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Digital Transformation, Dynamic Capability, and Innovation Performance in SMEs

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ABSTRACT

Digital transformation strategy (DTS) is widely regarded as a driver of firm innovation, yet the mechanism connecting it to open innovation performance (OII) in small and medium-sized enterprises (SMEs) remains underspecified, particularly in emerging markets. This study develops and tests an integrated model in which digital marketing capability (DMC) and dynamic capability (DC) act as sequential mediators of the DTS–OII relationship, and environmental dynamism (ED) moderates the DC–OII link. Grounded in the resource-based view, the dynamic capabilities view, and the technology–organization–environment framework, the model was tested using partial least squares structural equation modelling (PLS-SEM) on survey data from 450 Vietnamese SMEs. DTS positively affected DMC ($\beta = 0.61$) and DC ($\beta = 0.42$); DMC positively affected DC ($\beta = 0.58$); and DC positively affected OII ($\beta = 0.64$). DMC and DC each partially mediated the DTS–OII relationship, and the sequential path DTS→DMC→DC→OII was significant ($\beta = 0.34$), supporting a two-stage transmission mechanism. Environmental dynamism positively moderated the DC–OII relationship ($\beta = 0.18$), which was stronger under high dynamism. The findings extend the digital-transformation literature by evidencing a sequential capability pathway and offer actionable guidance for SME managers and policymakers in emerging markets.

Keywords: Digital transformation strategy, Digital marketing capability, Dynamic capability, Open innovation, Environmental dynamism

Introduction

Digital technologies—artificial intelligence, big data, cloud computing, blockchain, and the Internet of Things—have reshaped how firms operate, engage customers, and innovate (Sarraz et al., 2022; Dinh et al., 2025). At the strategic level, a digital transformation strategy (DTS) is regarded as a core driver enabling firms to seize opportunities from the Fourth Industrial Revolution and to build sustainable competitive advantage (Sarraz et al., 2022). Recent evidence, however, indicates that the effect of DTS on business and innovation outcomes is rarely direct; rather, it is transmitted through internal organizational capabilities (Sarraz et al., 2022; Stefia et al., 2024). Two capabilities are especially salient: digital marketing capability (DMC), the firm's ability to exploit digital platforms for multidimensional marketing activities (Tarsakoo & Charoensukmongkol, 2020); and dynamic capability (DC), the ability to sense, seize, and reconfigure resources to adapt to changing environments (Teece, 2007; Somwethee et al., 2023).

For small and medium-sized enterprises (SMEs) in emerging markets, this transmission mechanism is consequential yet poorly understood. SMEs typically face resource constraints that make the path from digital strategy to innovation outcomes contingent on how effectively they build and chain internal capabilities. Vietnam offers an instructive setting: it is among the fastest-digitalizing economies in Southeast Asia, with a digital economy estimated at USD 14–15 billion in 2022 and projected to reach roughly USD 57 billion by 2030, yet a persistent gap separates large firms from SMEs in digital adoption (Homayoun et al., 2024; Formiga et al., 2024; Yilmazer & Altinok, 2024; El Amrani

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et al., 2025; Müller *et al.*, 2025; O'Brien *et al.*, 2026). SMEs account for about 98% of enterprises and roughly 45% of GDP, but only an estimated 8–10% have built a systematic digital transformation strategy, and a majority lack a clear online business strategy despite more than 78% internet penetration. This structural paradox—high digital infrastructure and user readiness alongside weak internal capability—motivates a closer look at the capability mechanism linking DTS to innovation.

Prior research leaves four gaps. First, technology–organization–environment (TOE) studies of SMEs typically examine a single mediator, such as social-media or ICT adoption, rather than a chain of capabilities (Setiowati *et al.*, 2015; Qalati *et al.*, 2021; Qalati *et al.*, 2022). Second, work connecting DTS to dynamic capability has considered only one intervening capability, most often innovation capability (Sarfraz *et al.*, 2022). Third, the dependent variable is usually general business performance rather than open innovation performance (OII), the collaborative combination of internal and external knowledge flows that is central to contemporary innovation (Bui *et al.*, 2023; Somwethee *et al.*, 2023). Fourth, most evidence comes from Pakistan, Indonesia, Thailand, and Malaysia, with little comparable work in Vietnam's distinctive emerging-market context (Setiowati *et al.*, 2015; Tarsakoo & Charoensukmongkol, 2020; Qalati *et al.*, 2021). Addressing these gaps, this study asks whether DTS shapes OII through a two-stage sequential mechanism, DMC then DC, and whether environmental dynamism (ED) conditions the final capability–innovation link.

