

Digital Technology Adoption and SME Performance in Vietnam: A Pilot Study of Innovation Capability and Entrepreneurial Orientation

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Abstract. This exploratory study investigates how digitalization influences competitive performance among Vietnamese SMEs in post-pandemic markets, examining innovation capability as a mediator and entrepreneurial orientation as a potential moderator. Drawing on preliminary data from 60 SMEs across manufacturing, retail, and service sectors in Vietnam's major economic zones, we employ regression analysis to test three hypotheses derived from Resource-Based View and Dynamic Capabilities Theory. Results suggest positive associations between digital technology adoption and self-reported competitiveness ($\beta = 0.695$, $p < 0.001$), with innovation capability partially mediating this relationship (indirect effect = 0.150, 95% CI [0.089, 0.211]). However, entrepreneurial orientation did not significantly moderate the digitalization-competitiveness relationship ($\beta = 0.056$, $p = 0.294$), suggesting that managerial attitudes alone cannot overcome resource constraints. Firm size emerged as a critical factor, with larger SMEs better positioned to leverage digital investments. While these findings offer initial insights into SME digital transformation in emerging markets, the limited sample size severely restricts generalizability. This pilot study highlights the need for large-scale research incorporating objective performance metrics, longitudinal data, and examination of specific digital capabilities rather than generic technology adoption. Future research should address how resource-constrained SMEs can develop unique digital competencies that create sustainable competitive advantage.

Keywords. SMEs, competitiveness, digitalization, innovation ability, entrepreneurial orientation.

1. Introduction

Small and medium enterprises (SMEs) are the Vietnamese economic engines, and more than 98% of the registered businesses and generating up to 45% of Vietnam's GDP (Ministry of Planning and Investment of Vietnam, 2022). SMEs play an important role in employment, innovation, and economic stability. Nonetheless, SMEs from developing countries such as Vietnam are bound to be structurally disadvantaged through constrained access to capital, technology, and skilled manpower (OECD, 2021). These constraints were exactly put under the spotlight amid the COVID-19 pandemic, which saw supply chains get interrupted, client orders fall, and the capacity of SMEs to conduct business in traditional face-to-face markets get constricted (World Bank, 2023). The crisis put the vulnerability of SMEs to the outside shocks in the limelight and fast-tracked the desire for digital transformation as a survival mechanism.

Digitalization is a key facilitator during the pandemic, allowing businesses to operate remotely, engage with e-markets, digitalize on payments, and operate supply chains virtually. Outside of crisis management, digital transformation has appeared as a long-term strategic imperative for greater competitiveness, enhanced productivity, and access to the domestic and global markets. Yet, limited evidence is present regarding the impact of Vietnamese SMEs' digital adoption, and there exists considerable heterogeneity in adoption and performance levels (Nguyen et al., 2023). Although some firms have managed to leverage digital technology to create new products and markets, others could not take advantage of technology investments in terms of measurable gain in performance due to capability shortfalls and insufficient resources (Pham, 2023).

This study applies the Resource-Based View (Barney, 1991) and Dynamic Capabilities Theory (Teece, 2018) in a study of the impact of digitalization on driving SME competitiveness in post-COVID Vietnam. While growing international studies view digital transformation as a performance determinant for firms (Marcucci et al., 2022; Bai et al., 2021), few studies examine the mechanisms through which digital tools evolve competitive advantages in developing economies. Innovation potential as an intervening mechanism enabling SMEs to re-arrange their resources and enter new market spaces is possible. Entrepreneurial orientation (EO) - risk-taking, proactiveness, and innovativeness - can further enable the effect of digitalization by enabling open culture towards technological change (Covin & Slevin, 1989; Lumpkin & Dess, 1996). The interaction between digitalization, innovation, and EO in Vietnam's SMEs is hence not extensively researched.

This research addresses three gaps. First, it provides empirical evidence for the digital transition impact on SME competitiveness in an emerging economy context where digital take-up remains biased. Secondly, it explores the mediating role of innovation capability beyond a direct-effect model for considering mechanisms that transform digital adoption into better performance. Third, it tests the moderator function of EO to see whether strategic orientation amplifies the benefits of digitalization in situations where there are resource constraints. Emphasizing on Vietnamese SMEs this study advances theoretical and practical discussions around the mechanisms through which developing economies can use digital technologies to facilitate sustainable development. We develop a conceptual framework between digitalization, innovation capability, and SME competitiveness and EO as a moderator. Drawing on survey data obtained from mid-sized enterprises which have operated continuously between 2019 and 2024 in the top economic hubs, we empirically test these relationships using regression, mediation, and moderation tests. Findings of this study are expected to inform policymakers who are concerned with promoting digital readiness in SMEs and shape managers toward striking a balance between technology embracement and innovation and strategy to craft long-term competitive edge.

2. Literature Review

2.1. Digitalization and SME Competitiveness in Vietnam

Digitalization is one of the most potent drivers of SME competitiveness globally today, and its relevance to Vietnam has significantly altered over the last decade. In accordance with the Resource-Based View (RBV), firms can attain long-term competitive advantage via the ownership of valuable, rare, inimitable, and non-substitutable resources (Barney, 1991). Consistent with RBV, generic technologies (e.g., e-commerce platforms, cloud services, standard analytics tools) are not VRIN in themselves. The advantage emerges when firms uniquely configure and embed these tools within idiosyncratic resource bundles, for example, proprietary or locally specific data, customized workflows, tightly integrated supplier–customer interfaces, and routines that are path-dependent, causally ambiguous, and socially complex. In this study, ‘digitalization’ is therefore conceptualized as a capability-based deployment of digital tools (how they are integrated and used) rather than mere possession, aligning RBV with Dynamic Capabilities logic. There is evidence supporting the fact that companies adopting digital technologies are outperforming their peers on essential performance indicators such as productivity, cost savings, and response times to market. These benefits were experienced most intensely during the COVID-19 pandemic when digital technology allowed SMEs to operate under rigorous controls. Accordingly, our RBV application focuses on implementation capabilities, data governance, process integration, and customer-interface design, that are difficult to imitate, not on access to widely available platforms. This framing reconciles RBV with our context: the same generic tool can yield different performance outcomes depending on firm-specific complementarities

