

UNPACKING THE DRIVERS OF INNOVATION PERFORMANCE: THE INTERPLAY BETWEEN MANAGERIAL, RELATIONAL, TECHNOLOGICAL, AND LEARNING CAPABILITIES WITH INNOVATION STRATEGY

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Abstract

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In this paper, the effect of managerial, relational, technological, and learning capabilities on innovation performance is analyzed with a focus on the mediating function of innovation strategy. Leveraging the resource-based view (RBV), dynamic capabilities theory, and absorptive capacity theory, the research deepens our understanding of how companies can use internal and external strengths to advance innovation results (Chen & Kim, 2023; Gama & Magistretti, 2025). According to a quantitative design, the research draws on survey data from 208 Growth Enterprise Market (GEM)-listed high-tech small and medium-sized enterprises (SMEs) in China, analyzed with partial least squares structural equation modeling (PLS-SEM) in SmartPLS 4.0. The results indicate that the four organizational capabilities all have positive effects on innovation performance, while innovation strategy plays a vital mediating role, converting these capabilities to innovation outcomes. These findings emphasize the necessity for integrating managerial, technological, relational, and learning dimensions with a formal innovation strategy to achieve sustainable innovation success. The study provides practical implications for business executives and policymakers by emphasizing the necessity of capability development, strategic intent, and well-defined innovation management in changing market conditions.

Keywords: Innovation Performance, Managerial Capabilities, Relational Capabilities, Technological Capabilities, Innovation Strategy

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1. INTRODUCTION

Innovation performance has become a major driver of organizational competitiveness and long-term existence in the dynamic business world. In today's knowledge economy, companies need to build and enhance their capabilities on an ongoing basis if they are to maintain competitive advantage through innovation (Audretsch & Belitski, 2023). Innovation performance is the degree to which an organization has the capacity to develop and apply new ideas, processes, and products that cause business growth and market differentiation (Chen & Kim, 2023). Prior research has highlighted the impacts of managerial capabilities to cause strategic choice, resource deployment, and organizational learning, which are also determinants of innovation (Gao et al., 2023). In the same way, relational capabilities, through alliances with stakeholders like suppliers, customers, and research organizations, enhance knowledge exchange and speed up new idea commercialization (Long & Liao, 2023). Technological capabilities allow companies to leverage high-tech technologies, maximize research and development (R&D) spending, and drive product innovation, whereas learning capabilities create organizational flexibility and responsiveness to changing market circumstances (Bizami et al., 2023). However, to what extent such capabilities shape innovation performance hinges on the innovation strategy of an organization, a guiding system for capability exploitation (Jiang et al., 2023).

There exists a wealth of research that has been used to explore the impact of managerial competencies on innovation performance. Based on research, managerial competencies play an important role in developing an organizational culture that encourages innovation due to the fact that leaders set strategic direction, knowledge absorption, and coordination of resources for innovation (Kastelli et al., 2022). Good managerial decision-making stimulates experimentation and risk-taking, thereby contributing to increased innovation output (Baía & Ferreira, 2024). In addition, excellent managers with high leadership capability foster cross-functional collaboration, a setting where there is innovative problem-solving and sharing of knowledge (Audretsch & Belitski, 2023). Relational competencies have also been found to be important drivers of innovation performance. Companies developing excellent external networks with suppliers, customers, and research institutions are able to gain useful market information, technical expertise, and collaborative innovation possibilities (Khan et al., 2023). Empirical research indicates that high relational capability firms experience greater innovation success because they have greater absorptive capacity and knowledge co-creation (Li et al., 2023). Technological capabilities have been studied intensively in terms of innovation performance. Evidence shows that firms with advanced technological infrastructures experience higher agility in responding to market shocks and technological innovations (Chen et al., 2023). Empirical research supports that organizations that incorporate technology strategically into their innovation activities gain a competitive advantage through enhanced efficiency, cost minimization, and product differentiation (Robertson et al., 2023). Learning capabilities have been widely associated with innovation success. Organizational learning, exploratory and exploitative, helps firms adapt to changing market conditions (Harvey & Kudesia,

2023). Companies focusing on continuous learning create better innovation strategies through feedback, process improvement, and knowledge-sharing cultures (Audretsch & Belitski, 2023). Studies indicated that companies with good learning capabilities performed better than their peers in terms of long-term innovation performance because they are capable of absorbing and utilizing new knowledge efficiently (Chen & Kim, 2023).

Notwithstanding large volumes of research on innovation capabilities, some areas are still not covered. First, although earlier research has discussed isolated impacts of managerial, relational, technological, and learning capabilities on innovation performance, scant research has considered how these capabilities interact with one another under a combined innovation model (Gama & Magistretti, 2025). How these capabilities interact with one another is still under-researched, especially across different industry environments and in firms of varying sizes. Second, whereas innovation strategy is highlighted to be important in studies, few of them have explored its mediating influence between capabilities and innovation performance. Most literature has considered direct relationships and failed to account for the way in which innovation strategy acts as a direction-giving mechanism in the deployment of capabilities (Gao et al., 2023). Learning about how innovation strategy affects the role of different capabilities in achieving innovation success is vital (Chen et al., 2023). Third, little empirical research is available to understand how companies simultaneously balance and integrate multiple capabilities. Most research employs a disjointed method, highlighting discrete capabilities over their combinations. Most research is also from advanced economies, and few studies reveal how these configurations are played out in emerging economies (Khan et al., 2023).

