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ENHANCING VENTURE PERFORMANCE THROUGH PROCESS INNOVATION: THE MODERATING ROLE OF MARKET KNOWLEDGE AND GOVERNMENT SUPPORT

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Abstract
Amid volatile emerging-economy conditions, this study investigates how process innovation drives non-financial venture performance in Pakistani SMEs and whether market knowledge and government support strengthen this relationship. A cross-sectional survey of 395 SME owners/managers across ten Punjab divisions was analysed via PLS-SEM (SmartPLS 4.0 & WarpPLS 8.0). Process innovation significantly improves venture performance (β = .294, p < .001). Entrepreneurial education (β = .275) and digital readiness (β = .348) influence performance indirectly via process innovation (partial mediation). Government support positively moderates the innovation–performance link (β = .428, p = .012); market knowledge does not (β = .502, p = .150). Policymakers should simplify innovation-grant access; SME owners should leverage targeted training and phased digital adoption. Integrates Resource-Based and Knowledge-Based Views to explain non-financial SME performance in an emerging-market context.
Keywords: *Entrepreneurial Education, Digital Readiness, Process Innovation, Venture Performance, Market Knowledge, Government Support, SMEs, Pakistan*

INTRODUCTION

Small and medium-sized enterprises (SMEs) constitute roughly 90 % of all businesses worldwide and generate approximately 60 % of formal employment (World Bank, 2023). Yet, contemporary evidence from 2025 cohort studies shows that one in five new ventures fails within the first year, and only 35 % survive beyond the fifth anniversary. In Pakistan, SMEs contribute 40 % to GDP and 80 % to non-agricultural employment, but they remain disproportionately vulnerable to resource scarcity, erratic policy signals and accelerating digital disruption (Ali & Malik, 2021). These ventures operate in high-velocity markets where customer expectations, competitor actions and regulatory frameworks shift faster than the average SME's absorptive capacity allows. Consequently, the liability of smallness is compounded by what Teece (2024) labels a "liability of slowness," making sustained non-financial performance—customer satisfaction, brand equity, employee engagement and operational agility—both urgent and precarious.

Process innovation—defined by the 2025 OECD guideline as "the implementation of new or significantly improved production or delivery methods, including the use of AI, robotics, lean systems or green processes"—has emerged as a strategic equalizer that reduces cost per unit, shortens cycle time and heightens quality consistency. In emerging economies, process innovations do not require the heavy R&D outlays typical of product innovations; instead, they leverage low-cost digital tools, open-source platforms and government incubation schemes to reconfigure routines. For example, a 2024 study of 1,124 West-African SMEs found that those deploying cloud-based inventory analytics achieved a 23 % faster cash-conversion cycle and 18 % higher customer-loyalty scores than matched peers (Osei et al., 2024). Similarly, AI-driven chatbots adopted by Pakistani apparel exporters reduced query-response time from 24 hours to 90 seconds, directly lifting Net Promoter Scores by 15 points (Rehman et al., 2025). These illustrations underscore that process innovation is not merely technical tinkering; it is a dynamic capability that converts scarce resources into differentiated value propositions.

Nonetheless, the translation mechanism between process innovation and superior non-financial performance is neither linear nor universal. The Resource-Based View (RBV) posits that firm-specific, valuable, rare and inimitable resources generate competitive advantage (Barney, 1991). Yet, RBV has been critiqued for under-

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specifying contextual enablers. Dynamic Capabilities Theory (DCT) fills this gap by arguing that firms must sense, seize and reconfigure resources in rapidly changing environments (Teece et al., 1997). Recent meta-analytic evidence (Hadi, 2025) shows that external contingencies account for up to 40 % of the variance in innovation–performance relationships among emerging-market SMEs. Two such contingencies—market knowledge and government support—are especially salient.

Market knowledge encompasses the breadth and depth of information about customer preferences, competitor strategies and regulatory trends (Zakaria et al., 2025). SMEs endowed with rich market knowledge are four times more likely to successfully commercialise process innovations because they can rapidly pivot workflows to match shifting demand patterns. Conversely, firms with limited market intelligence often misalign process upgrades with latent needs, leading to costly capability–market mismatches (Aliasghar et al., 2022). Government support—ranging from direct innovation vouchers to ethical-AI guidelines mitigates resource constraints and lowers adoption risk. A 2025 IMF working paper demonstrates that SMEs receiving targeted digitalization grants register a 30 % faster AI-uptake rate and 19 % higher perceived performance gains than non-recipients.

Pakistan's unique ecosystem renders these contingencies even more critical. On the supply side, 42 % of Pakistani SMEs report severe credit rationing, and only 28 % possess in-house digital talent (State Bank of Pakistan, 2025). On the demand side, urban millennials—now 55 % of consumers—expect same-day delivery and hyper-personalized service, forcing SMEs to innovate processes or lose relevance. Policy signals are equally volatile: the Digital Pakistan Vision 2025 promises ubiquitous broadband and e-governance, yet regulatory clarity on data privacy remains fragmented. Within this crucible, entrepreneurial education and digital readiness function as antecedent capabilities that shape both the propensity to innovate and the ability to absorb external support.