While basic digital technologies such as e-commerce or data analytics are commercially accessible, the Resource-Based View (RBV) emphasizes that sustainable competitive advantage does not stem from ownership of generic technologies themselves but from how firms combine, embed, and exploit them within unique organizational contexts (Barney, 1991). In the case of SMEs, digital tools become valuable, rare, and inimitable when they are integrated with firm-specific knowledge, processes, and managerial routines that competitors cannot easily replicate. For instance, analytics capabilities or digital customer interfaces yield competitive benefits only when supported by distinct data sets, local market insights, or customized service models. Thus, digitalization in this study is conceptualized as the strategic deployment of digital tools within resource configurations that enhance information processing, responsiveness, and customer engagement—core sources of SME competitiveness rather than mere technology acquisition.

Digitalization also facilitates SME strategic positioning, in addition to instant operation benefits. Recent studies emphasize how Southeast Asian SMEs have restructured their business models in response to the post-COVID environment through digital transformation initiatives such as e-commerce integration, digital logistics, and data-driven management. These digital strategies are viewed as critical mechanisms for sustaining competitiveness and resilience (Nguyen et al., 2023; Nguyen and Pham, 2025; Tran et al., 2025; Sang, 2023). Collectively, these findings highlight that while digital tools are widely accessible, the way SMEs integrate and leverage them for innovation and process reconfiguration determines their long-term performance advantage within Vietnam’s evolving market landscape. Vietnamese SMEs leveraging digital platforms can match multinational companies by reducing the expense of transactions, raising the visibility of products, and gaining from online distribution channels (Pham, 2023). Digital capabilities make it possible to make decisions on the basis of information, and this makes it possible for SMEs to re-map products and services in line with changing customer needs. Even in the emerging economies of nations such as Vietnam, where underpinning infrastructure can be less developed, digitalization offers a platform to leapfrog into bridge logistics and geography barriers to deliver internationalization opportunities (OECD, 2021).

Government policy support has also been noticeable. Vietnam's National Program on Digital Transformation 2025 aims to promote the use of digital solutions among SMEs by enhancing the infrastructure, offering fiscal support, and establishing digital literacy (Ministry of Planning and Investment of Vietnam, 2022). Government intervention eliminates the obstacles for entry by SMEs and supports wider use of digital. Empirical evidence is in place to suggest that firms with sponsored government programs will invest in technology and achieve high levels of competitive performance. On this point, digitalization can be regarded as one of the sources of Vietnamese SME competitiveness in post-COVID markets with operational and strategic advantages.

H1: Capability-based digitalization, the firm-specific integration and use of e-commerce, cloud, and analytics within organizational routines, positively relates to Vietnamese SME competitiveness in post-COVID markets.

2.2. Innovation as a Mediator

Dynamic Capabilities Theory emphasizes the ability of firms to integrate, create, and rebuild resources as a response to environmental fluctuations (Teece, 2018). Digitalization strengthens this ability because it provides SMEs with tools of rapid experimentation, collaborative design, and continuous improvement. Computer-aided design, digital communication infrastructure, and cloud-computing-based data analysis allow SMEs to develop new products and services, thus allowing them to respond to market uncertainty in a fast way (Nguyen et al., 2023). Southeast Asian evidence quotes that technologically advanced SMEs attain quicker new product development, extension of the product line, and improvement in customer service and thus become competitive. Vietnam's online platforms are embedding SMEs in global value chains that foster co-creation and knowledge sharing with consumers and business partners. Partnerships spurred by such collaborations trigger innovation by enabling SMEs to have easier and broader access to additional ideas, market information, and technical knowledge (Bahmanova, 2024). Innovation not only enhances firm competitiveness directly but is also the main mechanism through which digitalization is influencing performance. SMEs that put technologically but fail to innovate may lose its advantage because technology by itself does not discriminate and develop loyalty for customers. Vietnamese empirical facts confirm this fact, which asserts that use of digital combined with innovative culture produces higher revenue growth and improved export opportunities (Pham, 2023). Therefore, innovation capacity also needs to be a mediator between the performance improvement caused by digitalization and realized performance improvement as well.

The Dynamic Capabilities Theory complements RBV by explaining how firms transform accessible technologies into unique sources of advantage. Digitalization fosters three main dynamic capabilities: (i) sensing, by allowing SMEs to detect market shifts through data analytics and customer feedback; (ii) seizing, by enabling faster innovation and product development through online collaboration and digital communication; and (iii) reconfiguring, by allowing restructuring of operations and value chains in response to environmental change (Teece, 2018). These capabilities represent the mechanisms through which digital tool adoption translates into sustained competitiveness, even when the underlying technologies are widely available. Hence, the theoretical focus moves from technology possession to the organizational capacity to leverage and continuously renew digital resources.

H2: Innovation capacity mediates the relationship between digitalization and the competitiveness of Vietnamese SMEs.

