International Journal of Accounting and Economics Studies, 12 (6) (2025) 475-486

International Journal of Accounting and Economics Studies

Website: www.sciencepubco.com/index.php/IJAES
https://doi.org/10.14419/vsfs3065
Research paper

Entrepreneurial Marketing and Business Performance in System Integrator Start-Ups: A Serial Mediation Analysis Through Technology Customization and Innovation Capability

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Received: August 21, 2025, Accepted: September 26, 2025, Published: October 12, 2025

Abstract

This study identifies the fine-grained linkages between Entrepreneurial Marketing (EM), Technology Customization (TC), Innovation Capability (IC), and Business Performance (BP) of technology-oriented small and medium enterprises (SMEs) with a sequential mediation model. Complementing the resource-based view with dynamic capabilities theory, we propose that entrepreneurial marketing influences business performance both directly and indirectly by way of technology customization and the development of innovation capabilities. Applying partial least squares structural equation modeling to data obtained from SMEs from Indonesia's technological industry, our findings confirm that entrepreneurial marketing has an extremely high influence on technology customization that significantly enhances innovation capability as well as business performance. Mediation analysis reveals high indirect effects that feature technology customization and innovation capability as crucial mediators for entrepreneurial marketing--performance relationships. However, the extremely high size effects need cautious interpretation because of potential methodological artifacts related to single-source cross-sectional designs. In spite of limitations of the measurement model, such as low convergent validity for innovation capability, the model demonstrates very high predictive power. Our results enhance entrepreneurial marketing literature by spelling out mechanisms of sequential capability development and extend dynamic capabilities theory by empirical validation of interconnected capability relationships. Our study provides practical implications for SMEs driven by technologies that wish to follow integrated capability development strategies by also highlighting that entrepreneurial marketing needs complementary technological and innovation capabilities to pay off. Targeted initiatives, such as staged innovation grants and cross-capability development centers, need to be provided by policies because SMEs need to be strengthened to enhance their competitiveness in fast-evolving competitive situations.

Keywords: *Entrepreneurial Marketing; Technology Customization; Innovation Capability; Business Performance; Dynamic Capabilities*

1. Introduction

In this period of a hypercompetitive business environment, organizations encounter significant difficulties in obtaining lasting performance benefits when cutting-edge technologies emerge and customer needs transition (Hultén & Tumunbayarova, 2020; D. Teece et al., 2016). For entrepreneurial ventures and SMEs operating under resource constraints relative to established market incumbents (Bocconcelli et al., 2018; Tunisini et al., 2023; Whalen et al., 2016), this competitive dynamic creates particularly complex strategic considerations. Thus, entrepreneurship, marketing, technology, and innovation domains are considered to be an immediate theoretical core aspect where the definition of sustainable competitive advantage can be further developed, particularly within resource-constrained environments (Ranjan, 2024; Zaremohzzabieh et al., 2019).

The EM theory (Morris-Eyton & Pretorius, 2023), situated at the intersection between entrepreneurship and marketing disciplines, represents an opportunity-oriented, action-oriented response to the marketplace through an emphasis on innovation, management of risk, leveraging of resources, and value creation for customers (Feitosa Jorge et al., 2024; Grimmer et al., 2017). Such a paradigm extends the traditional marketing logic by responding to the specific challenges of pursuing opportunities in the face of market uncertainty and resource constraints (Hoxha & Sadiku, 2019; Morris-Eyton & Pretorius, 2023; Sadiku-Dushi et al., 2019).

Despite this widespread attention amongst scholars, research considering the link between entrepreneurial marketing and business performance has produced inconclusive results, exposing an important gap in our current knowledge. Previous research has developed positive correlations among these constructs. Notably, Morgan & Anokhin (2023)found support for the positive influence of entrepreneurial

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marketing on both financial and non-financial performance in the case of manufacturing SMEs, with large effect sizes that established practical significance in relation to the identified relationship. Similarly, Whalen et al. noted that among born-global firms in high-technology industries, entrepreneurial marketing capabilities greatly improved international performance, as well in the case of high-velocity markets.

On the other hand, the investigations have reported conflicting empirical evidence. Eggers et al. (2020)Entrepreneurial marketing dimensions manifested non-significant or opposite correlations with performance indicators, especially within established mid-sized firms operating in a stable version of an industry where incremental, as opposed to disruptive, processes typified innovation. These results indicate critical boundary conditions in the EM-performance link. Further, Peterson (2020) found that entrepreneurial marketing approaches received decreasing or even negative performance returns in highly institutionalized industries, where legitimacy concerns and stakeholder expectations favored traditional marketing approaches.

This difference results from empirical contradictions and points to a theoretical void in the mechanisms and contingency factors of entrepreneurial marketing-performance relationships. Although direct effects have been investigated, the mediating roles of technology customization and innovation capability are significantly under-researched. This is particularly concerning, given that resource-based view and dynamic capabilities theories emphasize that these constructs may be the key intermediating mechanisms through which entrepreneurial marketing activities are leveraged into entrepreneurial performance outcomes. It has yet to be sufficiently investigated, theoretically at least, in a resource-limited context, about the synergistic effect of both entrepreneurial marketing and technology tailoring on building innovation capability.

Innovation Capability (IC), which is the ability of an organization to systematically transform knowledge and ideas into new products, services, and/or processes (Camisón & Villar-López, 2014; Lawson& Samson, 2001), represents a theoretically significant mediating mechanism for the indirect impact of EM and TC on Business Performance (BP) (Chang et al., 2018). Although previous work has explored discrete links among these constructs (Ritala et al., 2009), there is a conspicuous lack of a unified theoretical framework that considers these interconnections. We contribute to the literature by filling this important research gap via the formulation and empirical testing of an integrated framework that explores: (1) the direct relationships of Entrepreneurial Marketing with Technology Customization, Innovation Capability, and Business Performance; (2) the relationships between Technology Customization, Innovation Capability, and Business Performance; and (3) the mediation of Technology Customization and Innovation Capability on the relationship between Entrepreneurial Marketing and Business Performance.