Entrepreneurial Education equips founders with cognitive scripts for opportunity recognition, risk calibration and stakeholder mobilization (Martin et al., 2013). Recent evidence from 2,300 Asian SMEs shows that founders who completed structured entrepreneurship programmes were twice as likely to adopt AI-enabled process innovations within 18 months (Tan et al., 2025). Digital readiness—defined as the confluence of technical infrastructure, human capital and organizational culture necessary to exploit digital technologies—serves as a threshold resource. Without adequate readiness, even well-funded process innovations stall due to employee resistance or system incompatibilities (Nguyen et al., 2025).

Drawing on these insights, this study integrates RBV and DCT to develop a contingent-process model (Figure 1) in which:

1) Entrepreneurial Education and Digital Readiness enhance process innovation;
2) Process Innovation directly improves non-financial Venture Performance; and
3) Market Knowledge and Government Support moderate the Innovation–performance link.

By empirically testing this model on a large sample of Pakistani SMEs, the study contributes three-fold:

a) it extends RBV by treating Market Knowledge as a cognitive, context-specific resource;
b) it enriches DCT by demonstrating how Government Support acts as a seizing mechanism that amplifies Innovation benefits; and
c) it offers policy-calibrated evidence to accelerate Pakistan's digital-transformation agenda without replicating one-size-fits-all prescriptions.

PROBLEM STATEMENT

Over the past few decades, the growth, significance and contribution of the entrepreneurial ventures have grown immensely (Lee, Griffin W. Cottle, & Wiklund, 2021). With the advent of technology and internet and the common usage of smartphones and other gadgets, the access and ease of everyone to use internet and be present online has increased tremendously. Another factor that contributed to the growth of entrepreneurial ventures is the global economic recession and the ever-rising rates of inflation. People now are looking for multiple streams of income and each member of a household wants to contribute to the overall family income.

Under this turmoil, a positive change that occurred is a growing trend of starting entrepreneurial ventures. In an economy, where ease and convenience are everyone's priority, other people are bridging in these gaps by offering those services and earn a good amount out of it (Krishnan, Ganesh, & Rajendran, 2022). From moving services to carpooling, from consultancy and professional guidance to home based catering services, the services have increased beyond what one could imagine a few decades ago. These entrepreneurial ventures not only

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provide financial independence and support at an individual and family level, but at a macro level as well, providing an overall boost to the economy.

However, despite the rising number of these startups, the sustenance and performance of these entrepreneurial ventures is still a question mark. Most of the startups do not last more than a few years (Eklund, Levratto, & Ramello, 2020). The reasons behind such lower ratio of their survival and growth are what need to be identified.

It has remained a challenge to identify the drivers behind the performance of entrepreneurial ventures among the practitioners and researchers in the field of entrepreneurship (Jayasekara, Fernando, & Ranjani, 2020). Among the many factors that have been highlighted by various researches, the two factors that need attention include entrepreneurial education (Kanaan-Jebna, Alabdullah, Ahmed, & Ayyasamy, 2022) (Brownell, McMullen, & Jr., 2021). Theorists are of the view that it may be the lack of formal and structured education that can guide these entrepreneurs on how to run these ventures, how to market them and most importantly, how to fund them. Most of the individuals and people jumping into these ventures are without this knowledge and end up shutting it down because of not being able to earn as much as they might otherwise have thought that they would. If these entrepreneurs are well equipped with this knowledge and are properly education and trained on how to run and manage entrepreneurial ventures successfully, the benefits that can be reaped out of these ventures range far beyond just the owners themselves (Kanaan-Jebna, Alabdullah, Ahmed, & Ayyasamy, 2022).

Another key aspect that it relevant to venture performance and its improvement is the entrepreneur's ability to be innovative (Zeb & Ihsan, 2020). Researches like (Kariv, D., Krueger, N., Kashy, G., & Cisneros, L. 2024). Show that Process Innovation plays a crucial role in the performance of entrepreneurial ventures. However, Process Innovation alone will not ensure its survival, since most of the ventures are based on Process Innovation but only some of them actually thrive (Kariv, D., Krueger, N., Kashy, G., & Cisneros, L. 2024). This points out that there has to be some other force that in addition to entrepreneurial education and having an intention for it, along with being innovative, is a major driving force behind the success of these ventures.

The inclusion of market knowledge as a moderating variable in this study is grounded in both theoretical reasoning and empirical support. According to the Dynamic Capabilities Theory (Teece et al., 1997), the ability of firms to integrate, build, and reconfigure internal competencies in response to external market changes is critical for sustaining competitive advantage. In this context, market knowledge—defined as the firm's understanding of customer needs, competitor actions, and market trends—serves as an essential external contingency that influences how internal capabilities like process innovation translate into performance outcomes. Previous research (Joseph-Amankwah-Amoah & Adomako, 2021) suggests that innovation alone does not guarantee success unless it aligns with specific market requirements. Therefore, firms that possess deeper market insights are better positioned to tailor their innovative processes effectively, thereby optimizing venture performance. The moderator was selected based on this strategic alignment perspective, where market knowledge determines the contextual fit and relevance of innovation efforts. This justifies its role in the model, as it can either strengthen or weaken the effectiveness of process innovation depending on how well a firm understands and responds to its market environment.

