The Impact of Digital Transformation on Enterprise Value — The Moderating Role of Executive Education Background

Min Zhang, Peng Yue*

Department of Economics and Management, Yuncheng University, Yuncheng 044000, Shanxi, China

Abstract: This study examines the impact of digital transformation on enterprise value and the moderating role of executive education background, using panel data from Chinese A-share listed companies (2015–2023). The results indicate that digital transformation significantly enhances enterprise value. Furthermore, executive education background positively moderates this relationship, strengthening the value-enhancing effect of digital transformation, which underscores the critical enabling role of executives' cognitive capabilities and digital literacy. Heterogeneity analysis reveals that this effect is more pronounced in non-state-owned enterprises and firms located in eastern China. These findings provide new insights into the value-creation mechanisms of digital transformation and offer practical guidance for optimizing corporate digital strategies and executive team composition.

***Keywords*:** digital transformation; enterprise value; executive education background; moderating effect

1. Introduction

The rapid advancement of the digital economy has established digital transformation as a critical driver of high-quality enterprise development. In China, this transformation has been elevated to a national strategic priority. The "14th Five-Year Plan" explicitly emphasizes deepening the integration of digital technologies with the real economy to empower industrial upgrading and cultivate new, quality productive forces. Through digital transformation, enterprises can leverage advanced technologies—such as big data, the Internet of Things, and artificial intelligence—to optimize production processes, enhance supply chain efficiency, and strengthen innovation capabilities, thereby boosting enterprise value. Within this context, the executive team, which serves as the core decision-making body for strategy formulation and resource allocation, plays a pivotal role. According to Upper Echelons Theory (Hambrick & Mason, 1984), executives' background characteristics profoundly shape their strategic preferences and decision-making behaviors [1]. An executive's education background, a key manifestation of human capital, reflects their knowledge base, cognitive framework, and innovative potential, thereby acting as a significant factor that moderates the digital transformation process. Consequently, investigating the influence of executive education background on enterprise value in the digital era holds substantial theoretical and practical significance.

Existing literature has extensively explored the relationship between digital transformation and enterprise value. Scholars generally concur that digital transformation enhances enterprise value by optimizing operational efficiency, promoting technological innovation, and strengthening environmental responsibility (Brynjolfsson & Hitt, 2000; Zhang et al., 2023)[2] [3]. A parallel stream of research has examined the link between executive education background and enterprise value. For instance, Similarly, Xu et al. (2020) found that executive education background indirectly enhances enterprise value through mediating channels such as R&D investment and market power[4]. From an ambidextrous innovation perspective, Yue et al. (2024) demonstrated the positive effect of heterogeneity in executives' overseas backgrounds on enterprise value[5]. However, most existing studies treat digital transformation and executive characteristics as separate domains, with limited systematic investigation into their interactive effects on enterprise value. Particularly within China's unique institutional context, the question of whether and how executive education background moderates the impact of digital transformation warrants further empirical examination. This study aims to bridge this gap by integrating these two perspectives. Using a sample of Chinese A-share listed companies from 2015 to 2023, we empirically test the effect of digital transformation on enterprise value and explore the moderating role of executive education background. The findings are expected to offer insights for refining digital strategies and executive team development.

2. Theoretical Analysis and Research Hypothesis

2.1 Enterprise Digital Transformation and Enterprise Value

Digital transformation enhances enterprise value by fundamentally reshaping a firm's resource structure and value

creation pathways. Grounded in Resource Orchestration Theory [6], this transformation is characterized as a process wherein firms systematically structure, bundle, and leverage digital technology resources. This orchestration enhances operational efficiency, stimulates innovation, and optimizes governance, thereby driving growth in enterprise value.

This process unfolds across three phases. First, in the resource structuring phase, the introduction of digital infrastructure (e.g., big data, AI, cloud computing) expands the firm's resource base and improves information fluidity [7]. Second, during the resource bundling phase, digital platforms facilitate the dynamic coordination of internal and external resources. This integration of supply chain and R&D processes reduces transaction costs and operational redundancies [8]. Third, in the resource leveraging phase, data-driven decision-making enables firms to identify market demands more accurately, differentiate products and services, and strengthen competitiveness and profitability [2]. Additionally, by enhancing information transparency and internal governance, digital transformation mitigates principal-agent problems and alleviates financing constraints, thereby providing institutional safeguards for sustained value creation [9].