2.3. Entrepreneurial Orientation as a Moderator

Entrepreneurial orientation (EO) reflects a firm's strategic intent concerning risk-taking, innovativeness, and proactiveness (Covin & Slevin, 1989; Lumpkin & Dess, 1996). High EO firms are well placed to monitor new technologies, lead e-projects, and capitalize on technology shocks. Vietnamese SMEs with high EO, for instance, have been found to adapt more effectively to post-COVID market change, capitalizing on opportunities presented by consumers' behavioral shifts and rewriting global supply chain maps (Nguyen et al., 2023). EO can enhance digitalization returns by developing an innovative spirit, promoting swift decision-making, and inducing risk-taking in utilizing new digital channels (Pham, 2023). Nevertheless, studies assert EO can be useful only if there is available resource as well as managerial competence (Le & Hoang, 2022). Financing or human-capital-constrained SMEs cannot utilize the potential synergy between EO and digital technologies to the full, with the consequence that technology-enabled programs cannot be scaled up. In Vietnam, where the overwhelming majority of SMEs are structurally disadvantaged by inefficient access to finance and human capital, EO can therefore be said to be a conditional, rather than *ceteris paribus*, success driver. Firms with EO and sufficient resources will be able to exploit increased competitiveness, but EO will not suffice.

H3: EO is the reason behind the positive digitalization-competitiveness nexus of Vietnamese SMEs.

3. Methodology and Data Collection

Research Design and Sampling

Quantitative research design is employed in the research to empirically test the influence of digitalization on the Vietnamese SMEs' competitiveness with innovation an capability entrepreneurial orientation as the mediator and the moderator, respectively. The cross-sectional survey design is utilized since it allows for the collection of standardized data of different SMEs companies at a single point in time for comparison and statistical inferences (Bryman & Bell, 2015). This method has been extensively adopted in previous research (Pham, 2023), and is therefore deemed appropriate for use in this study. Our sample includes SMEs in manufacturing, retails and services industries with fewer than 250 workers as required by Vietnam's Ministry of Planning and Investment (2022). To ensure that data reflect pre-pandemic and post-pandemic performance only companies that have been operating between the period 2019 to 2024 are included. A purposive sampling method is utilized to collect 60 SMEs of key economic zones, i.e., Hanoi, Ho Chi Minh City, Da Nang, and Can Tho, which are geographically and sectorally diverse (OECD, 2021).

Data Collection and Variables

The present study makes use of a systematic survey method in collecting primary data from 60 small and medium enterprises (SMEs) of Vietnam's key economic hubs, i.e., Hanoi, Ho Chi Minh City, Da Nang, and Can Tho. The selection of these sites is intentional, as they together represent a variety of economic activities ranging from producing and selling to service-based SMEs, and covering a wide range of digitalization applications. To be eligible for the sample, firms needed to be classified as SMEs by the Vietnam Ministry of Planning and Investment (2022) – those with less than 250 employees – and indicate unintermittent operation from 2019 until 2024. This time-period is selected to provide assurance that the information encompassed pre- and post-COVID-19 business conditions to better understand the role of digitalization in contributing to resiliences and competitiveness during and beyond the pandemic.

Data are collected between January and April 2024 using a mixed-mode survey design involving online distribution over email and professional contacts and personal administration where feasible. The two-stage process helped to reduce possible non-response biases common in SME research (Dillman et al., 2014) and enable increased rates of return, especially from SMEs with weak internet coverage. The questionnaire is

built from validated scales in published research and pilot surveyed with 10 SME managers to guarantee unambiguity, cultural sensitivity, and measurement reliability items (Saunders et al., 2019). Ethical practice, including informed consent, anonymity, and voluntary response, is upheld strictly according to guidelines outlined by the American Psychological Association (APA, 2020).

During this research, four constructs of utmost importance – Digitalization (DIG), Competitiveness (COMP), Innovation Capability (INNO), and Entrepreneurial Orientation (EO) – were measured with multi-item scales drawn from previous studies to be applied to the Vietnamese SME context. The constructs are each measured on 5-point Likert scales with the anchor points 1 (Not used/Strongly disagree) to 5 (Extensively used/Strongly agree).

- Digitalization (DIG) is captured as the extent of adoption and integration of digital technologies in five domains: e-commerce, online customer relationship management (CRM), digital payments, cloud computing, and data analysis. Twenty indicators are used to capture the extent of implementation in each sector, such as “We sell products/services via online channels” (D1) and “Managers use dashboards/Bi for everyday decisions” (D17). A composite digitalization measure is derived as the average of all 20 items, which serves as a proxy for the general level of digital adoption at a firm. The 20 items were designed to capture five complementary dimensions of SME digitalization: digital presence, operations, communication, analytics, and infrastructure. While individual indicators (e.g., online sales vs. analytics dashboards) represent distinct domains, they collectively reflect the firm’s overall digital maturity. Following prior studies (OECD, 2021; Bai et al., 2021), digitalization is treated as a formative, multidimensional construct, meaning the indicators jointly define the construct rather than reflect a single latent factor. Each subdimension’s reliability (Cronbach’s α and AVE) was verified before aggregation into a composite index representing total digitalization capability.

- Competitiveness (COMP) is a perceived boost in firm performance relative to the pre-COVID-19 period. Eight items contained such areas as market share, revenues growth, profitability, productivity, customer acquisition, potential to enter new markets, export intensity, and brand visibility. Performance changes were measured by the respondents using a five-step scale ranging from “Much worse” to “Much better.” Composite competitiveness score is the average of these eight items. While this approach relies on managerial recall, it remains consistent with established SME competitiveness research where longitudinal objective data are unavailable. Respondents were instructed to base assessments on available records such as sales or customer growth where possible, reducing potential recall bias. Nonetheless, the subjective comparison across time is acknowledged as a limitation, as retrospective evaluations may be influenced by current performance perceptions (Golden, 1992).

- Innovation capability (INNO) measured a firm’s ability to develop new products, improve processes, invest in R&D, collaborate with external firms, experiment and prototype fast, apply customer input, and reorganize operations according to digital business models. Seven questions approximated this factor, and the responses were averaged to provide a composite score.