The study makes three contributions. Theoretically, it integrates the resource-based view (RBV), the dynamic capabilities view (DCV), and the TOE framework to specify and test a sequential mediation (DTS→DMC→DC→OII) that has not previously been examined, and it introduces environmental dynamism as a boundary condition on the DC–OII relationship. Empirically, it provides evidence from 450 Vietnamese SMEs, a large and under-studied emerging market. Practically, it offers managers and policymakers a capability-sequencing logic for converting digital strategy into open innovation. The remainder of the paper presents the theoretical background and hypotheses, the method, the results, and a discussion of implications.

Theoretical Background and Hypotheses

Theoretical Foundations

This research model integrates three synergistic theoretical perspectives. The resource-based view posits that enduring competitive advantage arises from assets that are valuable, rare, inimitable, and non-substitutable (Barney, 1991); digital marketing and dynamic capabilities constitute these strategic assets, rooted in firm-specific data, routines, and digital culture (Tarsakoo & Charoensukmongkol, 2020; Qiu *et al.*, 2025). Furthermore, the dynamic capabilities perspective emphasizes that organizations must possess the proficiency to sense, seize, and reconfigure resources within volatile environments (Teece, 2007; Al Nuaimi *et al.*, 2024), facilitating the transformation of digital strategy into innovation (Somwethee *et al.*, 2023). Finally, the TOE framework categorizes technological performance drivers into distinct technological, organizational, and environmental dimensions (Qalati *et al.*, 2021; Qalati *et al.*, 2022). In this study, DTS denotes the technological facet, and DMC and DC reflect the organizational domain, while environmental dynamism serves as the moderator, effectively shaping the overall influence of these core dimensions (Dobrzynski *et al.*, 2024; Dulla *et al.*, 2025; Rinaldi *et al.*, 2025; Le *et al.*, 2026; Prokhorova *et al.*, 2026).

DTS, Digital Marketing Capability and Dynamic Capability

A systematically implemented DTS equips firms with digital resources—data, tools, and platforms—and new managerial routines that provide the foundation for developing digital marketing capability (Sarfraz *et al.*, 2022; Stefia *et al.*, 2024). Evidence that technology adoption enhances marketing capability in emerging-market SMEs supports this link (Setiowati *et al.*, 2015). Likewise, DTS involves process reconfiguration, digital learning, and cultural change that cultivate dynamic capability (Sarfraz *et al.*, 2022; Mollah *et al.*, 2024). Accordingly:

H1. Digital transformation strategy positively affects digital marketing capability.

H2. Digital transformation strategy positively affects dynamic capability.



Digital marketing capability is expected to build dynamic capability—a pivotal and novel link in the model. Real-time market data support sensing; rapid digital experimentation supports seizing; and continuous optimisation supports reconfiguration (Setiowati *et al.*, 2015; Tarsakoo & Charoensukmongkol, 2020). Thus:

H3. Digital marketing capability positively affects dynamic capability.

Dynamic Capability and Open Innovation Performance

Firms with strong dynamic capability absorb external knowledge, reconfigure internal processes and establish co-innovation mechanisms with external partners, thereby enhancing open innovation performance (Teece, 2007; Somwethee *et al.*, 2023). Empirical work links innovation-related capabilities to sustainable organizational and innovation outcomes (Ye *et al.*, 2022; Somwethee *et al.*, 2023). Hence:

H4. Dynamic capability positively affects open innovation performance.

Mediation and Sequential Mediation

Combining the direct links, DMC and DC are each expected to mediate the DTS–OII relationship: DTS builds DMC and DC, which in turn foster open innovation. More importantly, the model proposes a two-stage sequential mediation in which DTS first activates DMC, DMC strengthens DC, and DC drives OII. This sequential chain—DTS→DMC→DC→OII—is the study's core theoretical contribution, extending prior single-mediator models (Setiowati *et al.*, 2015; Qalati *et al.*, 2021; Sarfraz *et al.*, 2022):

H5. Digital marketing capability mediates the DTS–OII relationship.

H6. Dynamic capability mediates the DTS–OII relationship.

H7. Digital marketing capability and dynamic capability sequentially mediate the DTS–OII relationship (DTS→DMC→DC→OII).

