

Moderating role of artificial intelligence in the impact of digital transformation and innovation on small and medium-sized enterprises' financial performance

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ABSTRACT

Objective: The objective of the article is to identify the moderating role of artificial intelligence (AI) in the relationship between digital transformation, innovation, and financial performance within small and medium-sized enterprises (SMEs). We aimed to investigate how AI amplifies the impacts of digital transformation and innovation on financial performance indicators, including profit, revenue, and return on assets (ROA), particularly in the context of an emerging economy.

Research Design & Methods: We adopted a quantitative research approach, utilising data collected through structured questionnaires from 246 SMEs in Vietnam. We used correlation analysis and ordinary least squares (OLS) regression to test the proposed hypotheses.

Findings: The results demonstrate significant positive impact of digital transformation and innovation on SMEs' financial performance, notably in revenue and profit. Importantly, AI adoption substantially enhances these positive effects, indicating its critical role as a moderating factor. SMEs integrating AI alongside digital transformation and innovative practices achieve better financial performance.

Implications & Recommendations: The study offers valuable evidence for SME managers and policymakers on promoting AI to maximise returns from digital and innovative investments, particularly in emerging markets where such empirical evidence is limited.

Contribution & Value Added: This study advances the literature by theorising and testing AI as a moderating strategic capability rather than a standalone performance predictor. Anchoring on the resource-based view (RBV), the study explains how AI complements digital transformation and innovation, amplifying their effects on SMEs' financial performance.

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INTRODUCTION

Small and medium-sized enterprises (SMEs) operate in an era of rapid digital change and growing environmental concerns. The combined pressures of Industry 4.0, digital transformation, and sustainability push SMEs to adopt new technologies and innovation to remain competitive (Khalid, 2024; Ramdani *et al.*, 2022). Among these technologies, AI has emerged as a key driver of organisational performance and competitiveness. This issue is particularly important for SMEs because of their critical contributions to employment generation and economic growth (Ardito *et al.*, 2024; Abrokwah-Larbi & Awuku-Larbi, 2024). Prior studies suggest that AI can improve decision-making, customer engagement, internal processes, and financial outcomes. Furthermore, when combined

with other digital technologies such as the Internet of Things and big data analytics, AI may further enhance operational efficiency and revenue growth (Ardito *et al.*, 2024).

However, despite its potential benefits, AI adoption remains challenging for SMEs. Existing studies point to barriers such as technological complexity, financial constraints, and limited human capital, which reduce SMEs' ability to implement and exploit AI effectively (Ardito *et al.*, 2024; Abrokwah-Larbi & Awuku-Larbi, 2024). Furthermore, SMEs frequently experience difficulty integrating AI effectively due to the high costs associated with initial technology investment, ongoing maintenance, and upskilling personnel to manage these technologies successfully. Moreover, SMEs' internal resources, lower than larger organisations', exacerbate these challenges, further hindering their ability to capitalise on AI's potential benefits. These challenges are even more evident in emerging economies, where SMEs often face limited access to finance, weak technological infrastructure, and institutional constraints. For example, in Vietnam, such conditions complicate firms' digital transformation efforts, even though AI and related digital capabilities may be essential for improving financial performance (Quoc Trung, 2021; Tuan, 2020; Nguyen, 2024).

Although the strategic importance of AI has been widely acknowledged, the existing literature still leaves several important questions unanswered. Firstly, empirical evidence on the financial effects of AI adoption in SMEs remains limited, particularly in emerging economies. Much of the prior research is conceptual or focuses on intermediate outcomes rather than direct financial performance (Ardito *et al.*, 2024; Abrokwah-Larbi & Awuku-Larbi, 2024). Secondly, although some studies indicate that AI can enhance firm performance (Chen *et al.*, 2022; Mohsen *et al.*, 2025; Huang & Lin, 2025; Narwane & Priyadarshinee, 2025), little is known about whether AI strengthens the effects of digital transformation and innovation on SME financial performance. In other words, the moderating role of AI in these relationships remains underexplored, especially in the context of SMEs in emerging markets. To address these gaps, we examined the relationships between digital transformation, innovation, and SMEs' financial performance with particular attention to AI's moderating role. Following Khan and Gupta (2025), we argue that a stronger application of AI may enhance the effects of digital transformation and innovation on SME financial performance. Our study was grounded in the resource-based view (RBV), which suggests that firms achieve sustained competitive advantage through valuable, rare, inimitable resources and capabilities. From this perspective, we may view AI as a strategic technological capability that enables SMEs to leverage digital transformation and innovation better to improve performance (Abrokwah-Larbi & Awuku-Larbi, 2024).