This study aims to address these gaps by examining the relationships between managerial, relational, technological, and learning capabilities, innovation strategy, and innovation performance. The specific research objectives are as follows:

- 1) to examine the impact of managerial capabilities on innovation performance;
- 2) to analyze the influence of relational capabilities on innovation performance;
- 3) to investigate the role of technological capabilities in enhancing innovation performance;
- 4) to assess the effect of learning capabilities on innovation performance;
- 5) to evaluate the mediating role of innovation strategy in the relationship between managerial, relational, technological, and learning capabilities and innovation performance.

This research enriches the literature with a holistic comprehension of the various organizational capabilities that affect innovation performance with the mediating effect of innovation strategy. Through the integration of the resource-based view (RBV) and dynamic capabilities theory, the research provides theoretical contributions in accounting for the capability-performance relationship (Pu et al., 2023). Additionally, the results will provide managerial implications for business leaders who want to maximize their innovation strategy through the utilization of managerial, relational, technological, and learning capabilities. Lastly, by filling the research gaps, this study offers insights that are valuable to policymakers and industry practitioners who want to develop innovation-led growth.

The organization of this paper is as follows. Section 2 discusses the literature, providing a thorough synthesis of previous empirical research on managerial, relational, technological, and learning capabilities, and their interrelations with innovation performance. It also points out the theoretical framework for the study and gaps in the literature. Section 3 discusses the empirical research methodology employed in the case of high-tech small and medium-sized enterprises (SMEs) listed on China's Growth Enterprise Market (GEM), detailing the research design, target population, sampling strategy, data collection procedures, and usage of SmartPLS for structural equation modeling. Section 4 discusses the results in terms of the assessment of the measurement model and the structural model, highlighting the direct and mediating relationships between the variables. Section 5 presents the findings and interprets them against existing literature, theoretical models, and real-world realities. It examines how the findings add to or reinforce knowledge in innovation management and capability theory. Section 6 summarizes the paper, concluding on key findings, theoretical as well as practical contributions, and study limitations. It also suggests directions for future research, inviting further investigation into innovation dynamics and strategic capability deployment across different organizational and geographical settings.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. Managerial capabilities and innovative performance

Managerial competencies play a crucial role in an organization's ability to innovate since they encompass strategic planning, leadership, and management of resources (Baia & Ferreira, 2024). Empirical research proves that firms with effective managerial competencies possess improved innovation performance due to their ability to develop a vision-driven culture with risk tolerance and experimentation (Harvey & Kudesia, 2023). Effective managers facilitate organizational goals to be integrated with innovative goals so that resources can be utilized optimally for R&D activities (Daradkeh et al., 2023). Managerial skills also affect the capacity to react adaptively to developing market conditions in a way that organizations can prepare for and react to technological innovation, customer demands, and competitive forces (Heubeck, 2023). Research has repeatedly found that adaptive and visionary managerial leadership in organizations gains better innovation outcomes with higher strategic responsiveness and the effective implementation of innovative projects (Khan et al., 2023).

As per these results, empirical research indicates that managerial ability has a direct impact on innovation performance by building a culture of knowledge exploration, risk-taking, and strategic resource mobilization (Shafiee et al., 2024). Well-managed organizations are most likely to establish formalized procedures for innovation so that new ideas are tested, developed, and implemented in a methodical manner (Kunz & Sonnenholzner, 2023). Besides, managerial capabilities facilitate cross-functional coordination within firms to enable the integration of multiple knowledge bases, driving innovative problem-solving and

product innovation (Vuorio & Torkkeli, 2023). Successful management of uncertainty and complexity also empowers firms to pursue breakthrough innovations while maintaining operational effectiveness (Heubeck, 2023). Given that managerial capabilities are crucial in fostering a strategic mindset for innovation, it is anticipated that:

H1: Managerial capabilities have a significant impact on innovation performance.

2.2. Relational capabilities and innovative performance

Relational capabilities, which reflect the ability of an organization to build and maintain interactive relationships with both internal and external stakeholders, have been recognized as major drivers of innovation (Long & Liao, 2023). Early research indicates that companies with strong relational capabilities gain benefits such as greater knowledge exchange, greater access to complementary assets, and greater absorptive capacity (Madhavaram et al., 2023). Intimate relationships between buyers, suppliers, R&D groups, and industry alliances spur open innovation processes and hence enable new product and process innovations (Shafiee et al., 2024). Relational competence also allows companies to draw upon external intelligence and market insights in order to ensure alignment of innovation activity with evolving industry trends and customer needs (Pan et al., 2023). Empirical research has consistently discovered that companies that were involved in extensive partnerships and networks performed better compared to their counterparts in innovation performance and responsiveness in the market (Chen & Kim, 2023).