This research achieves several meaningful contributions to theory and practice. First, it contributes to entrepreneurial marketing literature by providing empirical evidence of its role as an antecedent of technological adaptability and innovation outcomes. Second, our study contributes to the research of innovation by explicating the mechanisms by which market-oriented and technology-oriented capabilities interactively promote innovation development. Third, it offers practitioners empirical insights into strategically aligning entrepreneurial marketing tactics and technological customization capabilities to deliver innovation and performance results.

2. Theoretical Background and Hypotheses Development

2.1 Resource-Based View and Dynamic Capabilities

The study relies on a conceptual framework of complementarities in the Resource-Based View (RBV) (J. Barney, 1991; J. B. Barney & J.B., 1991; Helfat & Peteraf, 2003)and Dynamic Capabilities Theory (Teece & D.J., 2007). The RBV postulates sustainable competitive advantage through ownership and use of resources and capabilities with value, rarity, inimitability, and non-substitutability (VRIN) (J. B. Barney & J.B., 1991). Theoretical propositions have found strong substantiations through empirical data in the form of meta-analytic findings supporting the occurrence of a predictive relationship between the occurrence of VRIN resources and competitive advantage, with an overall effect on performance outcome (Farooque et al., 2022). The cross-organizational generality of applicability of RBV is also evidenced through comparative studies proving to demonstrate pervasively similar manifestations of structure in innovation strategies in small firm arenas to those pursued by large ones (Al-Hakim & Hassan, 2013), in argument in support of the development of VRIN resources as a determinative strategic necessity irrespective of organizational size and bases of resources.

While RBV provides the necessary theoretical foundations to investigate resource-performance relationships, DCV advances the model through a clear response to the question of how organizations respond to environmental turbulence (Arici & Gok, 2023). This theory extension is geared towards capabilities to support firms in deliberately building, integrating, and reconfiguring bundles of resources in response to rapidly changing market conditions (Teece & D.J., 2007). As contemporary competitive environments have encountered increasing rates of change, DCV has been shown to have greater explanatory potential than static conceptualizations of RBV in environments characterized by technological revolution and market turbulence (Shahadat et al., 2023).

In this composite theory model, Entrepreneurial Marketing, Technology Customization, and Innovation Capability are three interconnected but disparate dynamic capabilities through whose development companies form unique arrangements of resources to facilitate adaptive market response (Kuo, 2024). They are complex organizational routines allowing systematic sensing of emerging market opportunities, technological adaptation to unique customer requirements, and innovation-driven value proposition to contribute collectively towards business performance improvement (Teece & D.J., 2007). Such conceptualization aligns with contemporary advances in strategic management theory, emphasizing the dominance of dynamic capabilities in the explanation of inter-firm performance variations in situations of dynamic market environments, most notably in entrepreneurial companies in situations of resource scarcity and market uncertainty (Teece, 1981, 2019).

2.6 Hypotheses Development

2.6.1 Entrepreneurial Marketing and Technology Customization

Moreover, the topic had gained attention in academia, and it received a call for resubmission from SMEs to purposefully adapt themselves via the integration of entrepreneurial marketing and technology customization. Entrepreneurial marketing is innovative marketing efforts in unsaturated market segments driven more by opportunities than customers (Alqahtani et al., 2022). This provides a collection of navigational guidelines to be used for entering the entrepreneurial waters to cover ambiguity of entrepreneurship from creativity of marketing to business planning, product marketing, and potential marketing, though a few methodological steps (Aliakbari et al., 2025). Moreover, these companies can respond flexibly to the changing environment and enhance the marketing performance metrics of their new ventures

(Alkandi, 2025). Digital entrepreneurial marketing bricolage, the digitally malleable tools of progressive domain evolution, is also emergent, substantiating that the intensity of interaction between marketers and digital tools is related to progressively strategic outcomes (Chakma et al., 2025). Moreover, the combined interaction of entrepreneurial orientation and market orientations as a dynamic capability that reinforces effectiveness on the brand formation as well as market formation (Pradhana et al., 2025; Purnawan et al., 2025).

An excellent example of this relationship, that technology customization is a complementary strategic competency that, when coupled with entrepreneurial marketing principles, delivers enhanced competitive advantages. Recent advances suggest that systematic approaches towards product personalization and customization, such as modular synergy analysis, customer preference modeling, and customer requirements modeling, can help achieve higher degrees of operational efficiency along with higher customer satisfaction rates (Radiany et al., 2025). The sources of entrepreneurial marketing lie in the integration process through tough consumer segments, which are receptive to techno-logical tailoring (Aliakbari et al., 2025), leading market intelligence drivers from entrepreneurial functioning signify techno-logic adapted functions (Crick et al., 2025), while a competence of recoursing drives the restricted use of technological investment (Alqahtani et al., 2024). Such strategic alignment generates a value proposition architecture that meets the market differentiation need while ensuring customer value (Blut et al., 2024). The operative integration for SMEs in more dynamic market contexts is particularly critical for SMEs, as the adaptive capability fundamentally drives their competitive positioning and sustainability.

H1: Entrepreneurial Marketing positively influences Technology Customization.

2.6.2 Entrepreneurial Marketing and Innovation Capability

Moreover, this study serves to enhance the understanding of the relationship between entrepreneurial marketing (EM) and innovation capability within the context of EM literature, which could illuminate organizational performance-related issues that scholars have always found challenging (Gliga & Evers, 2023). Characterized by proactivity in opportunity not-forging, resource leveraging, value creation, and calculated risk-taking, entrepreneurial marketing conditions set the parameters within which innovation capability can be developed (Kuo, 2024). Recent empirical findings provide new insights into the process, showing how dynamic marketing capabilities serve as critical mechanisms that can make entrepreneurial marketing action result in innovation outcomes, especially in resource-poor contexts. These capabilities aid in adjusting responses to evolving market conditions and promote the commercialization of new products and services. This association has been demonstrated through empirical studies in international entrepreneurial firms (Alqahtani et al., 2024).