Our study contributes to both literature and practice. Firstly, it extends the emerging research on AI in SMEs by examining AI not only as a direct driver of firm performance but also as a moderating mechanism in the relationships between digital transformation, innovation, and financial performance. More importantly, it offers a novel theoretical contribution by anchoring in RBV theory to explain the model. Secondly, the study provides empirical evidence from an emerging economy context, where research on AI and SME financial performance remains limited. Finally, the findings offer practical implications for SME managers and policymakers by showing how AI capability development can strengthen the returns from digital transformation and innovation, while informing policies that support technology adoption, digital upskilling, and capability building among SMEs.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Resource-based View

The resource-based view (RBV) theory, initially introduced by Wernerfelt (1984) and further developed by Barney (1991), is a strategic management framework that emphasises the role of a firm's internal resources and capabilities as the primary sources of competitive advantage and superior performance. According to RBV, resources that are valuable, rare, inimitable, and non-substitutable are essential for gaining and maintaining competitive advantages, which in turn improve firm performance (Barney, 1991; Wernerfelt, 1984). These resources include tangible assets, such as physical and financial resources, and intangible assets, such as human capital, technological capabilities, organisational culture, and knowledge (Barney, 2001; Ardito *et al.*, 2024).

Researchers have extensively applied the RBV framework to understand the implications of digital technologies, particularly artificial intelligence (AI), for SMEs' financial performance. Chen *et al.* (2022) highlight AI capability as an intangible strategic resource critical for firm competitiveness, particularly within e-commerce SMEs. They state that AI capability combines infrastructure, technical skills, and organisational readiness. Together, these factors support more effective decision-making, more efficient operations, and better resource allocation, all of which improve firm performance. Ardito *et al.* (2024) reinforce the RBV perspective by examining the complementary nature of AI when integrated with the Internet of Things (IoT) and Big Data Analytics (BDA). Their research demonstrates that these complementary digital resources significantly amplify SMEs' revenue growth. Combined, AI, IoT, and BDA create a stronger digital ecosystem.

Further supporting the RBV theory, Abrokwah-Larbi and Awuku-Larbi (2024) emphasise AI's role specifically in marketing as a strategic resource. Their study found that applying AI to marketing significantly influences SMEs' financial performance through improved customer engagement, personalisation, and optimised internal business processes. AI capabilities, such as IoT, collaborative decision-making systems, and augmented reality, provide SMEs with unique resources for delivering superior customer experiences, efficient operations, and enhanced financial outcomes (Wu & Monfort, 2023). These intangible assets derived from AI technologies are difficult for competitors to replicate, allowing SMEs to sustain their competitive advantages and achieve superior long-term financial performance.

Overall, the RBV theory provides a robust theoretical foundation to understand how SMEs can develop unique digital capabilities, especially AI, to achieve and sustain superior financial performance. The strategic integration and management of AI and complementary digital resources significantly enhance SMEs' operational efficiency, market adaptability, and financial outcomes. This reaffirms RBV's emphasis on the central role of valuable, rare, and difficult-to-imitate resources in driving competitive advantage and firm performance.

Digital Transformation and Financial Performance of SMEs

Small and medium-sized enterprises (SMEs) are defined differently across regions and countries, typically based on criteria such as the number of employees, annual turnover, or asset size. According to the World Bank (2020), SMEs are businesses that employ fewer than 300 employees and have annual sales of less than 15 million USD. In this study, we used this definition when collecting data from SMEs.

Digital transformation is increasingly recognised as a pivotal strategic factor significantly influencing SME financial performance (Ji *et al.*, 2024; Zhao *et al.*, 2024). Digital transformation encompasses deploying advanced technologies, such as cloud computing, big data analytics, the Internet of Things (IoT), and automation, to optimise business processes, improve customer interactions, and facilitate strategic decisions (Nguyen, 2024). Previous research demonstrates that SMEs engaging in digital transformation often experience enhanced efficiency, productivity gains, reduced operational costs, and increased revenue, and competitive advantage (Chen & Zhang, 2024; Mahssouni *et al.*, 2023; Nguyen *et al.*, 2024; Saputra *et al.*, 2024; Wang *et al.*, 2024). For instance, SMEs leveraging big data analytics and cloud computing typically achieve better financial outcomes due to improved resource allocation and enhanced capability to respond promptly to market dynamics (Shiyyab *et al.*, 2023). However, the existing literature still leaves an important gap. Although prior studies generally report positive effects of digital transformation on firm outcomes, empirical evidence remains limited and fragmented for SMEs, particularly in emerging economies. Moreover, the literature has not sufficiently explained the mechanism through which digital transformation translates into superior financial performance under SME resource constraints. Drawing on the RBV, this study argues that we may understand digital transformation as a valuable, rare, and difficult-to-imitate organisational capability that enables SMEs to deploy resources more efficiently, improve adaptability, and strengthen their competitive position. From this perspective, digital transformation is expected to enhance SMEs' financial performance. Therefore, we hypothesised:

H1: Digital transformation positively affects financial performance.