Entrepreneurial education and digital adoption are widely acknowledged as key drivers of business success (Berman, T., Stuckler, D., Schallmo, D., & Kraus, S. 2024). However, existing research predominantly focuses on financial performance metrics, neglecting non-financial indicators like knowledge acquisition, sustainability-driven Process Innovation, and customer experience enhancement. Additionally, there is limited empirical research on Process Innovation as a mediator in SME performance (Tetteh, F. K., Nyantakyi, B., Owusu Kwateng, K., & Osei, H. V. 2025).

This study aims to bridge this gap by answering:

- How do Entrepreneurial Education and Digital Readiness impact on Venture Performance in SMEs?
- What role does Process Innovation play in mediating this relationship?
- How does Market Knowledge and Government Support moderate on Process Innovation and Venture Performance?

Thus, this particular research aims to identify if the factors like entrepreneurial education and Digital Readiness affect the venture performance or not and how this relationship is affected by the presence of ability to bring Process Innovations. Furthermore, it also aims to establish how much the market knowledge can affect the influence of ability to innovate on the performance of these entrepreneurial ventures. By establishing these links,

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this study aims to highlight the significance of formal education and training and the potential contribution it can make in the performance of entrepreneurial venture. By ensuring this formal education and training, a conducive environment can be created that not only encourages and promotes initiating such ventures but contributes in their long-term survival and growth as well.

RESEARCH OBJECTIVES

1. To examine the relationship between Entrepreneurial Education and Venture Performance.
2. To examine the relationship between Digital Readiness and Venture Performance.
3. To examine the relationship between Entrepreneurial Education and Process Innovation.
4. To examine the relationship between Digital Readiness and Process Innovation.
5. To examine the relationship between Process Innovation and Venture Performance.
6. To examine the mediating role of Process Innovation between Entrepreneurial Education and Venture Performance.
7. To examine the mediating role of Process Innovation between Digital Readiness and Venture Performance.
8. To examine the moderating impact of Market Knowledge on the relationship between Process Innovation and Venture Performance.
9. To examine the moderating impact of Government Support on the relationship of Process Innovation and Venture Performance.

RESEARCH QUESTIONS

This research aims to answer the following research question?

1. Is there any relationship between Entrepreneurial Education and Venture Performance?
2. Is there any relationship between Digital Readiness and Venture Performance?
3. Is there any relationship between Entrepreneurial Education and Process Innovation?
4. Is there any relationship between Digital Readiness and Process Innovation?
5. Is there any relationship between Process Innovation and Venture Performance?
6. Is there any mediating role of Process Innovation between Entrepreneurial Education and Venture Performance?
7. Is there any mediating role of Process Innovation between Digital Readiness and Venture Performance?
8. Is there any moderating impact of Market Knowledge in the relationship between Process Innovation and Venture Performance?
9. Is there any moderating impact of Government Support in the relationship between Process Innovation and Venture Performance?

SIGNIFICANCE OF THE RESEARCH

Integrates Resource-Based View and Knowledge-Based View by treating entrepreneurial education, digital readiness and market knowledge as rare, inimitable cognitive resources that jointly condition the innovation–performance link. Extends Dynamic Capabilities Theory by demonstrating how government support operates as a "seizing" mechanism that converts latent process innovations into measurable non-financial outcomes. Fills a literature gap on non-financial SME performance in emerging economies, where most studies focus narrowly on revenue and ROI.

Provides Pakistan-specific evidence at a time when the Digital Pakistan Vision 2025 and SME Policy 2024–29 are seeking evidence-based levers for inclusive growth. Captures sectoral heterogeneity across Punjab's ten administrative divisions, offering granular insight into how regional infrastructure and institutional quality shape innovation pay-offs.

Offers SME owners a clear capability-building roadmap: invest first in human capital (entrepreneurial education), then digital readiness, and finally align process upgrades with real-time market intelligence. Guides policymakers in calibrating innovation vouchers, tax credits and ethical-AI guidelines to maximise societal returns from scarce public funds. Supplies investors and development banks with validated non-financial indicators (customer experience, brand equity, operational agility) that predict long-term scalability beyond short-run profit metrics.

LITERATURE REVIEW

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VENTURE PERFORMANCE

Venture performance is a term used to describe a comprehensive evaluation of the success and efficiency of a newly created business with reference to a multitude of financial and non-financial performance indicators. Typically, financial metrics include such things as profitability, revenue growth, return on investment (ROI), market share and cost efficiency and represent the quantitative evidence that the economic viability of a venture. Nonetheless, indicators that do not pertain to finances, like customer satisfaction, product and service quality, innovative capacity, operational flexibility, employee engagement and visibility of the venture's brand reflect the strategic positioning and long-term viability of the venture.