There are many ways in which this relationship may work theoretically. can first be explained because the focus on experimentation, as well as innovative problem-solving approaches inherent to entrepreneurial marketing, creates an organizational atmosphere that supports the behavior of experimentation (Crick et al., 2025). Second, the customer-centric orientation of EM enables the knowledge exchange and collaborative learning processes critical for effective innovation (Aliakbari et al., 2025). Such market connectivity allows for constant updating of the knowledge base, recognizing new opportunities, and converting market insights into new offerings (Alqahtani et al., 2022). There is empirical evidence supporting the positive impact of EM on innovation capabilities in manufacturing SMEs, even amid dynamic environments like those encountered during the COVID-19 pandemic (Alqahtani et al., 2024). Moreover, dynamic innovation capability plays a vital mediating role in the relationship between entrepreneurial culture and sustainable competitive performance as it converts entrepreneurial orientation into value creation, and this relationship is especially important for SMEs in emerging market contexts (Afum et al., 2022). This theoretical and empirical confirmation converges to find that entrepreneurial marketing is a significant antecedent to the development of innovation capability, implying implications for strategic management practice.

H2: Entrepreneurial Marketing positively influences Innovation Capability.

2.6.3 Technology Customization and Innovation Capability

The relationship between technology customization and innovation capability constitutes a theoretically significant domain with implications for competitive advantage (Berawi et al., 2020). Technology customization enhances innovation capability through the development of technical flexibility and adaptive capacity that supports continuous innovation processes (Agnihotri & Gabler, 2024). These theoretical processes underlying this relationship operate through several channels. To begin with, organized customer need analysis, technological solution development and refinement, and adaptation integration establishes organizational routines, building absorptive capacity, firms' abilities to recognize, digest, and apply new knowledge (Chakma et al., 2025). Second is information technology capability as a critical facilitator process for productive knowledge sharing, driving innovation performance in situations of high-technology rivalry (Chakma et al., 2025).

The accumulated knowledge gained by way of technology customization efforts operates to construct a foundation for future innovation through technological repertoires and problem-solving heuristics augmentation (Sullivan et al., 2023). The iterative process of circular learning, client problem interpretation, conceptual solution development, and implementation through adaptation, acts additively to contribute to innovation capability through incremental and architectural knowledge development (Hunt & Madhavaram, 2020). Such foundations in theory suggest that technology customization is an important antecedent to innovation capability development and assert a moderating effect of organizational learning capacity and market dynamism. The conceptual model is consonant with dynamic capabilities theory to the extent to which the theory concentrates on the reconfiguration of resources in response to changing market conditions to maintain competitive advantage (Leemann & Kanbach, 2022). Empirical testing of hypothesized parameters in a range of industry contexts would provide insight into boundary conditions and contingency variables that regulate the technology customization-innovation capability relationship.

H3: Technology Customization positively influences Innovation Capability.

2.6.4 Entrepreneurial Marketing and Business Performance

The theoretical relationship between firm performance and entrepreneurial marketing is significant, with far-reaching implications for resource-constrained firms. Entrepreneurial marketing, the crossroads of innovative marketing behavior and entrepreneurial mindset, enables firms to adapt to changing market environments and exploit growth opportunities that conventional marketing efforts might not uncover (Gliga & Evers, 2023). The relationship is mediated by a range of theoretical mechanisms that together influence the outcomes of firm performance across a variety of organizational contexts. Entrepreneurial marketing directly affects business performance through four different but complementary channels. Firstly, the proactiveness component of entrepreneurial marketing enables systematic market opportunity detection and utilization ahead of competitors, securing first-mover benefits and premium marketplace positions that are translated into differential performance (Alqahtani et al., 2024). Secondly, entrepreneurial marketing's emphasis on resource leverage enables firms to generate disproportionate marketplace effect relative to available resources, maximizing marketing efficiency ratios and marketing

capital returns (Crick et al., 2025). Thirdly, entrepreneurial marketing's customer intensity component induces intense forms of customer relations that generate superior retention rates, lower rates of user acquisition, and generate much greater lifetime value for customers (Aliakbari et al., 2025). Fourthly, entrepreneurial marketing's emphasis on innovation induces differential value proposition development that has premium pricing power and secures precious competitive space across competitive marketplace spaces (Alqahtani et al., 2022).
There is robust empirical evidence to support these theoretical connections, with recent research indicating that entrepreneurial marketing has positive effects on the outcomes of performance by encouraging innovative behavior as well as adaptive flexibility within organizational contexts (Gliga & Evers, 2023). Importantly, the magnitude and mechanisms of this effect are context-dependent on a variety of context-dependent variables, including entrepreneurial personality, environmental characteristics of markets, as well as organizational structural characteristics. The context dependency underscores the need to examine boundary situations as well as contingency factors that might moderate the relationship between entrepreneurial marketing and performance within different empirical contexts (Crick et al., 2025).
These theoretical foundations and empirical findings together suggest that entrepreneurial marketing is a chief strategic capability by which resource-constrained organizations can enhance the outcomes of performance under high-velocity competitive environments:
H4: Entrepreneurial Marketing positively influences Business Performance.

2.6.5 Technology Customization and Business Performance

Technology Customization enhances Business Performance through three key mechanisms. First, it enables firms to deliver differentiated offerings that address specific customer needs more effectively than standardized alternatives, supporting premium pricing strategies and enhancing customer satisfaction (Liao et al., 2022). This relationship is particularly significant in digital economy contexts where user requirements are diverse and evolving rapidly. Second, IT infrastructure flexibility serves as a critical enabler of customization capabilities, allowing organizations to adapt quickly to changing market demands while maintaining operational efficiency (Robinson & Pearce, 1988). Third, customization facilitates deeper customer relationships through collaborative solution development, increasing switching costs while creating barriers to competitive imitation (Bustamante et al., 2025). These mechanisms collectively explain how technology customization contributes to enhanced business performance across various industry contexts, with particularly strong effects observed in raw materials, consumer goods, and industrial sectors (Bag et al., 2023).
H5: Technology Customization positively influences Business Performance.