Innovation and Financial Performance of SMEs

Innovation is recognised as a critical factor enabling SMEs to achieve competitive advantage and improve financial performance in increasingly dynamic and competitive markets (Žur & Wałęga, 2023; Zhu *et al.*, 2024). Innovation refers to introducing new or significantly improved products, processes, services, or business practices aimed at enhancing efficiency, productivity, and market competitiveness (Brännback *et al.*, 2009). For SMEs, innovation can include incremental improvements, such as optimising production processes or technology, as well as radical innovations, such as developing entirely new products or services. Innovative small and medium-sized enterprises usually perform better financially than their non-innovative counterparts (Endrődi-Kovács *et al.*, 2024). This is because they are more flexible and can exploit new market opportunities (Brännback *et al.*, 2009; Ramdani *et al.*, 2022). Furthermore, process innovations often result in cost reductions through enhanced operational efficiency, waste minimisation, and optimised resource use, positively impacting profitability (El Chaarani *et al.*, 2021; Brännback *et al.*, 2009; Nguyen *et al.*, 2025). However, the literature on innovation and SME performance still presents limitations. Firstly, although many studies report a positive link between innovation and firm outcomes, the evidence remains uneven across SME contexts and is still relatively scarce in emerging economies. Secondly, prior research has tended to emphasise innovation outcomes more than the strategic logic by which it generates financial returns for SMEs. From the perspective of RBV, innovation reflects a firm's ability to develop distinctive capabilities, renew its resource base, and create hard-to-replicate advantages in response to changing market conditions. For SMEs, such capability is especially important because it allows them to overcome resource constraints and convert limited resources into stronger financial outcomes. Thus, we hypothesised:

H2: Innovation positively affects financial performance.

Artificial Intelligence

Artificial intelligence (AI) is increasingly recognised as a critical technological capability that SMEs can leverage to amplify the benefits of digital transformation and innovation. Khan and Gupta (2025) confirm that AI positively moderates the relationship between green accounting practices and firm performance. Moreover, AI technologies, including machine learning algorithms, data analytics, and process automation, empower SMEs by enhancing their decision-making capabilities, operational efficiency, and market responsiveness (Sarker *et al.*, 2024). Ardito *et al.* (2024) concluded that RBV theory emphasises the important role complementary digital assets play in making AI technologies more valuable and useful, giving small businesses a significant market edge. Previous research demonstrates that firms integrating AI into their operations typically achieve superior financial outcomes through optimised resource utilisation, cost reductions, and improved decision-making quality (Dwivedi *et al.*, 2021; Shiyyab *et al.*, 2023), as well as an increase in organisational creativity and performance (Dubey *et al.*, 2020; Mikalef & Gupta, 2021). Notably, SMEs employing AI-driven analytics can significantly improve customer relationship management, optimise supply chain operations, and achieve higher efficiency levels (Abrokwah-Larbi & Awuku-Larbi, 2024).

Furthermore, AI technologies can significantly complement innovation activities within SMEs, enabling them to manage innovative processes effectively, reduce innovation risks, and enhance product and service development efficiency. Artificial Intelligence provides SMEs with the tools to process market data rapidly, better understand customer preferences, and accelerate new product and service development, thus magnifying innovation-driven financial outcomes (Abrokwah-Larbi & Awuku-Larbi, 2024; Dwivedi *et al.*, 2021). Nonetheless, the moderating role of AI in reinforcing the impact of digital transformation and innovation on SMEs' financial performance has received limited attention in empirical research. Based on these insights, we hypothesised:

H3: AI moderates the effect of digital transformation on financial performance.

H4: AI moderates the effect of innovation on financial performance.

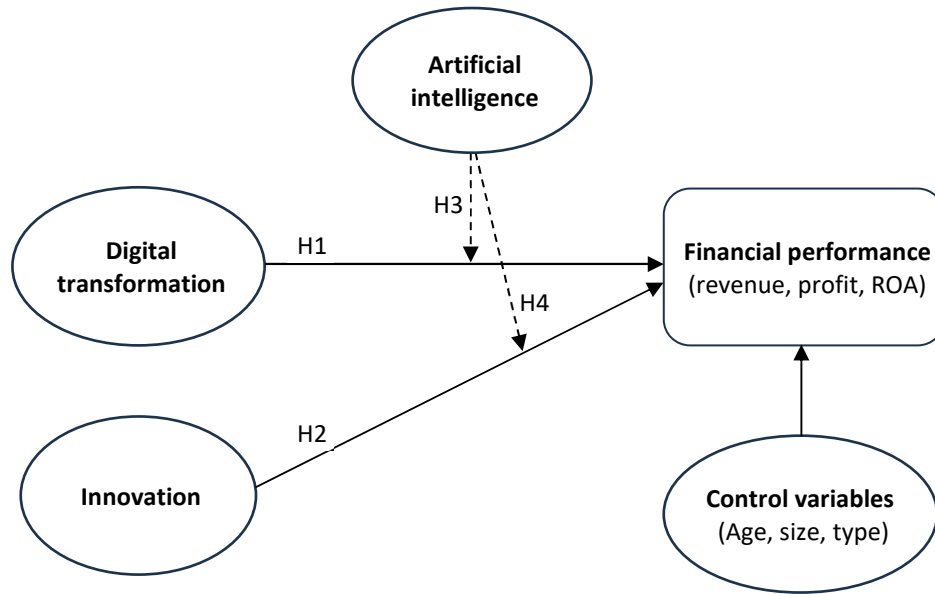


Figure 1. Research model

Source: own elaboration.