- Entrepreneurial orientation (EO) is scored on nine items using Covin and Slevin (1989), each of which is tapping into innovativeness, risk-taking, and proactiveness. Representative sample items included “We actively seek out new products/services/technologies” (E2) and “We are quick to seize new market opportunities” (E8). EO is viewed as a one-factor dimension, and total score is calculated based on the mean of all nine items..

All the answers in the questionnaires are coded and keyed into SPSS to be subjected to preliminary cleaning and tests of reliability before analysis. Missing values are very few (<2%) and managed via mean

imputation. For internal consistency and measurement scales validity enhancement purposes, three significant measures are computed: Cronbach's alpha (α), Composite Reliability (CR) and Average Variance Extracted (AVE). Cronbach's alpha is utilized to measure the degree to which items in a set are related to one another and can be computed as shown in Eq. (1):

$$\alpha = \frac{k}{k-1} \left(1 - \frac{\sum \text{Var}(\text{item})}{\text{Var}(\text{total})} \right) \quad (1)$$

where k represents the number of items. A Cronbach's α value of 0.70 or above is acceptable which indicate high internal consistency between items measuring the same construct (Hair et al., 2019).

Composite Reliability (CR), which is widely used in structural equation modeling, offers a closer approximation of reliability from the real factor loadings (λ_i) of each item and error variances ($\epsilon_i = 1 - \lambda_i^2$). The formula is:

$$CR = \frac{(\sum \lambda_i)^2}{(\sum \lambda_i)^2 + \sum \epsilon_i} \quad (2)$$

CR of 0.70 or more confirms the construct's reliability, i.e., high variance in the observed variables due to the latent factor.

Finally, convergent validity was examined through Average Variance Extracted (AVE), which gives the ratio of the proportion of the variance explained by a construct to error variance. It is defined as:

$$AVE = \frac{\sum \lambda_i^2}{n} \quad (3)$$

where n is the number of items. In this case, a minimum AVE of 0.50 is needed whereby over 50% of the observed variance in the items is explained by the underlying latent construct and not error.

Research Models and Analytical Approach

The model extends the previous work that linked digital adoption, innovation, and business competitiveness of firms (Teece, 2018; Barney, 1991). Three basic regression models are applied to test the hypotheses. The direct effect of digitalization on SME competitiveness is tested by the first model specified in Eq. (41):

$$COMP_i = \beta_0 + \beta_1 DIG_i + \beta_2 SIZE_i + \beta_3 AGE_i + \beta_4 SECTOR_i + \epsilon_i \quad (4)$$

where COMP is SME competitiveness; DIG is the digitalization index; and SIZE, AGE, and SECTOR are control variables.

The model checks if higher-level digital adoption SMEs are better performing in post-COVID markets. Control variables to explain heterogeneity among SMEs that can influence competitiveness regardless of digitalization, innovation capability, or entrepreneurial orientation are firm size (natural log of the number of employees), firm age (number of years since establishment), and industry (categorical dummies). The second model tests the mediating effect of innovation capability. Following the Preacher & Hayes' (2008) process and drawing on prior mediation research (Hayes, 2018), two equations are estimated here below as Eq. (5) and (6):

$$INNO_i = \beta_0 + \beta_1 DIG_i + \beta_2 SIZE_i + \beta_3 AGE_i + \beta_4 SECTOR_i + \epsilon_i \quad (5)$$

$$COMP_i = \beta_0 + \beta_1 DIG_i + \beta_2 INNO_i + \beta_3 SIZE_i + \beta_4 AGE_i + \beta_5 SECTOR_i + \varepsilon_i \quad (6)$$

Here, *COMP* is the competitiveness of SMEs, *DIG* is the index of digitalization, *INNO* is Innovation Capability and *SIZE*, *AGE*, and *SECTOR* are control variables.

Partial or full mediation is confirmed if *DIG* significantly predicts *INNO*, *INNO* significantly predicts *COMP*, and the *DIG* coefficient on *COMP* decreases when controlling for *INNO*. Bootstrapping with 5,000 resamples is used to calculate the significance of the indirect effect, creating equivalent confidence intervals (Preacher & Hayes, 2008).

The third model tests the interaction effect of entrepreneurial orientation by introducing an interaction term of Digitalization index with Entrepreneurial Orientation.

$$COMP_i = \beta_0 + \beta_1 DIG_i + \beta_2 EO_i + \beta_3 DIG_i \times EO_i + \beta_4 Controls_i + \varepsilon_i \quad (7)$$

where *COMP* represents SME competitiveness; *DIG* represents digitalization index; *INNO* represents Innovation Capability; *EO* offers Entrepreneurial Orientation; *Controls* are *SIZE*, *AGE*, and *SECTOR*.

A large and positive coefficient on the interaction term would imply that *EO* increases the digitalization effect on competitiveness. This approach adopts procedures outlined in earlier SME studies that experimented with organizational moderators (Lumpkin & Dess, 1996; Le & Hoang, 2022). We use SPSS and the Python to perform the data analysis. Descriptive statistics are calculated to obtain summary statistics of sample descriptors.

The research follows a cross-sectional design appropriate for exploratory investigation in contexts where longitudinal SME data are rarely available. This approach provides an initial empirical understanding of the post-COVID digitalization–competitiveness nexus but does not imply causality. Although additional contextual factors, such as competition intensity, market growth, and pre-pandemic performance, could enhance explanatory precision, these data were not consistently obtainable across firms. Core controls for firm size, age, and sector were retained to account for structural heterogeneity most relevant to Vietnamese SMEs. Mediation was tested using the classical Hayes (2018) and Kenny (1986) procedure, complemented by bootstrapped estimation (5,000 resamples) to provide more reliable confidence intervals for the indirect effect (Preacher & Hayes, 2008). The robustness of the findings was further assessed through sensitivity analyses involving log-transformed variables and outlier-trimmed models, all of which produced consistent coefficients and significance levels.