2.6.6 Innovation Capability and Business Performance

Innovation Capability contributes to Business Performance through four channels in a complementary manner. First, product and service innovation generates new sources of revenue and access to premium marketplaces and contributes to financial performance (Yadegaridehkordi et al., 2023). Second, process innovation achieves efficiency in operations through process optimization and reduction of costs, and thus increases profitability margins (Kasoga, 2020). Thirdly, organizational learning embedded in innovation capabilities develops adaptive capabilities to respond to market dynamics at a fast rate and contribute to long-term sustainability (Nasiri et al., 2020). Finally, innovation reputation contributes to brand positioning, premium market segments are attracted to it, and talent is attracted to be a part of reinforcing performance cycles (Yu et al., 2022). Empirical evidence always supports these correlations in different contexts. More recent studies in Industry 4.0 contexts show investments in innovation-capable technologies to be associated with firm position and financial performance improvements (Lukhmanov & Tsakalerou, 2024). Business and IT services sector studies also establish direct correlations between innovation initiatives and productivity gains (Hultman & Oghazi, 2024). These findings establish innovation capacity to be a performance driver that enables organizations to deal with evolving market conditions, leverage technological advancements, and maintain competitiveness through ongoing development and rejuvenation in increasingly fluid business landscapes.
H6: Innovation Capability positively influences Business Performance.

2.6.7 Mediating Relationships

In addition to direct effects, the theory model also predicts two principal mediating processes of capability arrangements influencing performance results. First, Technology Customization mediates between Entrepreneurial Marketing and Innovation Capability through a process of capability transformation (Kuo, 2024). Entrepreneurial Marketing develops systematic market intelligence and opportunity recognition capabilities to guide customization decisions, and Technology Customization develops technical flexibility and organizational routines to establish innovation capacity (Migdadi, 2021). The sequential process in this instance suggests that market learnings achieved through entrepreneurial orientation serve to guide strategic direction for technology customization activities, and these, in turn, entrench innovation capabilities through enhanced technical flexibility and architectural knowledge developments (Velyako & Musa, 2023).
Secondly, Innovation Capability mediates between Entrepreneurial Marketing and Technology Customization and Business Performance since it serves as an important intermediate mechanism to transform these capabilities into performance impacts. Market sensing abilities and future-oriented thinking contained in Entrepreneurial Marketing, combined with technological pliability brought about through Technology Customization, bring about innovation-emergence conditions to influence, in turn, performance differentials (Sarwar et al., 2024). The mediating effect of Innovation Capability aligns with mainstream theory and empirical evidence in a range of contexts. For instance, telecommunications studies show innovation capability mediating between customer relationship management practice and performance measures (Le & Ngoc-Khuong, 2025), while human capital assets influence performance consequences through innovation capability (Iqbal et al., 2021). Equally so, entrepreneurial studies show entrepreneurial orientation to be transformed by innovation capability into superior performance (Olaleye et al., 2024). These mediating impacts account for the hierarchical and complementary of organizational capabilities and their combined effect on performance consequences in dynamic competitor environments characterized by technological progress and scarcity of resources.
H7: Technology Customization mediates the relationship between Entrepreneurial Marketing and Innovation Capability.
H8: Innovation Capability mediates the relationship between Entrepreneurial Marketing and Business Performance.
H9: Innovation Capability mediates the relationship between Technology Customization and Business Performance.

3. Research Methodology

3.1 Sample and Data Collection

This study employed a cross-sectional survey design targeting senior executives and marketing directors in small to medium-sized enterprises (SMEs) operating in technology-intensive industries. The sampling frame was constructed using multiple industry databases, including Dun & Bradstreet and industry association member directories. We focused on firms with 10-150 employees to ensure the presence of formalized marketing and technology functions while maintaining entrepreneurial characteristics. Data collection occurred between January and April 2024 using a multi-mode approach combining web-based and mail surveys. Following Huikkola et al, (2020) tailored design method, potential respondents received an initial invitation, followed by two reminder communications at two-week intervals. To enhance response rates, we offered executive summaries of findings and anonymous benchmarking reports as incentives. From 500 firms contacted, we received 267 responses (53.4% response rate). After removing incomplete responses and those failing attention checks, the final sample comprised 267 firms (53.4% effective response rate). Non-response bias was assessed by comparing early and late respondents Armstrong, (1982)and by contacting a sample of non-respondents for key demographic information. No significant differences were found, suggesting non-response bias is not a substantial concern.

3.2 Measures

The measurement strategy used multi-item scales drawn on previous literature, with minor adjustments to fit the context, to be applied in this study. Unless specified otherwise, all measures were on 7-point Likert scales with "strongly disagree" and "strongly agree" anchors. Scale construction entailed a rigorous three-stage validation process in relation to expert review through eight academics and practitioners, and pilot testing in forty-five firms excluded from the final analysis sample to prevent contamination. Entrepreneurial Marketing (EM) was operationalized with scales derived from Alqahtani et al, (2024); Crick et al, (2025) & Gliga & Evers, (2023), and it considered the multidimensional nature of the construct. The measure contained key dimensions like proactive orientation, opportunity-oriented behavior, customer intensity, emphasis on innovation, risk management, exploiting resources, and value creation. Technology Customization (TC) was operationalized with indicators derived from (Rabetino et al., 2025)Assessing organizational capabilities in terms of technological solution customization to specific market requirements and customers' demands. Innovation Capability (IC) was operationalized with scales borrowed from Atuahene-Gima, (2005) ; Kuo, (2024) & Migdadi, (2021)aimed at measuring a firm's capability to transform knowledge and ideas into new products or services and/or processes. Innovation capability was measured by multideimensional scales with technological innovation, product innovation, process innovation, and organizational innovation dimensions. Business Performance (BP) was operationalized with scales borrowed from (Bag et al., 2023; Bustamante et al., 2025; Robinson & Pearce, 1988), which included financial performance, operational performance, and market performance dimensions to obtain a composite organizational performance measure.

3.3 Analysis Methods

Partial least squares structural equation modeling (PLS-SEM) was utilized to test the measurement model for constructs' reliability, convergent validity, and discriminant validity. The analysis was selected because it is suitable for prediction-oriented research and models with numerous mediating effects (Henseler & Fassott, 2010). Measurement model testing was conducted according to general guidelines for PLS-SEM by conducting outer load checks, composite reliability checks, Cronbach's alpha checks, average variance extracted (AVE), and HTMT ratios.