Besides, it requires the fully developed analysis of the venture performance to recognize the performance lapses, give the strategy and optimize resources. It is also convenient to enable the stakeholders to understand whether a venture is progressing in a sustainable, competitive and growth-driven manner in its target market or industry. Hence, venture performance is quite a critical criterion that is used by business persons, investors, policymakers and business support institutions aiming at promoting the creation of innovation, enhancing competitiveness and long-term sustainability of entrepreneurship firms.

ENTREPRENEURIAL EDUCATION

Entrepreneurial Education consists of repackaged educational programs and training modules, as well as experiences, which develop entrepreneurial knowledge, skills, competencies, attitudes, and other personal qualities that individuals need to succeed as entrepreneurs (Tan, Y. Y., Tok, L., Lam, L., Lam, C., Koh, A., and Seng, E. 2024). First, such learning programs aim at preparing them not only to understand the theoretical foundation of the entrepreneurship, but also to apply it to real-life scenarios. Entrepreneurial education equips the learner to spot and develop on business opportunities by evaluating the needs of the market in order to actualize innovations, take calculated risks and run those new enterprises and sustainably.

Li and Wu (2019) argued that entrepreneurial education mainly concerns the development of the inner of students through cultivating students' entrepreneurial mindset, opportunity recognition ability, leadership quality, resiliency and strategic decision-making ability. This type of education specifically contributes to shaping the perception, attitude and the intent towards entrepreneurship among students who can consequently enhance their level of preparation to join the entrepreneurial activity as either founders, partners and innovators in the existing organizations.

It is also noted that entrepreneurial education plays an important influence on entrepreneurial intention because it can influence on self-efficacy, active behavior and innovation orientation amongst the learning individuals. It equally creates an entrepreneurial culture in the learning institutions and thus the society in general. Case studies Exposure to case studies can be found through such programs, as well as business simulations and their incubators of startups provide students with a significant entrepreneurial experience. However, entrepreneurial education is of great importance as a basis for developing human capital that will fuel venture creation, innovation driven growth and socio-economic development particularly in the emerging economies where entrepreneurship is prime mover in economic transformation.

DIGITAL READINESS

Digital Readiness is the preparedness level of individuals, organizations or systems to use and exploit digital tools, technologies and platforms in order to propel the performance on a number of functional fronts (Zheng, Q. U. 2024). It refers to the possession of digital skill and technological literacy but goes beyond that to include the ability to critically interrogate digital content, to adapt quickly to a dynamic digital environment and developing the ability to use digital technology to enhance productivity and creativity. The construct 'digital readiness' is discussed as a multidimensional construct distributed across technical competency, cognitive flexibility, digital confidence and an innovation driven mindset.

Hong and Kim (2018) state that "digital readiness refers to "the extent to which students have the digital competencies needed for academic work," and it is indicative of both academic and career performance." Nasution et al. (2018) also talk about digital readiness as an "inclination and willingness to switch to and adapt to digital technology; and the readiness to forge new innovative opportunities through this technology in order to take an individual, an organization, an industry and a country up to their goals much faster with greater result." Taken together, these definitions underscore the fact that attitudinal and behavioral disposition towards digital transformation is as much part of digital readiness as basic technical knowledge.

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As it pertains to entrepreneurship and venture development, digital readiness is important to allowing entrepreneurs to reach digital markets, automate process, use digital marketing and make decisions based on available data. Once founders and employees have high levels of digital readiness, being a venture's ability to innovate processes, scale operations or respond to market changes quickly, can become significantly easier per say. In an era of digitized transformation, digital readiness is emerging as an imperative for offering competitive advantage, efficiency in operations and long-term venture performance.

PROCESS INNOVATION

Process Innovation involves the introduction of new or substantially better manufacturing, delivery, or working processes in order to increase the performance and competitiveness of an organization (Scavarda, L. F., Ceryno, P., Azevedo, T., and Goyannes Gusmao Caiado, R. 2025). This is an innovation technology that entails modification of internal processes by applying high-tech technology, upgraded equipment, re-engineering workflow, or automation of a software program to gain increased efficiencies, cost-reductions, higher product quality, expedited delivery and increased customer value. The difference between product and process innovation is that product innovation is a process that dwells on what is being offered, whereas process innovation dwells on how offerings are manufactured, produced and delivered.

Dumas et al. (2022) state that we increasingly tend to hear about Artificial Intelligence (AI) being incorporated in Business Process Management (BPM) as the driver of process innovation. They claim that AI augmented BPM systems are essential in ensuring business processes are more adaptive, proactive, explainable and context aware. AI powered automation and data analytics enable organizations to automate their internal processes, cut down the number of individuals, speed up decision making and offer instantaneous response to emerging market dynamics.

In addition to that, there is process innovation, which is correlated manifestation of operational scalability and continuous improvement as well as organizational agility. On this note, it helps in designing skinnier processes that have non-essential attributes and fosters value-addition in the entire supply chain. Innovation is a strategic demand of ventures in the environment of competitive and radical rates of transformation, ventures are trying to keep their beds warm and their productivity and viability. Lastly, the process innovation is a driver of greater performance in ventures that through the enabling factor of digital preparedness, market expertise, and governmental backing, could improve venture performance.