4. Result and Discussion

Construct Validity and Common Method Bias Tests

To assess the measurement validity of the constructs, an exploratory factor analysis (EFA) using principal component extraction with varimax rotation is conducted. The results, reported in Table 1, indicate that all items loaded strongly (≥ 0.60) on their intended constructs with no significant cross-loadings, confirming unidimensionality. The Kaiser–Meyer–Olkin (KMO) values ranges between 0.86 and 0.91, and Bartlett’s tests of sphericity are all significant at $p < 0.001$, demonstrating that the data are suitable for factor analysis. Each construct explains more than 50% of the total variance, and the cumulative explained variance for the four-factor solution was 61.2%, verifying a well-defined factor structure. Reliability and convergent validity are further supported by high Cronbach’s alpha (0.89–0.92), composite reliability (CR = 0.91–0.94), and average variance extracted (AVE = 0.63–0.66), exceeding the recommended thresholds (Hair et al., 2019).

Table 1. Reliability and Convergent Validity of Constructs

Construct	KMO	Bartlett's Test	No.	Factor Loadings Range	% Variance Explained	Cronbach's α	CR	AVE
Digitalization	0.913	0.000	20	0.63 – 0.84	58.4%	0.92	0.94	0.66
Competitiveness	0.874	0.000	8	0.69 – 0.82	61.7%	0.89	0.91	0.63
Innovation Capability	0.861	0.000	7	0.65 – 0.83	59.6%	0.91	0.92	0.65
Entrepreneurial	0.905	0.000	9	0.67 – 0.85	63.1%	0.90	0.93	0.64

To address potential common method bias resulting from single-respondent data, Harman's single-factor test is performed. The first unrotated factor accounted for only 37.8% of the total variance, which is below the 40% cutoff, indicating that common method variance is unlikely to bias the results significantly.

Table 2. Construct Validity and Common Method Bias Tests

Test	Result	Interpretation
Harman's Single Factor Test	First factor explained 37.8% of total variance	No severe common method bias
Total Variance Explained (Four-Factor Solution)	61.2%	Valid multidimensional structure

Descriptive statistics

Table 3 presents the descriptive statistics of the main study variables for the 60 sampled Vietnamese SMEs. Moderate usage of digital technologies is what the findings brought forward with a mean score of 3.54 (SD = 0.78). It is a sign that even though most SMEs have adopted digital technology into their businesses, most are at moderate levels of being digitally mature. Innovation capability (mean = 3.21, SD = 0.82) is also low, given that post-COVID-19 recovery emphasizes operational continuity more than high-involvement innovation activity. Entrepreneurial orientation had the highest mean (3.73), indicating that SME managers are proactive and risk-taking despite their limited resources. Competitiveness was at a mean of 3.61, indicating the positive recovery pattern from the pandemic.

Control variables show considerable variations. Firm size differs considerably (10 to 245 employees), which may in part explain variability in performance because larger SMEs possess more resources to invest in technology uptake. Firm age ranges from 3 to 25 years but is not directly related to competitiveness which suggest experiences in business is not a guarantee of post-pandemic competitiveness.

Table 3. Statistics Description

Variable	Mean	SD	Min	Max
Digitalization (DIG)	3.54	0.78	1.80	5.00
Innovation Capability (INNO)	3.21	0.82	1.50	5.00
Entrepreneurial Orientation (EO)	3.73	0.65	2.20	5.00
Competitiveness (COMP)	3.61	0.69	2.00	5.00
Firm Size	84.6	56.2	10	245
Firm Age	11.2	6.5	3	25

The correlation matrix is offered in Table 4, with high positive associations between digitalization, innovation capability, entrepreneurial orientation, and competitiveness. Digitalization was most highly correlated with competitiveness ($r = 0.65$, $p < 0.01$), offering preliminary support for H1 and confirming the pivotal role of digital tools in business improvement. The relationship between digitalization and innovation ($r = 0.61$, $p < 0.01$) also holds for the expected mediation effect (H2), as digital adoption seems

to create innovative capabilities that can lead to enhanced competitiveness. EO was positively correlated with both digitalization and competitiveness, though with weaker coefficients which indicate that while EO enables these variables, it is not necessarily the main driver of performance outcomes. Multicollinearity tests indicated acceptable VIF values (<2.5), and residual diagnostics confirmed no major heteroscedasticity or normality violations.

Table 4. Correlation Matrix

Variables	DIG	INNO	EO	COMP	Size	Age	VIF
DIG	1						1.82
INNO	0.61**	1					1.76
EO	0.48**	0.47**	1				1.65
COMP	0.65**	0.57**	0.51**	1			1.91
Size	0.36**	0.30*	0.22	0.33**	1		1.34
Age	0.14	0.11**	0.10*	0.09	0.18***	1	1.12

Note: Correlation result is significant at the 0.5 level (1-tailed) 0.01; level (2-tailed).

Figures 1–3 illustrate the distribution and relative strength of principal variables. Figure 1 provides mean scores for digitalization, innovation, EO, and competitiveness. The higher average for EO shows that managers' risk-taking attitudes are relatively robust, possibly laying a foundation for future digital innovation initiatives. Figure 2 illustrates a skewed firm size distribution, with most SMEs being relatively small (<100 employees), and few medium-sized. Such skew could be one reason why there are differences in performance, as larger firms tend to have more technological resources. Figure 3 is a relatively even spread of firm age, suggesting that younger firms and older firms participated in the survey but experience does not offer a clear advantage in digital transformation.