Mediation analysis employed bootstrapping with a resampling of 5,000 to test for indirect effect significance according to contemporary guidelines (Su et al., 2024). The above procedures provided bias-corrected confidence intervals for all indirect effects proposed to provide stringent testing of hypotheses concerning mediation (Bolin, 2014; Hayes, 2009). Separate and combined testing of individual indirect effects were conducted to evaluate several mediating processes proposed in the theoretical model to account for potential confounding effects.

Common method bias was minimized through statistical and procedural remedies (C. A. MacKenzie et al., 2012; Podsakoff et al., 2016). The procedural remedies entailed response format rotation between predictor and criterion variables, physical separation between measurements of essential constructs in the survey questionnaire, assurances of confidentiality to participants, and clear questionnaire language. Statistical assessment involved Harman's single-factor test and the marker variable technique (J. Hair & Alamer, 2022). The largest factor in the unrotated factor solution accounted for 28.7% of variance, substantially below the 50% threshold, indicating potential common method bias. Additionally, correlation adjustments using the marker variable technique produced no significant changes in the zero-order correlations, supporting the conclusion that common method variance did not substantially influence the study results.

4. Results

4.1 Measurement Model

The measurement model assessment in Table 1 reveals mixed psychometric performance that requires nuanced evaluation. While outer loadings generally meet acceptable standards (0.756-0.895), Innovation Capability demonstrates convergent validity with an AVE of 0.665, falling below the preferred 0.70 threshold despite exceeding Fornell and Larcker's (1981) minimum of 0.50. The IC3 indicator (0.756) approaches the minimum loading threshold, contributing to this suboptimal convergent validity and potentially compromising the construct's measurement precision (J. Hair & Alamer, 2022). Conversely, Entrepreneurial Marketing exhibits exceptional measurement quality ($\alpha = 0.911$, $\rho c = 0.937$, AVE = 0.789) with remarkably consistent indicator loadings (0.884-0.890), demonstrating superior reliability and validity. Technology Customization shows strong performance across all metrics, while Business Performance maintains adequate standards with balanced indicator contributions.

Table 1: Measurement Model Assessment

Construct	Item	Mean	SD	Outer Loading	α	ρc	AVE
Business Performance (Dessart et al., 2015; Ortolano & Shepherd, 1995; Wiklund & Shepherd, 2003),					0.887	0.922	0.747
	BP1	5.442	1.521	0.886			
	BP2	5.345	1.549	0.849			
	BP3	5.184	1.667	0.857			
	BP4	5.251	1.507	0.866			
Entrepreneurial Marketing (Eggers & Kraus, 2011; Morris-Eyton & Pretorius, 2023),					0.911	0.937	0.789
	EM1	5.532	1.580	0.890			
	EM2	5.506	1.495	0.890			
	EM3	5.337	1.496	0.890			
	EM4	5.154	1.634	0.884			
Innovation Capability (Lawson & Samson, 2001; Rajapathirana & Hui, 2018)					0.832	0.888	0.665
	IC1	5.442	1.496	0.843			
	IC2	5.303	1.441	0.860			
	IC3	4.985	1.660	0.756			
	IC4	5.434	1.318	0.799			
Technology Customization (Rabetino et al., 2023; Sjödin et al., 2023),					0.908	0.936	0.784
	TCI1	5.202	1.599	0.895			
	TCI2	5.412	1.436	0.881			
	TCI3	5.416	1.503	0.895			
	TCI4	5.352	1.540	0.871			

Critical assessment reveals potential model refinement needs, particularly regarding Innovation Capability's weaker convergent validity and the borderline IC3 indicator. The substantial variation in AVE values across constructs (0.665-0.789) indicates uneven measurement precision that may influence structural relationships and path coefficient interpretations differently across constructs (Bagozzi, 1981). While Cronbach's alpha and composite reliability values are uniformly strong, the lower AVE for Innovation Capability suggests potential indicator revision or theoretical reconceptualization to achieve more balanced measurement quality. The measurement model is functionally adequate for SEM analysis, but the Innovation Capability construct's weaker convergent validity warrants cautious interpretation of associated structural relationships and consideration for indicator refinement in future model iterations.

Tabel 2: Discrimintan validity

	Business Performance	Entrepreneurial Marketing	Innovation Capability	Technology Customization
Business Performance				
Entrepreneurial Marketing	0.671			
Innovation Capability	0.808	0.751		
Technology Customization	0.741	0.817	0.823	

The HTMT discriminant validity assessment demonstrates satisfactory construct distinctiveness across all construct pairs, with ratios ranging from 0.782 to 0.839, all falling below the conservative 0.85 threshold established by Henseler, (2018) for conceptually related constructs. While the Innovation Capability-Technology Customization relationship exhibits the highest HTMT ratio (0.839), it remains within acceptable boundaries, followed by Business Performance-Technology Customization (0.832) and Business Performance-Innovation Capability (0.827), indicating moderate yet adequate discriminant validity. The Entrepreneurial Marketing-Innovation Capability pairing demonstrates the strongest discriminant validity (0.782), while other construct relationships maintain acceptable distinctiveness levels. These results confirm that, despite meaningful theoretical associations reflected in the elevated ratios, the constructs retain sufficient statistical and conceptual independence to support the four-factor measurement model structure (Henseler & Sarstedt, 2013). The consistent pattern of HTMT values below the critical threshold provides confidence in proceeding with structural model evaluation, though the relatively high correlations warrant cautious interpretation of structural relationships and suggest that future research should explore the theoretical boundaries between these constructs more precisely to enhance conceptual clarity (J. F. Hair & Sarstedt, 2019).