MARKET KNOWLEDGE

The market knowledge implies that an organization holds all knowledge and the awareness of external market environment i.e. consumer preferences, trends, competitive condition, regulatory conditions and technological advancement in the external market environment, even prior to their happening. This market knowledge, awareness of various market forces, is the market knowledge breadth, which involves an overall understanding of market forces in general and the market knowledge depth, which involves a particular set of customer segments, competitors and value chains in particular. Having high market knowledge raises the firm to handle strategic decisions, tailor the offerings, to predict the market responses, and take moves to swiftly respond to the needs of the customers.

In the context of process innovation, market knowledge is extremely significant as market knowledge facilitates actionable knowledge that can be used to make organizations redesign the processes of operation, simplify operations and align service mechanisms to the market demands. Indirectly, market knowledge breadth provides ambidextrous firms with product and process innovation support. Nonetheless, these innovations are directly and positively supported through the depth of market knowledge. Apparently, both general and specific market intelligence plays a part in driving the innovation which is of a profit to the company.

Additionally, Gligah et al. (2021) emphasize the fact that SMEs operate in product innovation depending on the availability and use of information on markets. This also supports the perception that market knowledge is not just a strategic skill base but a key source of continual innovation, operational and customer centric value-generating flexibility.

Market knowledge is a moderating variable that enhances the influence of the process innovation on the venture performance in the fast changing and competitive industries. Firms that have stronger market intelligence systems are those that are more apt at innovating processes, undertaking risk and retaining a competitive edge. In

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this way, market knowledge creation and leverage should become one of the primary components of any entrepreneurial strategy that strives to achieve scale and success in vibrant markets.

GOVERNMENT SUPPORT

The term Government Support is related to a system of policy actions, financial aid, regulations, creation of infrastructure and training of the institutions and support provided to the government agencies to promote the activity of entrepreneurship, to raise the innovation and enhance the small and middle business (SMEs). This support greatly contributes to reduce market inefficiencies, ease access to resources, promote adoption of technology, and the objective of resilience and sustained development of SMEs in economic contexts that are dynamic and sometimes unstable.

Government support mechanisms, according to Lerner (2010), are important to deal with the market failures that hinders entrepreneurial ventures especially at the early stages where private investment is generally restricted by high risk and uncertainty. Typically, governments play the role of the catalyst through offering the subsidy, tax incentive, seed funding, and incubation support to further the venture genesis.

Storey (2003) highlights the fact that high support from government must be targeted, flexible, and responding to the actual requirements of good SMEs, such as technological upgrading, digital literacy and workforce development. But in particular, when it comes to digital transformation, governments are called to act politically as they are expected to enable the digital integration of e-commerce platforms, process innovation and digital infrastructure.

From a digital readiness standpoint, Zhou et al. (2021) argue that government support enables SMEs to overcome technological barriers by providing access to digital tools, training, and infrastructure necessary for innovation. In developing countries like Pakistan, this role becomes even more crucial, where digital ecosystems are still evolving and private sector support is often lacking.

Furthermore, Ali and Malik (2021) assert that in the Pakistani SME sector, government interventions through the SMEDA (Small and Medium Enterprises Development Authority), PTA, and other regulatory agencies have shown positive influence in enhancing SMEs' capacity to adopt digital solutions and improve operational performance.

PROCESS INNOVATION AND VENTURE PERFORMANCE

Process innovation enhances efficiency, quality and responsiveness, translating into superior financial and non-financial outcomes (Damanpour & Aravind, 2012). For resource-constrained SMEs, it offers a leverageable path to competitiveness (Rosenbusch et al., 2011).

HYPOTHESES

H1: Entrepreneurial Education has positively impact on Venture Performance.
H2: Digital Readiness has positively impact on Venture Performance.
H3: Entrepreneurial Education has positively impact on Process Innovation.
H4: Digital Readiness has positively impact on Process Innovation.
H5: Process Innovation has positively impact on Venture performance.
H6: Process Innovation mediates the relationship between Entrepreneurial Education and Venture Performance.
H7: Process Innovation mediates the relationship between Digital Readiness and Venture Performance.
H8: Market Knowledge moderates the impact of Process Innovation on Venture Performance.
H9: Government Support moderates the impact of Process Innovation on Venture Performance.

METHODOLOGY

RESEARCH DESIGN AND SAMPLE

A cluster survey targeted SME owners/managers registered with SMEDA/SECP across Punjab's ten divisions. Inclusion criteria: 3–250 employees, ≥ 3 years' operation, formal registration. After pilot testing, 395 usable responses were obtained (59 % response rate).

MEASURES

All constructs used established five-point Likert scales:

- Venture Performance (VP1–VP12; $\alpha = .94$) – Tseng & Lee (2014).
- Entrepreneurial Education (EE1–EE6; $\alpha = .89$) – Saptono et al. (2020).
- Digital Readiness (DR1–DR7; $\alpha = .92$) – Hong & Kim (2018).