Enterprise characteristics represent another important factor influencing financial performance. Prior research has demonstrated the significant impact of enterprise characteristics on performance (Coad *et al.*, 2018; Nguyen, 2024). Specifically, Nguyen (2024) concluded that firm type and size positively affect business performance, whereas Coad *et al.* (2018) found that firm age significantly influences financial outcomes. This study included firm type, size, and age as control variables because of their established effects on financial performance. Based on the hypotheses and arguments presented, we proposed the research model illustrated in Figure 1.

RESEARCH METHODOLOGY

We analysed the collected data with a quantitative research approach. Specifically, we used descriptive statistics, correlation analysis, and regression analysis to examine the relationships between variables in the research model. We selected the ordinary least squares (OLS) regression method to test the proposed hypotheses. We tested hypotheses H1 and H2, examining the direct effects of digital transformation and innovation on financial performance, using the regression equation (1).

$$F\_PERF_i = \alpha + \beta_1 DT_i + \beta_2 INNO_i + \beta_3 AGE_i + \beta_4 SIZE_i + \beta_5 TYPE_i + \varepsilon_i \quad (1)$$

In equation (1), F-PERF represents the financial performance of the enterprise as measured by ROA, profit, and revenue at the end of 2023; DT denotes digital transformation activities; AGE, SIZE, and TYPE are firm age, firm size, and firm type; α and β are regression coefficients; and ε is the error term. We used equation (2) to test hypothesis H3, which examines how AI might influence the relationship between digital transformation and financial performance.

$$F\_PERF_i = \gamma + \theta_1 DT_i + \theta_2 (AI \times DT)_i + \mu_i \quad (2)$$

In equation (2), γ and θ are regression coefficients; (AI $\times$ DT) represents the interaction term between AI and digital transformation, and μ is the error term.

We used the regression equation (3) to test hypothesis H4, which examines how AI might influence the relationship between innovation and financial performance.

$$F\_PERF_i = \delta + \sigma_1 INNO_i + \sigma_2 (AI \times INNO)_i + \omega_i \quad (3)$$

In equation (3), δ and σ are regression coefficients; (AI $\times$ INNO) represents the interaction term between AI and innovation, and ω is the error term. Table 1 presents the variables used in the regression model, including their labels and definitions.

Table 1. Explanation of variables

Variables	Labels	Definition
Financial performance	F-PERF	Revenue in billion VND at the end of 2023
		Profit in billion VND (after-tax earnings in 2023)
		ROA, EBIT divided by total assets in 2023, unit: %
Digital transformation	DT	Dummy variable that equals 1 if the firm engaged in any of the following actions in 2023: using cloud computing, employing big data analytics, or implementing Internet of Things technology; otherwise, it equals 0.
Innovation	INNO	Dummy variable, equals 1 if the enterprise had one of the following activities in 2023 (investing in new technologies, equipment or new software, launching a new product to market), otherwise equals 0.
Artificial intelligence	AI	Dummy variable, equals 1 if the SME had applied AI in business activities (manufacturing, sale, marketing, accounting and quality), otherwise equal 0.
Firm age	AGE	The age of SMEs.
Firm size	SIZE	Number of staff at the end of 2023
Firm type	TYPE	Dummy variable, equals 1 if the enterprise is FDI type, otherwise equal 0.

Source: own study.

We collected data in Vietnam through structured interviews with SME leaders using a questionnaire-based survey. To recruit eligible firms, we applied a snowball sampling technique. We first approached SME managers and owners through our professional networks, including friends and alumni working in SMEs. After each interview, we asked respondents to refer other SME leaders who met the sampling criteria. We then contacted these referred firms and invited them to participate in the study. We collected data over six months, from September 2024 to February 2025. The initial survey yielded 318 SME responses. After screening for missing data and incomplete responses, we excluded 72 observations, which resulted in a final sample of 246 SMEs for the empirical analysis. Table 2 reports the characteristics of the sampled firms. Most firms were small enterprises with fewer than 100 employees (63.0%) and had operated for 10 to 20 years (54.1%). Private enterprises