By and large, the descriptive statistics suggest three key observations. Firstly, Vietnamese SMEs are adopting digital tools proactively but with differential levels of maturity. Second, size remains a fundamental driver of the size and performance of digital initiatives, as per resource-based hypotheses of firm performance (Ayyagari et al., 2011). Third, entrepreneurial orientation will be high but will not automatically translate into competitiveness unless digital and innovation competence is enabled. Such trends justify the proposed regression, mediation, and moderation analyses to achieve how digitalization influences SME competitiveness in post-COVID economies.

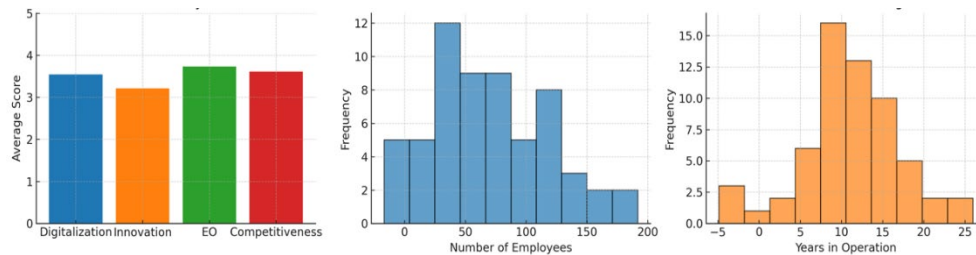


Fig.1: Mean scores of key variable, Distribution of Firm size, and Firm age

Results for main model

H1: Overall Effect of Digitalization on Competitiveness

The moderate R^2 value (0.339) observed is comparable to prior SME studies and reflects the multifactorial nature of competitiveness, which is influenced by numerous organizational and market conditions beyond digitalization alone. Although the model is statistically significant, the R^2 of 0.339

indicates that only about one-third of the variance in competitiveness is explained, a level consistent with exploratory SME research but suggesting room for model improvement through additional predictors.

Regression (Table 5) showed that digitalization was statistically and significantly correlated with competitiveness ($\beta = 0.695$, $p < 0.001$), supporting H1. This is in regard to the fact that SMEs embracing digital technologies in business operations, customer interaction, and exportation achieved improved performance in the post-pandemic era. Firm size is a positive and significant predictor ($\beta = 0.0012$, $p < 0.05$), while industry dummies and firm age are not significant. These are in accordance with the Resource-Based View (Barney, 1991), which argues that firms achieve long-run competitive advantage whenever they buy and use valuable, rare, and imitable resources. Digital technologies meet all these criteria, particularly in developing economies where technology adoption remains unbalanced, and bestowing a powerful advantage on pioneers. The positive effect of size agrees with findings presented by Ayyagari et al. (2011), as big SMEs can more easily invest in digital technologies to boost competitiveness. Insignificance of age means that years lived in the market don't automatically equate to digital ability or post-COVID competitiveness. Similarly, variation between sectors is insignificant, which means advantages of digitalization cut across sectors in Vietnam.

Table 5. Regression Results (Direct Effect)

Variable	Coef.		t-stat	p-value
Intercept	0.094	0.145	0.65	0.518
DIG	0.695***	0.036	19.10	0.000
Size	0.0012***	0.0004	2.74	0.008
Age	0.0010	0.0041	0.24	0.810
Sector (Retail)	0.041	0.063	0.65	0.517
Sector (Services)	0.038	0.067	0.57	0.572
R ²			0.339	
Adjusted R ²			0.325	
F Test			14.03***	

Notes: *** $p < 0.01$, ** $p < 0.05$

H2: Mediating Role of Innovation

The mediation test in Table 6 shows that digitalization was a significant predictor of innovation capability ($\beta = 0.571$, $p < 0.001$). Holding innovation constant in the regression diminished the coefficient between digitalization and competitiveness from 0.695 to 0.565, but innovation by itself is also a strong predictor of competitiveness ($\beta = 0.262$, $p < 0.001$). Bootstrapped indirect effects are significant and large (95% CI [0.120, 0.200]), indicating partial mediation. The findings indicate to the extent that digital tools enable competitiveness directly but also equip SMEs with the potential for innovation, thereby enhancing their competitive edge. This has been supplemented by the Dynamic Capabilities Theory (Teece, 2018), stating that firms must reconfigure and use resources dynamically in a way that enables competitive advantage to be sustained in face of uncertain environments. Vietnamese SMEs that adopted digital technologies enhance their ability to innovate new products, improve processes and keep up with changing customer needs in the post-pandemic period. The same goes for other developing economies (Bai et al., 2021), where digitalization enables agility and innovation to assist SMEs in responding to crisis-induced constraints. The value of firm size as a control variable again supports the resource-dependence perspective: large scale SMEs can invest more in innovation, thereby increasing the value of digital transformation.

Table 6. Mediation Analysis

Model 5: DIG → INNO	Model 6: DIG & INNO → COMP
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	Coef.	SE	t-stat	p-value	Coef.	SE	t-stat	p-value
Intercept	0.182	0.124	1.47	0.145	0.110	0.139	0.79	0.432
Digitalization (DIG)	0.571*	0.037	15.36	0.000	0.565*	0.048	11.71	0.000
Innovation Capability (INNO)	-	-	-	-	0.262*	0.056	4.67	0.000
Firm Size	0.0008**	0.0004	2.00	0.049	0.0010**	0.0004	2.54	0.012
Firm Age	0.0011	0.0040	0.28	0.780	0.0009	0.0041	0.22	0.823
Sector (Retail)	0.032	0.061	0.52	0.605	0.035	0.066	0.53	0.594
Sector (Services)	0.027	0.064	0.42	0.673	0.041	0.068	0.60	0.548
R ²		0.412				0.525		
Adjusted R ²		0.398				0.503		
F Test		21.45***				24.19***		
Bootstrapped Indirect Effect (95 % Bias-Corrected CI)					[0.120, 0.200]			

Notes: *** p < 0.01, ** p < 0.05

H3: Moderating Effect of Entrepreneurial Orientation

Table 7 presents the result of the moderation analysis of testing whether entrepreneurial orientation (EO) strengthens the positive impact of digitalization (DIG) on SME competitiveness (COMP). The interaction term (DIG × EO) was not statistically significant (p = 0.294). This indicates that EO does not moderate the digitalization–competitiveness relationship in this sample. Digitalization remains a good and substantial competitiveness predictor in this model ($\beta = 0.498$, p = 0.010).