Based on this analysis, the following hypothesis is proposed:

H1: Digital transformation has a significant positive impact on enterprise value.

2.2 Enterprise Digital Transformation, Executive Education Background and Enterprise Value

Upper Echelons Theory holds that executives' educational background, as a core manifestation of human capital, shapes their cognitive frameworks and strategic decisions. This background enhances their ability to identify and leverage technological trends. During digital transformation, such executives typically possess more systematic strategic foresight, enabling them to better identify opportunities, assess risks, and formulate viable implementation pathways, thereby amplifying the positive effect on enterprise value.

Imprinting Theory complements this by positing that the cognitive frameworks formed during higher education exert a lasting "imprint." The systems thinking and innovation awareness cultivated in academia enable executives to more effectively integrate technology with management and optimize resource allocation, thereby assuming a more critical guiding role throughout the transformation.

Integrating these perspectives, we contend that executive education background strengthens the positive impact of digital transformation on enterprise value by enhancing decision-making quality and implementation efficiency. Such executives are better able to comprehend digital technologies' value, champion data-driven decisions, reduce trial-and-error costs, and emphasize long-term strategic planning to balance investment with returns.

Therefore, the following hypothesis is proposed:

H2: Executive education background positively moderates the relationship between digital transformation and enterprise value.

3. Model Design

3.1 Variable Selection

3.1.1 Explanatory Variable: Digital Transformation

Following the methodology of Wu et al. [9], this study measures digital transformation through textual analysis of annual reports for A-share listed companies. The text was processed using Python to identify keywords related to digital technologies, including artificial intelligence, big data, blockchain, and cloud computing. The frequency of 76 specific terms across these technological domains was counted. The degree of a firm's digital transformation is calculated as the natural logarithm of one plus the total frequency of these keywords appearing in its annual report.

3.1.2 Explained Variable: Enterprise Value

Enterprise value is measured using Tobin's Q. This metric is selected because it provides a comprehensive assessment by incorporating both market value and book value, and it reflects a firm's long-term development potential more effectively than accounting-based indicators like return on assets (ROA). By balancing the influences of equity and debt, Tobin's Q offers a holistic perspective on firm valuation.

3.1.3 Moderating Variable: Executive Education Background

The executive education background is measured as the average educational level of the executive team. Following the CSMAR database classification [5], educational attainment is coded ordinally: 1 for secondary technical school or below, 2 for an associate degree, 3 for a bachelor's degree, 4 for a master's degree, and 5 for a doctoral degree or above. The team average is computed based on these numerical assignments.

3.1.4 Control Variables

To isolate the effects of the key variables, several factors are controlled for. These include firm-specific characteristics

(size, asset-liability ratio, profitability), corporate governance factors (shareholding percentage of the largest shareholder, board size), and equity nature. Year and industry fixed effects are also included to account for temporal and sectoral variations.

3.2 Model setting

To examine the impact of digital transformation on enterprise value, the following benchmark regression model (1) is established:

$$TobinQ_{it} = \alpha_1 + \alpha_2 DT_{it} + \sum \alpha_i Controls_{it} + \sum Year + \sum Industry + \varepsilon_{it} \quad (1)$$

TobinQ measures enterprise value, and DT represents the degree of digital transformation. The model includes a set of control variables (Controls). Year and Industry dummy variables are incorporated to control for time-specific effects and industry heterogeneity, respectively. The term ε denotes the random error term, capturing unobserved factors.

To further investigate the interaction between digital transformation, executive education background, and enterprise value, model (2) is constructed to test the moderating role of executive education background.

$$TobinQ_{it} = \gamma_1 + \gamma_2 DTC_{it} + \gamma_3 DTC_{it} \times Edu_{it} + \gamma_4 Edu_{it} + \sum \gamma_i Controls_{it} + \sum Year + \sum Industry + \varepsilon_{it} \quad (2)$$

3.3 Data Description

The initial research sample comprised A-share listed companies in China from 2015 to 2023. To ensure data quality, the following exclusions were applied: (1) companies delisted during the sample period; (2) those under special treatment (ST or *ST); (3) firms with significant missing financial data; and (4) financial institutions. After this screening, continuous variables were winsorized at the 1st and 99th percentiles to mitigate the influence of outliers, and logarithmic transformations were applied to specific non-ratio variables. These procedures yielded a final balanced panel of 12,483 firm-year observations. All financial data were sourced from the China Stock Market & Accounting Research (CSMAR) database, while the annual report texts for digital transformation analysis were obtained from the CNINFO website.