Table 2. Characteristics of the sample firms

Sample characteristics	Frequency	Percentage (%)
Enterprise size		
Under 100 employees	155	63.0%
100-200 employees	54	22.0%
Above 200 employees	37	15.0%
Enterprise age		
Under 10 years	47	19.1%
10-20 years	133	54.1%
Above 20 years	66	26.8%
Enterprise type		
Private enterprise	175	71.1%
State-owned enterprise	16	6.5%
FDI enterprise	55	22.4%
Industry type		
Food and foodstuff	56	22.8%
Beverages and tobacco	20	8.1%
Paper and paper products	27	11.0%
Medicinal products	34	13.8%
Rubber and plastic products	35	14.2%
Wood products	32	13.0%
Metal products	42	17.1%

Source: own study.

accounted for the largest share of the sample (71.1%), followed by FDI enterprises (22.4%) and state-owned enterprises (6.5%). The sample also included firms from several manufacturing sectors, with food and foodstuffs representing the largest proportion (22.8%).

RESULTS AND DISCUSSION

Descriptive Statistics

Table 3 provides descriptive statistics for the primary variables analysed in this study, derived from a sample of 246 SMEs in Vietnam. The financial performance indicators considered were revenue, profit after tax, and return on assets (ROA). The SMEs reported an average revenue of 84.24 billion VND, with values ranging from 0 billion VND to 379.77 billion VND, indicating substantial variability within the sample. Profit after tax averaged approximately 5.67 billion VND, ranging from a minimum loss of -106.65 billion VND to a maximum profit of 129.11 billion VND. The average ROA was approximately 5.7%, with a wide range from -80.6% to 45.3%, further highlighting the diversity in financial performance among these SMEs.

Table 3. Descriptive statistics

Variables	Mean	Maximum	Minimum	Std. Dev.	Observations
REVENUE	84.240	379.766	0.000	82.346	246
PROFIT	5.669	129.110	-106.649	106.533	246
ROA	0.057	0.453	-0.806	0.362	246
DT	0.305	1.000	0.000	0.461	246
INNO	0.220	1.000	0.000	0.415	246
AI	0.146	1.000	0.000	0.354	246
AGE	17.829	36.000	2.000	6.575	246
SIZE	80.496	297.000	3.000	73.905	246
TYPE	0.224	1.000	0.000	0.417	246

Source: own study.

Regarding digital transformation activities, 30.5% of SMEs reported engaging in digital initiatives, such as cloud computing, big data analytics, or utilising Internet of Things (IoT) technologies. In terms of innovation activities, such as launching new products or investing in new technologies, 22% of SMEs indicated active participation. Approximately 14.6% of SMEs applied AI, indicating a moderate integration of advanced technological practices within business operations.

The average SME age was approximately 17.83 years, reflecting a mature set of enterprises, with the youngest at two years and the oldest at 36 years. Firm size averaged about 80 employees per enterprise, with considerable variation noted, as the smallest SMEs had as few as three employees and the largest employed up to 297. Finally, about 22.4% of SMEs were foreign direct investment (FDI) enterprises, highlighting a noteworthy representation of international investment among the sampled businesses.

Correlation Results

Table 4 presents the correlation analysis results, providing preliminary insights into the relationships between the study's key variables. Revenue demonstrated a positive but relatively weak correlation with profit ($r = 0.131$), indicating that SMEs with higher revenues were somewhat likely to achieve better profitability, although the relationship was not strongly pronounced. Similarly, revenue showed minimal correlation with ROA ($r = 0.015$), suggesting limited direct association between higher revenue and asset returns within this SME sample.

Digital transformation (DT) activities showed a strong positive correlation with revenue ($r = 0.506$), suggesting that SMEs engaging in digital initiatives generally achieved higher revenue. Innovation (INNO) also exhibited a positive correlation with revenue ($r = 0.348$), further underscoring innovation's significance in enhancing SME financial outcomes. AI application correlated positively with revenue ($r = 0.314$), reinforcing the role of AI technologies in potential revenue growth for SMEs. There was a

moderately positive correlation ($r = 0.420$) between INNO and AI, indicating that these two factors often co-occur in SMEs. Digital transformation and AI also showed a positive association ($r = 0.225$), highlighting their complementary roles in enhancing SME performance.

Table 4. Correlating results

Factors	REVENUE	PROFIT	ROA	DT	INNO	AI	AGE	SIZE	FDI
REVENUE	1.000	—	—	—	—	—	—	—	—
PROFIT	0.131*	1.000	—	—	—	—	—	—	—
ROA	0.015	0.112*	1.000	—	—	—	—	—	—
DT	0.506***	0.198***	0.056	1.000	—	—	—	—	—
INNO	0.348***	0.233***	0.168***	0.118*	1.000	—	—	—	—
AI	0.314***	0.237***	0.408***	0.225***	0.420***	1.000	—	—	—
AGE	0.165**	-0.020	-0.075	0.070	-0.082	-0.100	1.000	—	—
SIZE	0.425***	0.036	-0.094	0.229***	0.105	-0.030	0.229***	1.000	—
TYPE	0.087	0.073	0.088	0.153**	0.163	0.219***	-0.176***	0.008	1.000

Note: *** is 1% Significance, ** is 5% significance, and * is 10% significance.