This validates the importance of the direct effect evidenced in earlier models: digitally adopting SMEs with higher coverage have better competitiveness results irrespective of the intensity of EO. On the other hand, EO by itself is not significantly associated with competitiveness when digital as well as interaction-term-controlled ($\beta = -0.066$, p = 0.720). This would mean that an entrepreneurial and risk-taking managerial mindset may be inadequate to guarantee improved performance unless supported by real investments in digital resources and abilities. The findings do not provide empirical confirmation to H3 and therefore evidence indicates EO fails to moderate the relationship between digitalization and competitiveness in this scenario.

The result can be attributed to structural constraints commonly faced by Vietnamese SMEs, i.e., limited financing access, illiteracy in digital matters, and poor institutional support. Entrepreneurially focused-firms are likewise sure to fall behind competitive advantage from digitalization unless supplemented with appropriate resources and operational capabilities. These findings enrich our theoretical understanding of the role played by capability-building initiatives and outside assistance mechanisms in enabling SMEs to translate entrepreneurial orientation into tangible performance gains in a digitalized economy.

Table 7. Moderation Analysis

Variable	Coef.	SE	t-stat	p-value
Intercept	0.074	0.156	0.47	0.640
Digitalization (DIG)	0.482**	0.194	2.49	0.014
Entrepreneurial Orientation (EO)	-0.059	0.185	-0.32	0.751
DIG × EO	0.056	0.053	1.06	0.294
Firm Size	0.0011**	0.0005	2.29	0.026
Firm Age	0.0011	0.0044	0.25	0.802
Sector (Retail)	0.039	0.067	0.58	0.561

Sector (Services)	0.043	0.071	0.61	0.542
Province (Da Nang)	0.021	0.069	0.30	0.765
Province (Can Tho)	0.018	0.066	0.27	0.790
Province (HCMC)	0.026	0.064	0.41	0.682
R ²	0.436			
Adjusted R ²	0.386			
F Test	8.69***			

Notes: Reference groups are Hanoi province and Manufacturing sector; *** $p < 0.01$, ** $p < 0.05$; dependent variable = SME Competitiveness (COMP).

Firm size was always positively and significantly correlated with competitiveness in all models, suggesting that larger SMEs have resource capabilities which enable them to invest in digital resources, experiment with innovations, and absorb the risks of digital transformation. This is consistent with the resource-based view of firm performance (Ayyagari et al., 2011), where technology adoption scale effects are highlighted. Age of the firm is not a predictor, implying that experience or market age does not necessarily equate to competitiveness in online environments. The result supports Coad et al. (2013), who also assumed that older firms would be less innovative and slower in the adoption of technological change. Sectoral heterogeneity is not significant, indicating digitalization is a cross-sector competitiveness driver in Vietnam, OECD (2021) reports. These findings in general indicate digitalization is a powerful competitiveness driver, whose impact is subject to the firm size as well as the ability to innovate. EO alone is not sufficient to substitute for resource constraints, and policy guidance and capacity-building interventions need to be provided by policymakers in order to allow small firms to fully take advantage of digital transformation. In general, the results provide strong empirical evidence to support H1 and H2 to demonstrate that digitalization is a significant driver of the competitiveness of SMEs in Vietnam and that innovation is a significant mechanism through which technological uptake is translated to enhanced performance.

The results suggest that synergies between digital tools and innovation initiatives need to be achieved in order for one to be able to achieve best competitive advantages. H3 is rejected, meaning that EO does not reinforce digitalization advantages. The result demonstrates that entrepreneurial orientation will only bring value under favorable conditions, such as good access to finance, competent personnel, or policy supporting regimes. The results have significant significance for theory and practice. They support RBV and Dynamic Capabilities Theory by setting that technology adoption develops competitiveness through capability building, specifically innovation. They also present extensions to EO literature by showing its effects may be contingent in emerging economies like Vietnam.

Discussion, Theoretical Implications, and Policy Recommendations

The results emphasize digitalization's significant contribution to Vietnamese SMEs' competitiveness in post-COVID markets, offering new insights into how technology adoption interacts with organizational capabilities and strategic orientation. The empirical evidence demonstrates that digitalization is positively associated with competitiveness, reinforcing the idea that digital technologies serve as critical resources enabling SMEs to survive, serve customers more efficiently, and respond flexibly to rapidly changing market conditions. This finding supports the Resource-Based View (Barney, 1991), which posits that firms gain sustainable competitive advantages through resources that are valuable, rare, inimitable, and non-substitutable. For Vietnamese SMEs, digital technology meets these criteria as it allows them to overcome size constraints, reduce costs, and expand market reach. Prior evidence similarly shows that SMEs adopting digital technologies recovered faster and performed better than those that did not during and after the pandemic (OECD, 2021; European Commission, 2022).