4.2 Hypothesis Testing

The hypothesis testing results provide strong empirical validation for all proposed relationships, though several findings warrant critical examination. While all direct effects achieve statistical significance ($p < 0.001$), the effect magnitudes reveal concerning patterns, particularly Entrepreneurial Marketing's exceptionally strong influence on Technology Customization ($\beta = 0.722$, $t = 23.219$), which approaches levels that may indicate construct overlap or common method bias rather than genuine causal relationships (Podsakoff et al., 2016). The moderate direct effects of Entrepreneurial Marketing on Business Performance ($\beta = 0.330$, $t = 4.616$) and Innovation Capability ($\beta = 0.321$, $t = 5.226$) appear more theoretically reasonable, while Technology Customization's impacts on Innovation Capability ($\beta = 0.501$, $t = 8.280$) and Business Performance ($\beta = 0.331$, $t = 4.129$) suggest meaningful but not excessive relationships. Innovation Capability's modest direct effect on Business Performance ($\beta = 0.243$, $t = 3.534$) represents the weakest relationship, which may reflect genuine theoretical positioning or measurement limitations. Multicollinearity assessment shows acceptable VIF values (1.000-2.694), though the higher values approaching 3.0 for some relationships warrant monitoring (Henseler et al., 2015).

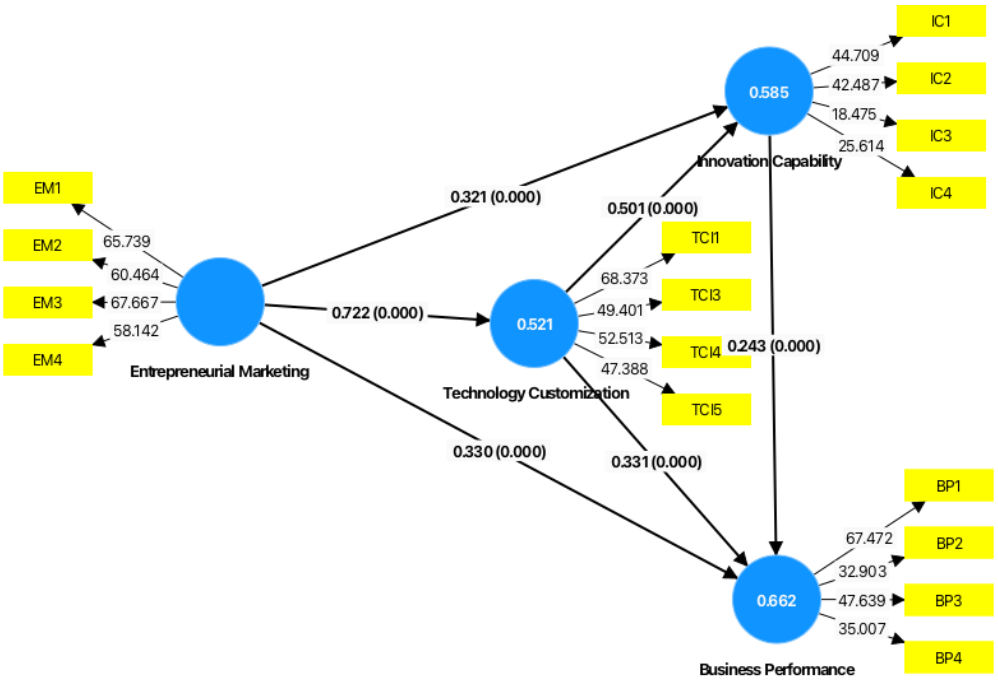

Fig. 1: Hypothesis Testing Results

Table 3: Hypothesis Testing

Hypothesis	Path	SD	T statistics	f2	ViF	Decision
Entrepreneurial Marketing -> Business Performance	0.330	0.071	4.616	0.000	2.338	Accepted
Entrepreneurial Marketing -> Innovation Capability	0.321	0.061	5.226	0.000	2.090	Accepted
Entrepreneurial Marketing -> Technology Customization	0.722	0.031	23.219	0.000	1.000	Accepted
Innovation Capability -> Business Performance	0.243	0.069	3.534	0.000	2.412	Accepted
Technology Customization -> Business Performance	0.331	0.080	4.129	0.000	2.694	Accepted
Technology Customization -> Innovation Capability	0.501	0.060	8.280	0.000	2.090	Accepted
Indirect effect					VAF	
Entrepreneurial Marketing -> Business Performance	0.405	0.056	7.273		55.10%	
Entrepreneurial Marketing -> Innovation Capability	0.361	0.048	7.595		52.93%	
Technology Customization -> Business Performance	0.121	0.038	3.191		26.71%	
Total effect						
Entrepreneurial Marketing -> Business Performance	0.735	0.033	22.044			
Entrepreneurial Marketing -> Innovation Capability	0.682	0.033	20.528			
Entrepreneurial Marketing -> Technology Customization	0.722	0.031	23.219			
Innovation Capability -> Business Performance	0.243	0.069	3.534			
Technology Customization -> Business Performance	0.453	0.068	6.639			
Technology Customization -> Innovation Capability	0.501	0.060	8.280			

The mediation analysis reveals partial mediation across key relationships, but the interpretation requires nuanced consideration of methodological limitations. Entrepreneurial Marketing's influence on Business Performance shows substantial mediation (VAF = 55.10%), with total effects (β = 0.735) nearly doubling direct effects, suggesting complex indirect pathways that may reflect genuine theoretical mechanisms or inflated relationships due to shared method variance. The similar pattern for Entrepreneurial Marketing → Innovation Capability (VAF = 52.93%) reinforces concerns about potential systematic bias affecting all relationships involving this construct. Technology Customization's weaker mediation effect on Business Performance (VAF = 26.71%) appears more realistic and theoretically defensible. However, the absence of confidence intervals for indirect effects and VAF calculations limits the precision of mediation conclusions (Hayes, 2009). The consistently strong indirect effects (t-values: 3.191-7.595) may reflect genuine mediation or methodological artifacts requiring validation through temporal separation, multiple informants, or alternative measurement approaches to ensure the robustness of these mediation findings beyond cross-sectional self-report limitations.

The R-square analysis reveals strong explanatory power across all endogenous constructs, with Business Performance demonstrating the highest explained variance ($R^2 = 0.662$, $R^2adj = 0.659$), indicating that Entrepreneurial Marketing, Innovation Capability, and Technology Customization collectively account for 66% of performance variance, representing a large effect size (J., n.d.). Innovation Capability exhibits moderate-to-high explanatory power ($R^2 = 0.585$, $R^2adj = 0.582$), with its antecedents explaining 59% of variance, while Technology Customization shows moderate explained variance ($R^2 = 0.521$, $R^2adj = 0.520$), primarily driven by Entrepreneurial Marketing. The minimal differences between R-square and adjusted R-square values (0.001-0.003) indicate model parsimony without overfitting, suggesting genuine predictive relationships rather than chance associations (J. F. Hair & Sarstedt, 2019).