Source: own study.

Furthermore, firm size (SIZE) correlated positively with revenue ($r = 0.425$), suggesting that larger SMEs tend to generate higher revenues. Firm age (AGE) exhibited a relatively weak positive correlation with revenue ($r = 0.165$), indicating that older SMEs tend to perform slightly better financially. Foreign direct investment (FDI) status (TYPE) showed only a weak correlation with revenue ($r = 0.087$), indicating minimal direct financial impact of foreign ownership in this sample. These initial correlations provide essential groundwork for subsequent regression analyses, emphasising digital transformation, innovation, and AI as critical drivers of financial performance within SMEs.

Regression Results

Table 5 presents the regression results for equation (1), highlighting the effects of digital transformation (DT), innovation (INNO), firm age (AGE), firm size (SIZE), and firm type (TYPE) on SMEs' financial performance, measured by revenue, profit, and return on assets (ROA).

Table 5. Regression results of equation 1

Independent variables	Revenue		Profit		ROA	
	Beta	T-statistics	Beta	T-statistics	Beta	T-statistics
Constant	4.034	0.321	-14.429	-0.696	0.079	1.098
DT	71.949***	7.962	41.175***	2.765	0.046	0.888
INNO	55.524***	5.624	54.523***	3.351	0.142**	2.523
AGE	1.183*	1.856	-0.111	-0.106	-0.002	-0.456
SIZE	0.314***	5.489	-0.038	-0.399	-0.001	-1.470
TYPE	-1.243	-0.125	2.611	0.159	0.042	0.738
Observations	246	246	246	246	246	246
R ²	0.4361		0.0845		0.0482	
F-statistics	37.1203***		4.4455***		2.4331**	
Prob (F-stat)	0.0000		0.0007		0.0346	

Note: *** is 1% Significance, ** is 5% significance, and * is 10% significance.

Source: own study.

The analysis revealed a significant positive effect of digital transformation on revenue ($\beta = 71.949$, $p < 0.01$) and profit ($\beta = 41.175$, $p < 0.01$), supporting hypothesis H1. These findings confirm that SMEs implementing digital technologies typically achieve superior financial outcomes in revenue and profitability. Innovation also significantly impacted revenue and profit, thereby validating hypothesis H2 and emphasising its role in improving SMEs' financial performance. The effect of innovation on ROA was positive and significant at the 5% level, further underscoring its positive financial impact.

Firm size positively and significantly influenced revenue at the 1% significance level, suggesting that larger SMEs generally generate higher revenue. Firm age showed a mild positive impact on revenue at the 10% significance level, suggesting that older SMEs may have marginally higher revenue performance. Firm type showed insignificant effects on revenue, profit, and ROA. Overall, the regression model explained 43.61% of the variance in revenue, 8.45% in profit, and 4.82% in ROA, demonstrating stronger predictive power for revenue than for profit and ROA.

Table 6 presents the regression results of equation (2), which investigated the moderating effect of AI on the relationship between digital transformation and SMEs' financial performance indicators.

Table 6. Regression results of equation 2

Independent variables	Revenue		Profit		ROA	
	Beta	T-statistics	Beta	T-statistics	Beta	T-statistics
Constant	56.692	10.891	-8.305	-1.066	0.044	1.592
DT	67.276***	6.376	18.676	1.183	0.004	0.072
(AI*DT)	86.552***	4.869	101.853***	3.831	0.149	1.584
Observations	246	246	246	246	246	246
R ²	0.3223		0.0941		0.0133	
F-statistics	57.7943***		12.6228***		1.6412	
Prob (F-stat)	0.0000		0.0000		0.1958	

Note. *** is 1% Significance, ** is 5% significance, and * is 10% significance.

Source: own study.

The analysis demonstrated that digital transformation significantly and positively impacted revenue ($\beta = 67.276$, $p < 0.01$), affirming its direct beneficial effect on financial performance. Moreover, the interaction term between AI and digital transformation ($AI \times DT$) significantly enhanced revenue ($\beta = 86.552$, $p < 0.01$) and profit ($\beta = 101.853$, $p < 0.01$), strongly supporting hypothesis H3, which posits that AI moderates the positive relationship between digital transformation and SMEs' financial performance. Figure 2 further illustrates this moderating effect. As shown, the slope was considerably steeper for firms with AI applications than for those without AI applications, suggesting that digital transformation generates greater improvements in revenue and profit when combined with AI. This visual pattern is consistent with the regression results and provides additional support for H3.