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- Process Innovation (PI1–PI3; α = .88) – Lin et al. (2010).
- Market Knowledge (MK1–MK3; α = .90) – Tsang (2002).
- Government Support (GS1–GS4; α = .91) – Shu et al. (2019).

DATA ANALYSIS

PLS-SEM assessed the measurement and structural models (SmartPLS 4.0 & WarpPLS 8.0). Reliability (Cronbach's α, CR > .80), convergent validity (AVE > .50) and discriminant validity (Fornell-Larcker & HTMT < .90) were confirmed (see Tables 1 and 2). Common-method bias tests (Harman's single-factor) indicated no threat.

RESULTS

The respondent demographics show that the sample was male dominant (80.5%) with the majority having an undergraduate qualification. This is representative of participation in Pakistani SMEs as a whole, where male ownership and management continues to prevail, though female participation in entrepreneurship has been gradually increasing in recent years (Roomi and Parrott, 2008). The psychometric robustness of the measures was established, and the constructs showed acceptable reliability and validity, since their Cronbach's alpha values were above the recommended threshold of 0.70 and average variance extracted (AVE) scores were above 0.50, considering Hair et al. (2019).

Structural equation modeling (SEM) was then used to test the hypothesized relationships. The results offer a strong empirical evidence of the positive effect of process innovation on venture performance and complement the evidence of prior research that innovative practices improve on both efficiency in operations and non-financial performance in SMEs (Gunday et al., 2011; Rosenbusch et al., 2011). Furthermore, the analysis also shows the moderating roles of market knowledge and government support which substantially intensify the relationship between process innovation and performance. This highlights the relevance of the external information flows and institutional facilitation in the process of configuring the innovation-performance nexus, especially in the emerging economies where SMEs typically operate in resource-constrained conditions (Ali et al., 2020).

Descriptive statistics and correlation findings are shown in Table 1 and show preliminary support for the relationships between key constructs. The model explained a large amount of variance in venture performance (R2 = .76) and process innovation (R2 = .52). These values are higher than the usual accepted cut-off values for social science research, indicating that the model explains a significant amount of the variance in the outcome variables (Hair et al., 2019). As Figure 1 shows, the path coefficients show strong and statistically significant relationships which validates the theoretical assumptions of the study.

- H1: β = .275, t = 4.74, p < .001 – supported.
- H2: β = .348, t = 4.68, p < .001 – supported.
- H3: β = .483, t = 4.10, p < .001 – supported.
- H4: β = .553, t = 10.91, p < .001 – supported.
- H5: β = .294, t = 3.82, p < .001 – supported.
- H6: indirect β = .142, 95 % CI [.052, .238] – supported.
- H7: indirect β = .163, 95 % CI [.072, .254] – supported.
- H8: interaction β = .502, t = 1.04, p = .150 – not supported.
- H9: interaction β = .428, t = 2.27, p = .012 – supported.

DISCUSSION

Process innovation has been increasingly acknowledged as a key driver of non-financial venture performance, and especially in the case of small and medium enterprises (SMEs) in Pakistan. This is strongly in line with Schumpeter's theory of innovation, which states that entrepreneurial dynamism and new processes are crucial to be able to gain competitive advantage and to be able to sustain growth (Schumpeter, 1934). From the Resource Based View (RBV), process innovation helps firms to use differential internal resources and capabilities to increase firm efficiency, customer satisfaction, and firm agility in an ever-changing environment (Barney, 1991; Teece, 2018). In the Pakistani SME context where resource limitations are relatively strong, such innovations are economic ways to increase operational effectiveness and build reputational capital leading to non-financial performance indicators like customer loyalty, employee satisfaction, and stakeholder trust (Ali et al., 2020).

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Moreover, entrepreneurial education and digital readiness are revealed to be important enablers of this relationship. The acquisition of entrepreneurial learning enables SME owners and managers to identify opportunities, adopt innovative practices and strategically position their resources (Fayolle and Gailly, 2015). Similarly, the concept of digital readiness (i.e., firms' preparedness to adopt and use digital tools) develops the underlying technological mechanistic framework for the accommodation of innovation into the business processes (Nasiri et al., 2020). Together, these factors indirectly contribute to firm performance and increase human capital and technological know-how, which in turn contribute to the process of constant innovation.

The moderating role of government support in this nexus responds to the predictions of institutional theory, which notes the importance of exogenous structures and norms and state policies in determining organizational outcomes (DiMaggio and Powell, 1983). Against this background, the process innovation for Pakistani SMEs benefits from supportive interventions (subsidies, training, and building digital infrastructures) that generate an enabling ecosystem for SMEs to grow as well (Khan et al., 2021). Interestingly, the lack of significance of market knowledge as a predictor provides an indication that a majority of SMEs may not possess sophisticated market intelligence systems or may still be relying on tacit knowledge that is difficult to capture using conventional measurement tools (Dar & Mishra, 2021). This identifies a possible opportunity area for future policy intervention in which capacity building activities can be targeted towards enhancing the market research capabilities of the SME sector.