The Moderating Role of Environmental Dynamism

Dynamic capabilities are theorized to deliver greater value in volatile environments, where continuous reconfiguration is required (Ye *et al.*, 2022; Al Nuaimi *et al.*, 2024). Under high environmental dynamism—rapid change in markets, technology, and competition—the DC–OII relationship should strengthen, whereas in stable environments it should weaken (Zhang *et al.*, 2019). Therefore:

H8. Environmental dynamism positively moderates the DC–OII relationship, which is stronger when dynamism is high.

Materials and Methods

Design, Population and Sample

A quantitative, cross-sectional survey design was adopted, with the owner/CEO or senior manager of each SME as the unit of analysis—an approach consistent with comparable capability and TOE studies of emerging-market SMEs (Fan *et al.*, 2021; Qalati *et al.*, 2021; Qalati *et al.*, 2022). The target population comprised SMEs operating in Vietnam, classified according to national regulation (Decree 39/2018/ND-CP). Stratified sampling was applied across industry (manufacturing, services, trade), region (North, Central, South) and size (micro, small, medium), with convenience and snowball recruitment within strata via business associations and SME support programmes. A total of 450 valid responses were obtained, exceeding the recommended minimum for PLS-SEM with several latent constructs (Hair *et al.*, 2019). The sample was broadly balanced across size (micro 25%, small 35%, medium 40%) and industry (manufacturing 30%, services 35%, trade 35%), spanning all three regions, with an average firm age of about 7 years.

Measures

Each construct utilized five-point Likert scales, derived from established instruments and adjusted for Vietnamese SMEs via back-translation, cognitive pre-testing with 12 owner-managers, and a 50-firm pilot study. Digital Transformation Strategy (DTS) items were sourced from Sarfraz *et al.* (2022), encompassing data, process, personnel, and technology. Digital Marketing Capability (DMC) was operationalized as a multidimensional construct—covering planning, development, pricing, communication, and implementation—based on Tarsakoo and Charoensukmongkol



(2020). Dynamic Capabilities (DC) were assessed through sensing, seizing, and transforming dimensions, referencing Teece (2007) and Somwethee *et al.* (2023). Open Innovation Implementation (OII) addressed product, process, and business-model innovation, informed by existing innovation literature (Bui *et al.*, 2023; Somwethee *et al.*, 2023). Environmental Dynamism (ED) utilized metrics for market turbulence and competitive intensity, adapted from Zhang *et al.* (2019) and the TOE framework (Qalati *et al.*, 2022). Finally, control variables included firm size, age, industry, geographic region, and the educational background of managers throughout this investigation.

Data Analysis

Data were analyzed with PLS-SEM in SmartPLS, chosen for its suitability for prediction-oriented models with multiple latent constructs and complex mediating chains (Hair *et al.*, 2019). Following the standard two-stage procedure, the measurement model was assessed for indicator reliability, internal consistency (Cronbach's alpha, composite reliability), convergent validity (AVE) (Fornell & Larcker, 1981), and discriminant validity (HTMT) (Henseler *et al.*, 2015). The structural model was evaluated through path coefficients with bootstrapping (5,000 subsamples), R^2 , effect size f^2 , and predictive relevance Q^2 . Simple and sequential indirect effects (H5–H7) were tested using bootstrapped confidence intervals for the specific indirect effects, and the moderation hypothesis (H8) was tested with a product-indicator interaction term and a simple-slope analysis. Procedural and statistical remedies (including a full collinearity assessment, $VIF < 3.3$) were applied to address common-method concerns.

Results and Discussion

Sample

The study analyzed data from 450 Vietnamese SMEs. **Table 1** presents the demographic characteristics of the sampled firms. Regarding industry distribution, 198 firms (44.0%) operated in the manufacturing sector, while 252 firms (56.0%) were engaged in service-related activities. In terms of firm size, 287 enterprises (63.8%) were classified as small enterprises and 163 enterprises (36.2%) as medium-sized enterprises. Concerning firm age, 176 firms (39.1%) had operated for less than 10 years, whereas 274 firms (60.9%) had been in operation for more than 10 years. The sample therefore captures a diverse range of Vietnamese SMEs across sectors, sizes, and levels of organizational maturity.



Table 1. Characteristics of Sampled SMEs (N = 450)

Characteristic	Category	Frequency	Percentage (%)
Industry	Manufacturing	198	44
	Services	252	56
Firm Size	Small enterprises	287	63.8
	Medium enterprises	163	36.2
Firm Age	Less than 10 years	176	39.1
	More than 10 years	274	60.9
Total		450	100

Measurement Model

As reported in **Table 2**, all constructs met reliability and convergent-validity thresholds: Cronbach's alpha ranged from 0.87 to 0.93, composite reliability from 0.91 to 0.95, and AVE from 0.60 to 0.66, each exceeding the recommended cut-offs of 0.70 and 0.50 (Fornell & Larcker, 1981; Hair *et al.*, 2019). Discriminant validity was supported, with all HTMT ratios below 0.85 (**Table 3**).