The direct influence of digital transformation on profit and ROA remained statistically insignificant when evaluated independently of the AI interaction. This result suggests that combining digital transformation with AI technologies significantly amplifies SMEs' profitability. The regression model in equation (2) explains approximately 32.23% of the variance in revenue, 9.41% in profit, and 1.33% in ROA, indicating solid explanatory power, particularly for revenue and profit.

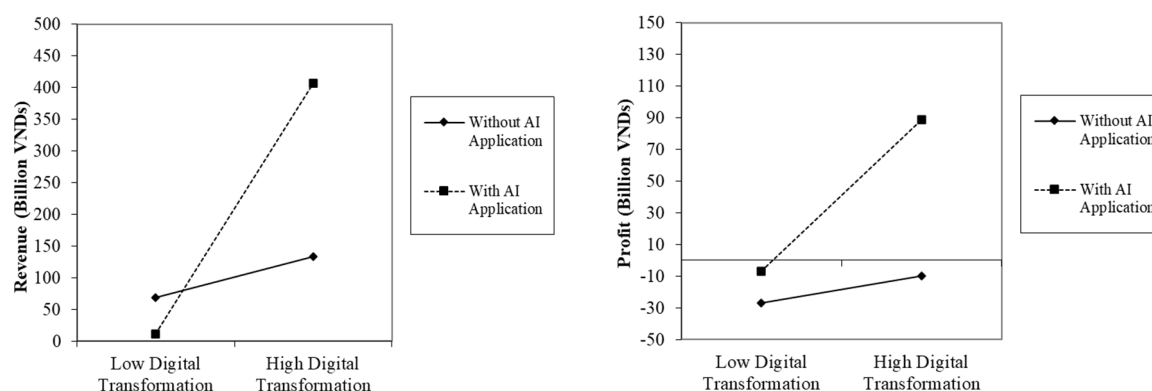


Figure 2. Moderation interaction AI*DT

Source: own elaboration.

Table 7 presents regression analysis results for equation (3), examining the moderating role of AI on the relationship between innovation (INNO) and SMEs' financial performance indicators.

Table 7. Regression results of equation 3

Independent variables	Revenue		Profit		ROA	
	Beta	T-statistics	Beta	T-statistics	Beta	T-statistics
Constant	69.069	12.707	-7.457	-1.011	0.025	0.987
INNO	35.598**	2.441	23.537	1.190	0.039	0.578
(AI*INNO)	78.680***	3.796	85.139***	3.029	0.251***	2.581
Observations	246	246	246	246	246	246
R ²	0.1703		0.0886		0.0541	
F-statistics	24.9506***		11.8153***		6.9502	
Prob (F-stat)	0.0000		0.0000		0.0011	

Note: *** is 1% Significance, ** is 5% significance, and * is 10% significance.

Source: own study.

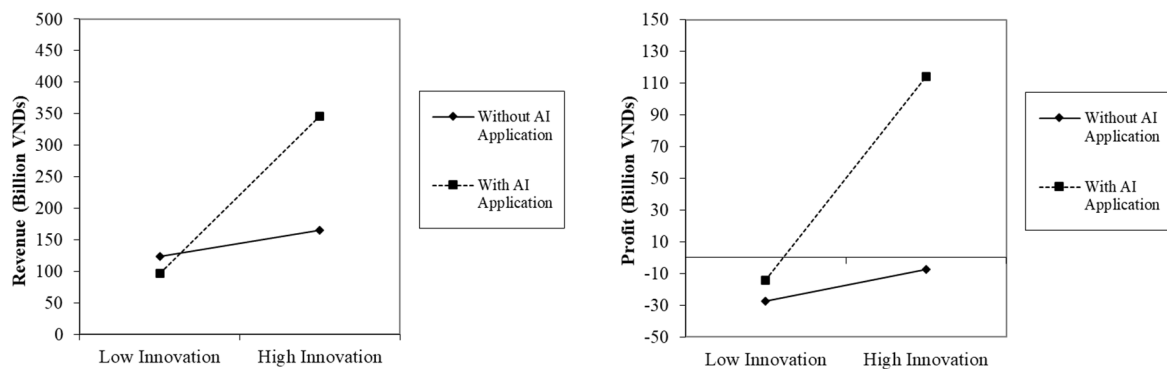


Figure 3. Moderation interaction AI*Innovation

Source: own elaboration.

Discussion

The findings from this study reveal that digital transformation, innovation, and AI significantly influence the financial performance of SMEs, consistent with the findings of prior studies. This study shows that SMEs actively engaging in digital transformation and innovation increase their revenue and profits. This result aligns with the findings of Ardito *et al.* (2024) and Abrokwah-Larbi and Awuku-Larbi (2024). Ardito *et al.* (2024) also identified a substantial positive correlation between digital transformation and SMEs' revenue growth, particularly when integrated with AI. They emphasise that AI's combination with technologies such as the Internet of Things and big data analytics significantly enhances strategic decision-making and operational efficiency, resulting in marked financial gains.