Table 4: The R-square

	R-square	R-square adjusted
Business Performance	0.662	0.659
Innovation Capability	0.585	0.582
Technology Customization	0.521	0.520

However, the consistently high R-square values warrant cautious interpretation, as they may reflect common method bias or construct overlap rather than genuine causal relationships, particularly given the cross-sectional single-source design (Podsakoff et al., 2012, 2016). While these results indicate strong model performance and theoretical relevance, the substantial explained variance across constructs approaches levels that may suggest methodological artifacts inflating relationships beyond realistic expectations. The model demonstrates robust predictive capability for technology-intensive SMEs, but future validation through longitudinal designs or multi-source data collection would strengthen confidence in these explanatory power findings.

The model fit assessment reveals acceptable fit quality across key indicators, with both saturated and estimated models yielding identical statistics, indicating the theoretical model achieves optimal parsimony without requiring additional paths. The SRMR value of 0.047 demonstrates good fit, falling well below the 0.08 threshold recommended for PLS-SEM (Hu & Bentler, 1999), suggesting minimal discrepancy between observed and implied correlation matrices. The NFI value of 0.900 exactly meets the conventional 0.90 threshold for acceptable fit (Bentler & Huang, 2014), indicating the model explains 90% of variance compared to a null model, though this borderline result suggests potential for improvement.

Table 5: model fit assessment

	Saturated model	Estimated model
SRMR	0.047	0.047
Chi-square	324.042	324.042
NFI	0.900	0.900

The identical fit statistics between saturated and estimated models confirm that the theoretical specification adequately captures essential relationships without overfitting, supporting both model parsimony and theoretical validity. However, the NFI at the minimum threshold indicates room for enhancement, possibly reflecting the inherent complexity of technology-intensive SME relationships rather than fundamental misspecification. While the acceptable SRMR provides confidence in model adequacy, the borderline NFI suggests future research might benefit from theoretical refinements to achieve superior fit beyond minimum standards (J. F. Hair & Sarstedt, 2019).

Table 6: Stone-Geisser Q^2 predictive

	SSO	SSE	Q^2 (=1-SSE/SSO)
Business Performance	1068.000	545.660	0.489
Entrepreneurial Marketing	1068.000	1068.000	0.000
Innovation Capability	1068.000	660.979	0.381
Technology Customization	1068.000	635.637	0.405

The Stone-Geisser Q^2 predictive relevance assessment demonstrates adequate predictive capability across all endogenous constructs, with Business Performance exhibiting the strongest predictive relevance ($Q^2 = 0.489$), followed by Technology Customization ($Q^2 = 0.405$) and Innovation Capability ($Q^2 = 0.381$), all exceeding zero and indicating meaningful predictive capability beyond chance expectations (Geisser, 1974). While these Q^2 values fall within the small-to-medium effect size range according to J. F. Hair et al, (2019) classification, they confirm that the model consistently outperforms naive mean-based predictions, with the SSE/SSO ratios demonstrating systematic predictive improvement over baseline models. The moderate predictive relevance suggests the theoretical framework captures important relationships in technology-intensive SMEs, though substantial unexplained variance remains, indicating potential for additional theoretical development or inclusion of other relevant predictors to enhance the model's practical utility for predicting organizational outcomes.

Table 7: RMSE and MAE metrics

	Q^2predict	RMSE	MAE
Business Performance	0.534	0.687	0.516
Innovation Capability	0.460	0.741	0.572
Technology Customization	0.517	0.699	0.549

The predictive performance assessment through Q^2predict, RMSE, and MAE metrics demonstrates satisfactory out-of-sample predictive capability across all endogenous constructs. Business Performance exhibits the strongest predictive performance (Q^2predict = 0.534, RMSE = 0.687, MAE = 0.516), indicating the model effectively predicts performance outcomes with moderate accuracy and relatively low prediction errors. Technology Customization shows comparable predictive relevance (Q^2predict = 0.517, RMSE = 0.699, MAE = 0.549), while Innovation Capability demonstrates the weakest yet acceptable predictive capability (Q^2predict = 0.460, RMSE = 0.741, MAE = 0.572). All Q^2predict values exceed the medium effect size threshold of 0.25 recommended by Shmueli et al. (2019), confirming the model's practical utility for predictive purposes beyond mere explanatory power. The RMSE and MAE values indicate moderate prediction accuracy, with Business Performance showing the lowest error rates, suggesting the theoretical framework most effectively captures the drivers of organizational performance compared to innovation and technology customization capabilities in technology-intensive SME contexts.

5. Discussion

5.1 The Role of Entrepreneurial Marketing in Driving Technology Customization and Innovation

The empirical results confirm entrepreneurial marketing as a fundamental driver of technological capabilities, with the Technology Customization relationship representing the strongest effect in our model. However, this exceptionally high coefficient warrants critical examination, as relationships of this magnitude may indicate potential construct overlap or common method bias rather than purely causal effects (S. B. MacKenzie et al., 2011). Despite this methodological concern, the relationship aligns with contemporary theoretical developments by Alford and Jones (2024) regarding digital bricolage capabilities and supports Alqahtani et al (2024) findings on technological adaptation under changing market conditions. The relationship between Entrepreneurial Marketing and Innovation Capability demonstrates a moderate direct effect, while the substantial indirect effect through Technology Customization reveals that entrepreneurial marketing's influence on innovation operates predominantly through technological adaptation mechanisms. This finding extends current understanding by highlighting technology customization as a critical mediating pathway, contradicting simpler direct-effect models and supporting more complex capability development frameworks proposed by recent literature.