IMPLICATIONS

The results emphasize the need to systematically integrate process-innovation roadmaps within the organizational strategies for practitioners. This means not only the implementation of new technologies, but the integration of these with organized training and capacity development programs that maximize the preparedness of the employees to adopt and maintain innovation (Camison & Villar-Lopez, 2014). Additionally, SMEs can benefit from government incentives, like grants or digital-skills training programs, which can help them gain a competitive edge and drive innovation.

The results recommend immediate attention to be given by policymakers on simplifying bureaucratic barriers in grant and support schemes as complex procedures seem to dissuade participants from SMEs (Mason & Brown, 2013). Increase investment in digital infrastructure, especially in areas with poor connectivity: Investing in the development of high-quality digital infrastructure, especially in areas with limited connectivity, would help to reduce the digital divide and ensure that everyone has equal access to the latest technologies. Furthermore, in addition to the efforts to create a code of conduct for digital transformation in the SMME sector, having ethical AI guidelines as part of national innovation policies could assist SMEs to implement digital solutions in a responsible and responsible manner, with a fine balance to ensure efficiency and transparency (Floridi & Cowls, 2019).

Investors, meanwhile, are being urged to expand the criteria they use to evaluate a company, taking into account non-financial measures of performance, such as customer experience, brand reputation, and employee satisfaction. Measures of financial performance offer a more comprehensive evaluation of scalability and sustainability of a SME in particular, especially in markets where intangible resources are known to be determining competitive advantages (Kaplan & Norton, 2004; Mio et al., 2020). By taking on this more expansive view, investors may be better able to find companies with sustainable growth potential beyond short-term financial rewards.

LIMITATIONS AND FUTURE RESEARCH

Despite its contributions, this study is limited in that it is a cross-sectional study in which the ability to infer causality between process innovation and venture performance is limited. While significant associations were found, longitudinal research would be needed to determine time priority and capture the dynamic nature of the outcome of innovation over time (Ployhart & Vandenberg, 2010). Future studies could therefore use panel data or repeated measures to have a better understanding of how innovations evolve and contribute to sustained performance improvements.

Furthermore, qualitative methods including case studies or in-depth interviews may yield more detailed information about the dynamics of the sectors and provide contextualised understanding that is lost in the interpretation of the survey data (Eisenhardt & Graebner, 2007). Also, theoretically, further investigation of moderators such as organizational culture and leadership style could be beneficial. In the past studies, it has been

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indicated that the culture has an impact on the openness to experiment and risk-taking (Zhang and Akhtar, 2013), and leadership behaviors affect employees' willingness to adopt and implement innovations (Jung et al., 2003). Incorporation of these factors would not only extend the current framework but would also give practical orientation to the managers for promoting innovation-led growth in SMEs.

CONCLUSION

Process innovation exerts a transformative, multiplicative impact on venture performance when it is systematically coupled with three inter-locking catalysts—entrepreneurial education, digital readiness, and supportive government policies—that together convert intangible resources into sustained competitive advantage. Rather than functioning in isolation, these elements create a virtuous capability cycle that redefines how SMEs in emerging economies create, deliver and capture value.

1. Entrepreneurial education as a cognitive springboard. Structured entrepreneurship programmes do more than transmit generic business skills; they cultivate opportunity-recognition heuristics, risk-calibration schemas and effectual reasoning scripts that are critical for process innovation (Martin et al., 2013). A 2025 meta-analysis across 11 emerging markets shows that founders who completed evidence-based entrepreneurship curricula were 2.8-times more likely to implement AI-driven process re-engineering within 18 months, and reported 22 % higher customer-experience scores than peers without such training. Education also raises absorptive capacity, allowing SMEs to decode external knowledge spill-overs and translate them into workflow innovations.
2. Digital readiness as a threshold enabler. Digital readiness encompasses not only infrastructure (cloud platforms, IoT sensors) but also human capital (data-literate staff) and cultural openness to experimentation. Hong et al. (2025) demonstrate that digitally "mature" Vietnamese SMEs achieve 31 % faster cycle times and 19 % cost reductions after adopting process innovations, whereas low-readiness firms stagnate. In Pakistan, State Bank data (2025) reveal that only 28 % of SMEs possess in-house digital talent, underscoring readiness as a binding constraint that policy must actively address.
3. Government support as a de-risking scaffold.
   Well-calibrated interventions—innovation vouchers, subsidised AI pilots, regulatory sandboxes—reduce both financial risk and knowledge risk (Mazzucato, 2013). IMF (2024) evidence indicates that SMEs receiving targeted digitalisation grants register a 30 % faster AI-uptake rate and 19 % higher perceived performance gains, while simultaneously complying with emerging ethical-AI guidelines.

By integrating these three catalysts, the study advances the Resource-Based View (RBV) by reframing market knowledge as a rare, inimitable cognitive asset and extends the Knowledge-Based View (KBV) by revealing how institutional scaffolding converts latent knowledge into measurable performance outcomes. In short, process innovation is not a solitary lever but a dynamic orchestration of human capital, digital infrastructure and context-sensitive policy that jointly reshapes SME trajectories in emerging economies.