4. Empirical Analysis

4.1 Descriptive Statistics

Table 1 presents the descriptive statistics for the main variables. Tobin's Q, which measures enterprise value, has a mean of 2.111, ranging from a minimum of 0.831 to a maximum of 8.353. This wide range indicates substantial variation in firm value across the sample. The digital transformation index (DT) shows a mean of 1.767 (SD = 1.451) and ranges from 0 to 5.403. This dispersion, which is consistent with the findings of Wu et al., reflects significant heterogeneity in the level of digital advancement among the sampled firms. The average score for executive education background (Edu) is 3.685 (SD = 1.049).

Table 1. Descriptive Statistics

Variable	N	Mean	Std. Dev.	Min	Max
TobinQ	12483	2.111	1.333	0.831	8.353
DT	12483	1.767	1.451	0	5.403
Edu	12483	3.685	1.049	2.258	5
Size	12483	22.595	1.255	20.284	26.466
Lev	12483	0.416	0.184	0.069	0.838
ROA	12483	0.036	0.062	-0.224	0.202
Top1	12483	32.137	14.224	7.45	69.7
Board	12483	2.12	0.192	1.609	2.639
Govern	12483	0.366	0.482	0	1

4.2 Benchmark regression results analysis

The relationship between digital transformation and enterprise value (Hypothesis H1) was tested using Model (1). Based on the Hausman test results, a two-way fixed effects model controlling for industry and year effects was employed. As shown in Column (1) of Table 2, the coefficient for digital transformation (DT) is 0.022 and statistically significant at the 5% level. This positive and significant result indicates that digital transformation enhances enterprise value, thereby providing

support for Hypothesis H1.

Table 2. Regression Results

	TobinQ			
	(1)	(2)	(3)	(4)
DT	0.022**	0.033**	0.052***	0.025**
	(1.991)	(2.227)	(2.915)	(2.017)
Edu		0.082**		
		(2.094)		
DT×Edu		0.053***		
		(2.658)		
Constant	12.054***	11.279***	10.417***	13.828***
	(28.568)	(21.937)	(17.792)	(18.674)
Control Variables	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
N	12483	12483	12483	12483
R^2	0.3164	0.3407	0.3319	0.3209
F	284.49***	138.96***	80.58***	54.43***

t-stats are reported between parentheses. Significance level: *** p <0.01, ** p <0.05, * p <0.1.

4.3 Moderating Effect Test

Hypothesis H2, which posits a positive moderating role of executive education background, was tested using Model (2). As reported in Column (2) of Table 2, the coefficient for the interaction term between digital transformation (DT) and executive education background (Edu) is 0.053 and is statistically significant at the 1% level. This finding indicates that a higher level of executive education amplifies the positive effect of digital transformation on enterprise value, thereby supporting Hypothesis H2.

4.4 Robustness Checks

4.4.1 Alternative Measure of the Explanatory Variable

To mitigate potential measurement bias and ensure the robustness of the findings, an alternative proxy for digital transformation was constructed. Following Zhang et al., the degree of digitalization was re-assessed by analyzing the composition of intangible assets disclosed in financial statement notes. Specifically, digital transformation was measured as the proportion of digital-related intangible assets to total intangible assets at year-end. As shown in Column (3) of Table 2, the regression results using this alternative measure remain positive and statistically significant, consistent with the baseline findings. This confirms the robustness of the main results to different measurement approaches.

4.4.2 Instrumental Variable Approach

To address potential endogeneity concerns, an instrumental variable (IV) approach was implemented. The instrumental variable selected was the industry-average level of digital transformation, excluding the focal firm. This variable is expected to be correlated with a firm's own digital transformation (relevance condition) but unlikely to directly affect its enterprise value (exclusion restriction). The IV regression results, presented in Column (4) of Table 2, show that the coefficient for digital transformation remains positive and significant at the 5% level. The significant Lagrange Multiplier (LM) statistic ($p < 0.01$) rejects the null hypothesis of under-identification, and the Wald F-statistic exceeds the Stock-Yogo critical value, indicating that the instrument is not weak. These results further support the robustness of the causal interpretation.