More importantly, this study advances the literature by showing that we should view AI not only as a direct predictor of performance but also as a moderating capability that strengthens the financial effects of digital transformation and innovation. This result is consistent with Khan and Gupta (2025), as well as Chen *et al.* (2022) and Wu and Monfort (2023), who stressed AI's role as a strategic resource enhancing organisational efficiency and decision quality. However, unlike much of the existing literature, which tends to examine AI, digital transformation, and innovation separately, our findings highlight their complementarity and show that performance gains are stronger when these capabilities are combined.

Moreover, the findings reinforce the RBV perspective. RBV argues that firms achieve superior performance when they possess valuable, rare, and difficult-to-imitate resources and capabilities that competitors cannot easily substitute (Wernerfelt, 1984; Barney, 1991). From this perspective, digital transformation, innovation, and especially AI act as strategic capabilities that help SMEs deploy re-

sources more effectively, enhance adaptability, and strengthen competitive advantage. This interpretation is consistent with prior studies showing that AI capabilities improve decision-making, operational efficiency, and firm competitiveness (Chen *et al.*, 2022), and that their value is stronger when combined with complementary digital resources such as IoT and big data analytics (Ardito *et al.*, 2024). It also aligns with evidence that AI-driven capabilities improve customer engagement, personalisation, and internal processes, thereby strengthening financial outcomes (Abrokwah-Larbi & Awuku-Larbi, 2024). Our findings extend this line of research by showing that AI not only contributes to performance directly but also amplifies the performance effects of digital transformation and innovation.

Finally, the results add important evidence from the context of SMEs in an emerging economy. Prior studies have noted that SMEs often face financial, technological, and institutional barriers that limit the effective use of advanced technologies (Melo *et al.*, 2023; Nguyen, 2024). Our findings refine this view by showing that when SMEs develop AI capability, the financial returns to digital transformation and innovation become significantly stronger. This suggests that the benefits of these strategic initiatives depend not only on adoption itself but also on the firm's ability to combine them with complementary capabilities such as AI.

CONCLUSIONS

This study empirically investigated the moderating role of AI in enhancing the relationship between digital transformation, innovation, and financial performance among small and medium-sized enterprises (SMEs). The findings indicate that digital transformation and innovation significantly improve SMEs' financial performance, notably revenue and profitability. Crucially, AI adoption substantially amplifies these positive effects, underscoring AI's critical strategic value in optimising digital and innovative initiatives.

Theoretically, this research enriches the technology-adoption literature by illustrating the synergistic interactions between AI, digital transformation, and innovation. While earlier studies typically examined these elements separately, our findings highlight the need to integrate AI into digital transformation and innovation strategies to maximise financial outcomes. By validating the RBV theory, the study emphasises the importance of AI as an intangible strategic resource that significantly contributes to competitive advantages and sustained financial success.

Practically, the findings offer meaningful insights for SME managers. SMEs should prioritise developing and integrating AI capabilities within broader digital and innovation initiatives. Specifically, investments in AI-driven automation, predictive analytics, and data-driven decision-making can significantly enhance operational efficiencies, customer interactions, and market responsiveness. Managers should adopt comprehensive technological strategies, recognising AI's potential to transform operational performance and maximise returns from digital investments and innovative activities.

For policymakers, the study highlights the necessity of creating supportive environments to facilitate SMEs' adoption of AI, digital transformation, and innovation. Policies could include financial incentives such as subsidies or tax breaks to encourage AI adoption. Moreover, implementing training programmes that improve digital literacy and AI competencies among SME leaders and employees should be prioritised. Establishing AI innovation hubs or collaborative ecosystems to offer SMEs access to essential AI expertise and resources would further enhance the adoption of these technologies. By implementing these policy measures, governments can significantly boost SME performance and contribute to broader economic growth and competitiveness.

Despite these meaningful contributions, we acknowledge some limitations. Firstly, the data collection relied on self-reporting by SME leaders, potentially introducing response bias or inaccuracies due to recall limitations or perceptions. This method may affect the objectivity of the findings. Moreover, the snowball sampling approach might constrain the results' representativeness and generalisability. Because participants were recruited through existing networks, the sample may not represent all SME groups in Vietnam or elsewhere.

Future research could address these limitations by employing more rigorous sampling methods, such as stratified random sampling or larger-scale surveys, to increase representativeness and mitigate potential biases associated with snowball sampling. Furthermore, future research could explore

other performance dimensions, such as market share, customer satisfaction, or environmental sustainability metrics, to understand comprehensively how digital transformation, innovation, and AI integration influence SME success beyond financial metrics. Extending research into comparative analyses across sectors or different geographical contexts could also yield valuable insights into variations in the effectiveness and applicability of AI-driven strategies.

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Use of Artificial Intelligence

This text is free of AI/GAI usage except for grammar and spell-checking performed with Grammarly.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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