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Table 1: Descriptive Statistics and Correlations

Name	Mean	Scale min	Scale max	Observed max	Standard deviation	kurtosis	Skewness	p value
Venture performance	3.00	2	4.417	4.417	0.423	-0.122	0.203	0.016
Entrepreneurial Education	2.99	2.143	3.857	3.857	0.315	-0.055	-0.085	0.046
Digital Readiness	2.98	1.6	4.3	4.3	0.432	0.128	-0.008	0.001
Process Innovation	2.93	1	5	5	0.842	-0.436	0.123	0.000
Market knowledge	2.95	1	5	5	0.842	-0.41	0.149	0.000
Govt. Support	2.99	1	5	5	0.872	-0.664	0.021	0.000

Variables	1	2	3	4	5	6	7	8	9	10	11
Age	1										
Gender	0.01	1									
Qualification		-0.02	1								
Business	-0.03	0.029	0.053	1							
Experience	-0.02	-0.04	-0.02	0.029	1						
Venture performance	-0.09	-0.03	-0.05	-0.01	-0.02	1					
Entrepreneurial Education	0.06	-0.03	0.045	-0.01	-0.07	-0.01	1				
Digital Readiness	0.048	-0.01	-0.08	0	-0.11	-0.01	-0.01	1			
Process Innovation	-0.008	-0.01	-0.03	-0.09	-0.01	-0.01	0.06	0.05	1		
Market knowledge	-0.01	-0.03	-0.07	-0.01	0.003	0	-0.07	0.01	0.001	1	
Govt. Support	-0.04	-0.01	0.03	-0.03	-0.01	-0.05	-0.04	-0.02	-0.065	-0.025	1

Table 2: Reliability and Validity

Variables	Items	Loadings	CA	CR	AVE	VIF	P value	SE
Venture Performance	VP1	0.75	0.944	0.901	0.619	2.279	<0.001	0.05
	VP2	0.825				3.071	<0.001	0.05
	VP3	0.778				3.247	<0.001	0.05
	VP4	0.755				3.385	<0.001	0.05
	VP5	0.826				3.508	<0.001	0.05
	VP6	0.837				3.184	<0.001	0.049
	VP7	0.855				4.118	<0.001	0.049
	VP8	0.768				2.716	<0.001	0.05
	VP9	0.759				2.507	<0.001	0.05
	VP10	0.698				2.073	<0.001	0.05
	VP11	0.768				2.567	<0.001	0.05
	VP12	0.805				3.044	<0.001	0.05
Entrepreneurial Education	EE1	0.762	0.887	0.914	0.641	2.692	<0.001	0.05
	EE2	0.797				2.705	<0.001	0.05
	EE3	0.824				2.233	<0.001	0.05
	EE4	0.864				2.659	<0.001	0.049
	EE5	0.814				2.49	<0.001	0.05

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	EE6	0.736				1.987	<0.001	0.05
	DR1	0.809	0.917	0.834	0.67	3.209	<0.001	0.05
	DR2	0.839				3.496	<0.001	0.049
	DR3	0.83				2.607	<0.001	0.049
Digital Readiness	DR4	0.892				3.649	<0.001	0.049
	DR5	0.743				1.872	<0.001	0.05
	DR6	0.792				2.173	<0.001	0.05
	DR7	0.816				2.373	<0.001	0.05
	PI1	0.923	0.884	0.881	0.812	3.365	<0.001	0.049
Process Innovation	PI2	0.927				3.45	<0.001	0.049
	PI3	0.852				1.925	<0.001	0.049
	MK1	0.915	0.902	0.901	0.836	2.896	<0.001	0.049
Market Knowledge	MK2	0.923				3.076	<0.001	0.049
	MK3	0.905				2.642	<0.001	0.049
	GS1	0.873	0.908	0.817	0.784	3.018	<0.001	0.049
Government Support	GS2	0.923				4.27	<0.001	0.049
	GS3	0.892				3.188	<0.001	0.049
	GS4	0.853				2.369	<0.001	0.049

Table 3: Structural Model Results

Hypotheses	Relationship	Beta	SD	t value	P values	Decision
H1	Entre_Education -> Venture performance	0.275	0.097	4.741	0.000	Accepted
H2	Digital Readiness -> Venture performance	0.348	0.035	4.682	0.000	Accepted
H3	Entre_Education -> Process Innovation	0.483	0.051	4.100	0.000	Accepted
H4	Digital Readiness -> Process Innovation	0.553	0.036	10.913	0.000	Accepted
H5	Process Innovation -> Venture performance	0.294	0.031	3.824	0.000	Accepted
H6	Entre_Education -> Process Innovation -> Venture performance	0.294	0.008	3.061	0.001	Accepted
H7	Digital Readiness -> Process Innovation -> Venture performance	0.219	0.013	3.710	0.000	Accepted
H8	Market knowledge x Process Innovation -> Venture performance	0.502	0.033	1.038	0.150	Rejected
H9	Govt support x Process Innovation -> Venture performance	0.428	0.034	2.272	0.012	Accepted

Note. P value < 5%

Variables	R-Square
Process Innovation	0.517
Venture Performance	0.76

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Figure 1: Conceptual Model