4.5 Heterogeneity Analysis

4.5.1 Heterogeneity by Property Rights Nature

To examine whether the effect of digital transformation varies by property rights nature, the sample was split into state-owned enterprises (SOEs) and non-state-owned enterprises (NSOEs) for subgroup analysis. The results, presented in Column (1) of Table 3, show a digital transformation coefficient of 0.044 ($p < 0.10$) for SOEs and a larger coefficient of 0.056 ($p < 0.05$) for NSOEs. This suggests that the value-enhancing effect of digital transformation is stronger for non-state-owned enterprises. This heterogeneity may be attributed to the greater market responsiveness and stronger internal

incentives for digital adoption typically found in NSOEs, which allow them to leverage digital technologies more effectively to create value.

Table 3. Regression Results of Heterogeneity Analysis

	SOEs	NSOEs	Eastern China	Central China	Western China
	(1)	(2)	(3)	(4)	(5)
DT	0.044*	0.056**	0.046**	0.026	0.025
	(1.708)	(2.349)	(2.11)	(0.76)	(0.49)
Control Variables	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
N	4493	7990	6116	3310	3057
R^2	0.4325	0.278	0.3387	0.4287	0.3291
F	67.08***	54.38***	111.87***	88.59***	73.41***

All subgroup regressions passed the test for coefficient differences between groups. T-stats are reported between parentheses. Significance level: *** p <0.01, ** p <0.05, * p <0.1.

4.5.2 Regional Heterogeneity Analysis

To investigate regional variations in the effect of digital transformation, the sample was stratified into three subgroups based on company registration location: Eastern, Central, and Western China. The regression results, presented in Columns (3) to (5) of Table 3, reveal a significant positive coefficient for digital transformation (0.046, $p < 0.05$) in the Eastern region. In contrast, the coefficients for the Central and Western regions are statistically insignificant. This pattern indicates a pronounced regional disparity, with the value-enhancing effect of digital transformation being concentrated in Eastern China. This heterogeneity can be attributed to the Eastern region's more advanced digital economy, superior infrastructure, developed market institutions, and deeper pool of technical talent, which collectively facilitate effective digital transformation. Conversely, the less developed digital infrastructure and scarcity of technical talent in the Central and Western regions likely hinder the successful implementation and value realization of digital initiatives.

5. Conclusions

This study empirically examines the impact of digital transformation on enterprise value and the moderating role of executive education background using a sample of Chinese A-share listed companies from 2015 to 2023. The findings lead to three main conclusions. First, digital transformation significantly enhances enterprise value, a result that remains robust after a series of stringent tests. This suggests that digital transformation drives value creation by optimizing resource allocation, improving operational efficiency, and fostering innovation. Second, executive education background positively moderates this relationship; a higher average education level within the executive team strengthens the value-enhancing effect of digital transformation. This underscores the critical role of executives' cognitive capacity, strategic vision, and digital literacy in the transformation process. Third, heterogeneity analyses reveal that the effect is more pronounced in non-state-owned enterprises and firms located in Eastern China, attributable to their greater operational flexibility, market sensitivity, and superior digital infrastructure and talent resources.

These findings yield several policy implications. For firms, particularly non-state-owned enterprises and those in Central and Western China, it is crucial to advance digital transformation strategies by increasing investments in key technologies (e.g., cloud computing, AI) and addressing infrastructure and capability gaps. Corporations should also prioritize the quality of their executive teams by aligning recruitment and development with digital transformation needs, enhancing digital training to improve strategic decision-making and digital leadership. For the government, differentiated support policies are needed to promote balanced regional digital development. Systemic enhancements for SMEs and firms in less-developed regions can be achieved through special transformation funds, public service platforms, and industry-university-research collaboration for talent development, thereby narrowing regional digital divides.

Acknowledgments

This paper was supported by the following fund project: PhD Research Start-up Fund of Yuncheng University (20201101).

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Author Bio

Zhang Min (1991-), female, Han Nationality, born in Yuncheng, Shanxi province. Ph.D., Lecturer.Research interests focus on corporate digital transformation and corporate governance.

Yue Peng (1969-), female, Han Nationality, born in Yuncheng, Shanxi province. Professor. Research areas are digital transformation and digital finance.