shen, Wenli Fu, Honghui Lin. Analysis of carbon trading accounting and disclosure for key listed emission enterprises in China—Evidence from 2020-2022 annual reports. Chinese Certified Public Accountant, 2023, (12): 78-83.*

[6] *Chun Yuan, Tusheng Xiao, Chunxiao Geng, Yu Sheng. Digital transition and corporate division: Specialization or vertical integration. China Industrial Economics, 2021, (09): 137-155.*

[7] *Mingzeng Yang, Qincheng Zhang, Zihan Wang. Impact of the new audit report standards on audit quality: Evidence from a quasi-natural experiment of A+H shares listed companies in 2016. Audit Research, 2018, (05): 74-81.*

[8] *Yang Yu, Fang Chen, Erda Wang. Data elements allocation, new productivity, and regional green innovation performance. Statistics and Decision, 2024, 40(17): 5-.*