Innovation capacity serves as a mediator, providing additional support for the Dynamic Capabilities Theory (Teece, 2018), which argues that firms must reconfigure resources to remain adaptive amid environmental shocks. The results indicate that digitalization enhances competitiveness primarily through its role in fostering innovation, such as new product development, process improvement, and collaborative R&D. This reinforces that technology adoption alone is insufficient for improved performance; firms must deploy digital tools strategically to develop new competencies and create customer value. The finding confirms the view that innovation is the missing link between technology investment and competitiveness, particularly under turbulent post-COVID conditions. It is also consistent with evidence from emerging markets showing that digitalization enhances firm resilience when supported by organizational learning and innovation (Bai et al., 2021; Marcucci et al., 2022).

The absence of a strong moderating role of entrepreneurial orientation (EO) suggests that, although risk-taking and proactive management are desirable, they do not necessarily determine the strength of the digitalization–competitiveness relationship. This may reflect underlying weaknesses in the Vietnamese SME ecosystem, such as limited access to finance, skills shortages, and regulatory barriers, that constrain firms from translating entrepreneurial intent into digital success (Le & Hoang, 2022; Tran & Vo, 2023). Similar findings have been reported in other emerging economies, where EO contributes to performance only when adequate resources, technological capabilities, and institutional support are present (Covin & Slevin, 1989; Lumpkin & Dess, 1996; Wales et al., 2021).

Theoretically, this research contributes to SME literature in three ways. First, it extends the Resource-Based View by demonstrating that digitalization can act as a strategic resource fostering competitiveness and resilience in turbulent environments (Wernerfelt, 1984; Barney, 1991). Second, it reinforces the Dynamic Capabilities perspective by showing that innovation capability mediates the relationship between technology adoption and competitiveness, emphasizing the role of complementary organizational routines (Eisenhardt & Martin, 2000; Teece, 2018). Third, it provides a balanced view of EO, highlighting that entrepreneurial orientation alone is insufficient for performance improvement without conducive conditions, thereby clarifying its boundary effects in small-firm contexts (Anderson et al., 2015; Wales et al., 2021).

Beyond its strategic effects, digitalization has concrete applications in logistics and informatics, which are central to SME competitiveness. Many surveyed firms reported adopting digital logistics solutions such as online inventory management, shipment tracking, and last-mile delivery coordination through e-commerce platforms. These tools enhance supply chain visibility, reduce delivery times, and minimize stockouts. From an informatics standpoint, SMEs increasingly employ enterprise resource planning (ERP), cloud-based analytics, and digital payment systems to integrate financial and operational data, improving decision accuracy and transaction efficiency. Customer service automation using chatbots and CRM systems further supports service quality and responsiveness. Together, these advancements show that SME digitalization directly strengthens logistics performance, information management, and service delivery, key themes in logistics and service science research (Han, 2023; Simanjuntak et al., 2025).

The policy implications derived from these findings suggest several priority actions for government agencies and support institutions to enhance SME competitiveness. Developing digital infrastructure, particularly in rural areas, remains vital to closing the digital divide and improving access to technology solutions (OECD, 2021). Economic incentives such as grants, low-interest loans, and tax credits can help address financing constraints for technology investment. Innovation support through R&D subsidies, university–industry collaborations, and innovation vouchers can help firms translate technology adoption into sustainable competitive advantage (Marcucci et al., 2022). Digital-skills training for SME managers and employees, focused on e-commerce, data analytics, and platform management, would further strengthen firms' digital capabilities (World Bank, 2023). Finally, fostering an entrepreneurial support

ecosystem with greater access to venture capital, mentorship, and professional networks would allow entrepreneurial orientation to yield stronger performance outcomes (Wales et al., 2021; Le & Hoang, 2022).

For SME managers, the study highlights that digitalization should be viewed not as a standalone investment but as a continuous strategic transformation. Maximizing returns from digital tools requires sustained innovation, process reengineering, and customer co-creation. While entrepreneurial orientation remains essential for recognizing opportunities, its effectiveness depends on supporting capabilities, financial resources, and collaborative partnerships. Overall, digital transformation's contribution to competitiveness is multidimensional, it requires not only adopting technology but also cultivating innovation capability and ensuring supportive institutional and organizational environments.

5. Conclusion

This exploratory study provides preliminary evidence on the relationship between digitalization and SME competitiveness in Vietnam's post-pandemic economy. Our findings, based on a pilot sample of 60 firms, suggest that digital technology adoption is associated with improved competitive performance, with this relationship partially mediated by innovation capability. These initial results align with Dynamic Capabilities Theory's proposition that firms must reconfigure resources to respond to environmental changes, though our cross-sectional design prevents causal inference.

The non-significant moderating effect of entrepreneurial orientation warrants further investigation with larger samples, as our study lacked statistical power to detect potentially subtle interaction effects. The strong influence of firm size on digitalization outcomes suggests that resource availability remains a critical boundary condition for digital transformation benefits, consistent with resource-based perspectives on firm heterogeneity.

This pilot study's primary contribution lies in identifying potential mechanisms linking digitalization to competitiveness in an understudied emerging market context. However, several limitations must be addressed in future research: (1) expanding sample size to at least 200 firms for adequate statistical power, (2) incorporating objective performance measures and longitudinal data to establish causality, (3) developing context-specific measures of digital capability rather than generic technology adoption scales, and (4) examining industry-specific digitalization patterns given sectoral heterogeneity.

For practitioners, our preliminary findings suggest that digitalization investments should be coupled with deliberate innovation capability development rather than treating technology adoption as sufficient for competitive advantage. Policymakers should note that smaller SMEs may require targeted support to overcome resource constraints that limit their ability to leverage digital technologies effectively.

Future research should move beyond counting digital tools to understanding how firms develop unique digital capabilities that competitors cannot easily replicate or incorporate objective performance indicators or panel data to validate retrospective self-reports and further improve construct validity. Only through such deeper investigation can we understand how digitalization creates sustainable competitive advantage rather than temporary performance improvements.

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