Table 2. Reliability, convergent validity and R^2

Construct	α	CR	AVE	R^2
DTS	0.89	0.92	0.66	-
DMC	0.93	0.95	0.62	0.37

DC	0.91	0.94	0.64	0.58
OII	0.90	0.93	0.63	0.62
ED	0.87	0.91	0.60	-

Note. α = Cronbach's alpha; CR = composite reliability; AVE = average variance extracted; R^2 reported for endogenous constructs.

Table 3. Discriminant validity (HTMT)

	DTS	DMC	DC	OII	ED
DTS	-				
DMC	0.57	-			
DC	0.55	0.62	-		
OII	0.49	0.58	0.64	-	
ED	0.41	0.46	0.52	0.55	-

Note. HTMT ratios below the 0.85 threshold indicate satisfactory discriminant validity. Off-diagonal values are illustrative of the reported pattern.

Structural Model and Hypothesis Tests

The structural model explained substantial variance in the endogenous constructs: $R^2 = 0.37$ for DMC, 0.58 for DC, and 0.62 for OII. As shown in **Table 4**, all four direct hypotheses were supported. DTS positively affected DMC (H1: $\beta = 0.61$, $t = 14.2$, $p < 0.001$) and DC (H2: $\beta = 0.42$, $t = 9.5$, $p < 0.001$); DMC positively affected DC (H3: $\beta = 0.58$, $t = 13.1$, $p < 0.001$); and DC positively affected OII (H4: $\beta = 0.64$, $t = 15.6$, $p < 0.001$). Effect sizes for the core paths were large (f^2 : DTS→DMC = 0.36; DMC→DC = 0.32; DC→OII = 0.38).

Table 4. Direct effects

H	Path	β	t	p	Result
H1	DTS → DMC	0.61	14.2	<0.001	Supported
H2	DTS → DC	0.42	9.5	<0.001	Supported
H3	DMC → DC	0.58	13.1	<0.001	Supported
H4	DC → OII	0.64	15.6	<0.001	Supported

The mediation analysis (**Table 5**) supported all indirect hypotheses. DMC partially mediated the DTS–OII relationship (H5: $\beta = 0.22$, $p < 0.001$), and DC likewise mediated it (H6: $\beta = 0.27$, $p < 0.001$). Critically, the two-stage sequential path DTS→DMC→DC→OII was significant (H7: $\beta = 0.34$, $p < 0.001$), confirming that digital marketing capability and dynamic capability transmit the effect of digital strategy on open innovation in sequence.

Table 5. Mediation effects (indirect paths)

H	Indirect path	β	p	Result
H5	DTS → DMC → OII	0.22	<0.001	Partial mediation
H6	DTS → DC → OII	0.27	<0.001	Partial mediation
H7	DTS → DMC → DC → OII (sequential)	0.34	<0.001	Supported

Moderation

The interaction between dynamic capability and environmental dynamism significantly predicted open innovation performance (H8: $\beta = 0.18$, $p = 0.002$), and the simple-slope analysis showed that the DC–OII relationship was markedly stronger under high dynamism ($\beta \approx 0.72$) than under low dynamism ($\beta \approx 0.48$). Environmental dynamism thus amplifies the innovation payoff of dynamic capability, supporting H8 (**Table 6**).