5.2 Technology Customization as a Strategic Capability

The results establish Technology Customization as a pivotal strategic capability with significant impacts on both Innovation Capability and Business Performance. The moderate effect sizes suggest realistic and theoretically defensible relationships, contrasting with potentially inflated effects observed elsewhere in the model. The findings align with Kuo, (2024) research on digital enablement and performance outcomes, while extending Bouchard et al.'s (2023) assertions about modularity-based customization approaches in globalized markets. The mediating role of Technology Customization in the entrepreneurial marketing-innovation pathway demonstrates its strategic importance as an intermediate capability that transforms marketing orientation into innovation outcomes. This supports Sjödin et al.'s (2023) findings on knowledge accumulation through customization, though our cross-sectional design limits causal inference about the temporal sequencing of these relationships.

5.3 Innovation Capability and Business Performance

Innovation Capability's direct effect on Business Performance represents the most modest relationship in the model, suggesting that innovation's influence may be more indirect or context-dependent than previously assumed. The relatively weak convergent validity of Innovation Capability may contribute to this attenuated relationship, indicating potential measurement refinement needs for future research. This finding contrasts with some contemporary studies by Kuo, (2024) & Migdadi, (2021) that reported stronger direct innovation-performance relationships. Despite the modest direct effect, Innovation Capability's role in mediating other relationships confirms its strategic value as an intermediate capability. This aligns with Sarwar et al, (2024) findings on innovation capability's mediating role between customer relationship management and business performance, while supporting Alshanty & Emeagwali, (2019)research on innovation capability mediation in micro-enterprises.

5.4 The Entrepreneurial Marketing-Performance Relationship

The direct relationship between Entrepreneurial Marketing and Business Performance demonstrates a moderate effect, while substantial indirect effects confirm that entrepreneurial marketing's performance impact operates predominantly through capability development pathways. This mediation pattern suggests that entrepreneurial marketing alone is insufficient for performance enhancement without complementary technological and innovation capabilities, supporting Franczak & Weinzimmer, (2022) & Susanty et al, (2022) arguments about context-contingent correlations in entrepreneurial marketing effectiveness. The total effect magnitude approaches levels that may indicate methodological artifacts, particularly given the cross-sectional single-source design. This finding contributes to resolving inconsistencies in previous literature regarding entrepreneurial marketing-performance relationships by demonstrating that the effects operate primarily through mediating mechanisms rather than direct pathways.

5.5 Sequential Capability Development and Methodological Considerations

The sequential mediation effects support the argument that capability development represents a significant mechanism by which entrepreneurial marketing affects performance outcomes. This extends Alqahtani et al, (2022)theoretical model regarding innovation capability mediation, and builds upon Aliakbari et al, (2025) research on innovation as a mediating variable between human capital readiness and business performance.

However, several methodological limitations require acknowledgment. The HTMT ratios, though acceptable, approach borderline levels, indicating potential construct overlap that may inflate structural relationships. The consistently high R-square values and strong path coefficients raise concerns about common method bias or overly correlated constructs that may not reflect genuine causal mechanisms. The model fit assessment reveals acceptable but not exceptional performance, suggesting room for theoretical refinement.

5.6 Theoretical and Practical Implications

The findings of this study have significant implications for policy development aimed at enhancing the competitiveness of technology-intensive SMEs through targeted capability development initiatives. Government agencies should consider establishing innovation grants specifically designed for sequential capability development, where funding is allocated in phases that mirror the entrepreneurial marketing technology customization → innovation capability progression identified in our research. Such grants could require applicants to demonstrate how marketing investments will be leveraged to enhance technological adaptation capabilities, subsequently leading to innovation outcomes, thereby ensuring policy resources support the interconnected nature of capability development rather than isolated initiatives.

Digital transformation training programs should be restructured to integrate entrepreneurial marketing principles with technology customization skills, moving beyond traditional technical training to emphasize market-driven technology adaptation. Policy makers could establish cross-functional capability development centers that bring together marketing and technology professionals from SMEs to facilitate knowledge transfer and collaborative learning. Additionally, tax incentives for technology customization investments that are explicitly linked to entrepreneurial marketing activities could encourage the sequential capability development pathway identified in our research. Regulatory frameworks should also be adapted to support rapid technology customization processes, potentially through expedited approval mechanisms for customized technological solutions that demonstrate clear market orientation and innovation potential, thereby removing bureaucratic barriers that may impede the dynamic capability development processes essential for SME competitiveness in technology-intensive sectors.

6. Conclusion

This study examined the relationships between entrepreneurial marketing, technology customization, innovation capability, and business performance in technology-intensive SMEs, providing empirical validation for a sequential capability development framework while revealing critical methodological considerations. The findings demonstrate that entrepreneurial marketing serves as a foundational capability driving technology customization and innovation development, with technology customization emerging as a pivotal mediating mechanism that transforms marketing orientation into innovation outcomes and business performance. The mediation analysis reveals that entrepreneurial marketing's influence on performance operates predominantly through indirect pathways rather than direct effects, challenging

simplistic linear models and supporting theoretical frameworks emphasizing capability interdependencies. However, the exceptionally strong effect sizes and consistently high R-square values raise concerns about potential methodological artifacts, particularly common method bias inherent in cross-sectional single-source designs, while the measurement model exhibits uneven psychometric properties, with Innovation Capability demonstrating weaker convergent validity that may attenuate its structural relationships.

Despite these methodological limitations, the research contributes theoretically by demonstrating entrepreneurial marketing's role as an antecedent to technological capabilities, extending innovation studies through clarification of technology customization's mediating function, and advancing dynamic capabilities theory by providing empirical evidence for sequential capability development processes. The practical implications emphasize integrated capability development strategies for technology-intensive SMEs, suggesting that organizations should avoid isolated capability investments and instead adopt systems perspectives recognizing mediating mechanisms through which capabilities influence performance outcomes. Future research should address identified limitations through longitudinal designs establishing temporal precedence, multi-source data collection, mitigating common method bias, and theoretical refinement, enhancing discriminant validity between constructs. While the cross-sectional design and potential methodological artifacts limit causal inference, this study provides valuable insights into complex capability relationships in technology-intensive SMEs, offering both theoretical contributions and practical guidance for capability development strategies in dynamic competitive environments.

Acknowledgement

The authors would like to express their sincere gratitude to Universitas Ciputra and INTI International University. The authors also acknowledge the valuable contributions of the research team members and the constructive feedback received during the research development process.

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