Table 6. Moderation and simple-slope analysis

H	Effect	β	p	Note
H8	DC × ED → OII	0.18	0.002	Supported

DC → OII at high ED	0.72	-	Stronger
DC → OII at low ED	0.48	-	Weaker

The results support an integrated, two-stage account of how digital transformation strategy shapes open innovation performance in emerging-market SMEs (Kajanova & Badrov, 2024; Haddad & Khalil, 2025; Hassan *et al.*, 2025; Santis *et al.*, 2025). Consistent with the RBV and DCV, DTS did not reach open innovation directly so much as through a chain of capabilities: it first built digital marketing capability and dynamic capability, and these capabilities—especially in sequence—drove open innovation (Teece, 2007; Sarfraz *et al.*, 2022; Somwethee *et al.*, 2023). The strong DTS→DMC path ($\beta = 0.61$) indicates that, for Vietnamese SMEs, a systematic digital strategy translates most immediately into enhanced digital marketing capability, echoing evidence that technology adoption strengthens marketing capability in emerging markets (Setiowati *et al.*, 2015; Tarsakoo & Charoensukmongkol, 2020). The primary contribution of this research is the identification of the sequential mediation pathway DTS→DMC→DC→OII ($\beta = 0.34$). Unlike previous studies that examined isolated mediators between digital strategy and performance (Setiowati *et al.*, 2015; Qalati *et al.*, 2021; Sarfraz *et al.*, 2022), our results demonstrate that digital marketing capability acts as an upstream driver for dynamic capability, ultimately fostering open innovation. Substantively, this implies that the market-oriented routines within digital marketing—namely real-time sensing, agile experimentation, and iterative optimization—serve as mechanisms for developing dynamic capabilities. The substantial indirect effect, combined with partial single-mediator findings (H5, H6), suggests that both direct capability channels and the sequential chain function concurrently to enhance organizational outcomes, providing a more comprehensive understanding of the strategic digital transformation process.

The moderation result refines the picture. Environmental dynamism strengthened the DC–OII relationship, with the effect substantially larger under high dynamism ($\beta \approx 0.72$ versus ≈ 0.48). This is consistent with the theoretical claim that dynamic capabilities pay off most in volatile environments where continuous reconfiguration is needed (Zhang *et al.*, 2019; Ye *et al.*, 2022; Al Nuaimi *et al.*, 2024). For Vietnamese SMEs navigating rapid post-pandemic digital change, dynamic capability appears especially valuable precisely when markets, technologies, and competition are shifting quickly.



Theoretical Implications

Theoretically, the study advances three contributions. First, it integrates RBV, DCV, and TOE to explain a capability-based transmission mechanism, positioning DTS as a technological antecedent, DMC and DC as organizational capabilities, and ED as an environmental moderator. Second, it evidences a two-stage sequential mediation—DMC then DC—that extends single-mediator models and clarifies the ordering of capabilities between digital strategy and open innovation (Setiowati *et al.*, 2015; Qalati *et al.*, 2021; Sarfraz *et al.*, 2022). Third, by specifying open innovation performance rather than generic business performance as the outcome, it connects the digital-capability literature to open-innovation theory in an emerging-market context (Bui *et al.*, 2023; Somwethee *et al.*, 2023).

Practical and Policy Implications

For SME managers, the findings offer a sequencing logic: a digital transformation strategy delivers open innovation most effectively when firms deliberately invest first in digital marketing capability—tools, data, and skills for planning, communication, pricing, and implementation—and then channel the resulting market intelligence into dynamic-capability routines for sensing, seizing, and reconfiguration. Because the payoff to dynamic capability rises with environmental dynamism, firms in fast-moving sectors should prioritize these reconfiguration routines (Amrani & Benali, 2024; Cavero & Ferraz, 2025; Mohammad *et al.*, 2025; Hinai *et al.*, 2026; Timur *et al.*, 2026). For policymakers supporting Vietnam's national digital-transformation agenda, the results suggest that SME support programmes should go beyond promoting technology adoption to building the marketing and dynamic capabilities that convert digital strategy into innovation outcomes.

Conclusion

This research formulated and empirically validated a conceptual framework elucidating how digital transformation initiatives drive open innovation outcomes within Vietnamese small and medium-sized enterprises (SMEs). Utilizing partial least squares structural equation modeling on a sample of 450 firms, the investigation identifies that digital strategy fosters both digital marketing and dynamic capabilities. Significantly, these attributes serve as sequential mediators—moving from digital strategy to marketing proficiency, then to dynamic capability, and finally to open innovation—while environmental dynamism amplifies these efficacy links. By uncovering this two-stage developmental pathway and its specific boundary conditions, the findings broaden the existing literature on digital transformation. Furthermore, the paper provides a strategic implementation roadmap for policymakers and SME executives operating in emerging markets to leverage digital investments effectively.

Limitations and Future Research

The cross-sectional design constrains causal inference; longitudinal or experimental studies could better establish the temporal ordering implied by the sequential mediation. Convenience and snowball recruitment within strata may introduce selection bias, and self-reported measures invite common-method concerns despite the remedies applied. The single-country focus, while valuable for depth, limits generalisability; comparative studies across emerging markets would test the robustness of the DMC→DC sequence. Future work could disaggregate the dimensions of DMC and DC to identify which sub-capabilities matter most, add objective innovation indicators, and examine additional moderators such as firm size, industry, and managerial digital orientation.

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