Empirical research also confirms the assumption that relational capabilities enable the co-creation of knowledge and technological innovation, which results in enhanced innovation performance (Jiang et al., 2023). Highly connected organizations are capable of better sensing new opportunities, managing innovation risk, and accelerating the commercialization of new technologies (Shaik et al., 2023). In addition, engagement with different stakeholders fosters cross-industry learning where firms can integrate fresh ideas from other industries into their innovation process (Tang et al., 2023). Strong relational capabilities also allow for trust and long-term relationships, which are critical to the sustainability of ongoing innovation activities (Singh et al., 2023). Due to the major contribution of relational capabilities toward innovation outcomes, it is projected that:

H2: Relational capabilities have a significant impact on innovation performance.

2.3. Technological capabilities and innovative performance

Technological competencies, as a company's capability to acquire, develop, and effectively utilize technology, have been widely adopted as the core drivers of innovation (Bizami et al., 2023). Previous empirical research indicates that companies with higher technological competencies are likely to create innovative products, enhance operational effectiveness, and sustain a competitive edge (Chen et al., 2023). The capacity to incorporate emerging technologies, including artificial intelligence, automation, and digital platforms, has been

associated with speeding up cycles of innovation and increased product differentiation (Gama & Magistretti, 2025). In addition, technological competence allows companies to innovate new business models, optimize supply chain operations, and enhance customer experiences through data-driven decision-making (Pattanayak et al., 2024). Firms that invest in strong technology infrastructures are well-placed to maintain ongoing innovation and respond to disruptive changes in their industries (Pan et al., 2023).

Empirical studies are also in agreement with the mutual dependence of technological capabilities and innovation performance, validating the contributions of research-based technology as well as digitalization in capitalizing on innovation (Borger et al., 2023). High-technological capability companies respond more to changes in the marketplace because they can utilize sophisticated software to test as well as create new options, as well as improve existing products (Gama & Magistretti, 2025). Besides, possessing technical competence between departments promotes synergistic cooperation and data sharing to implement improved innovation plans (Tang et al., 2023). Leveraging technology innovations towards competitive advantage places companies at the leading edge in innovation-based sectors (Rahman et al., 2023). As grounds for these hypotheses, it is argued that:

H3: Technological capabilities have a significant impact on innovation performance.

2.4. Learning capabilities and innovative performance

Learning capabilities, or the capability of an organization to absorb, process, and implement new knowledge, have been firmly associated with improved innovation results (Gama & Magistretti, 2025). Empirical studies show that organizations with high learning capabilities tend to adopt ongoing improvement, learn from outside the organization, and try new ways (Gao et al., 2023). Both explorative and exploitative learning have also been found to influence innovation performance significantly by promoting adaptation and recombination of knowledge (Audretsch & Belitski, 2023). In addition, organizations with a focus on learning also foster an environment of innovation where workers feel free to try out new things, learn from one another, and question traditional methods (Kastelli et al., 2022). Previous studies underscore that companies with strong learning systems are more likely to be successful in the long term in maintaining competitive innovation approaches (Bizami et al., 2023).

Empirical studies also indicate that learning capabilities improve the capacity of an organization to manage dynamic market conditions, react to new technologies, and create innovative value proposals (Harvey & Kudesia, 2023). Organizations with a culture of learning are better equipped to transform knowledge into action innovation strategies, driving ongoing product and process improvement (Daradkeh et al., 2023). Besides, learning capabilities enable organizational resilience, by which firms better cope with uncertainty and disruptions (Shaik et al., 2023). Since learning takes a forefront role in innovation, it follows that:

H4: Learning capabilities have a significant impact on innovation performance.

2.5. Innovation strategy as mediator

Innovation strategy is also a critical driver of managerial capabilities and innovation performance because it provides direction and a framework that directs the practice of innovation programs (Li et al., 2023). Empirical evidence suggests that firms with strong managerial capabilities will be able to develop well-thought-out innovation strategies aligned with long-term vision and market positioning (Teece, 2023). Effective managerial decision-making facilitates the creation of innovation-centered strategies by ensuring that investments in resources, skills, and technology are strategically placed (Vuorio & Torkkeli, 2023).

Empirical results also indicate that the mediating role of innovation strategy strengthens managerial competences' impact on innovation performance by causing leadership decisions to be realized in terms of formalized innovation processes (Shaik et al., 2023). Organizations that integrate managerial knowledge into their innovation strategies realize higher coordination, better risk management, and greater implementation of innovative projects (Shafiee et al., 2024). Furthermore, innovation strategies offer a framework through which firms can leverage managerial capabilities to facilitate collaboration, knowledge sharing, and disruptive innovation, further deepening their innovation outcomes (Khan et al., 2023). Since innovation strategy serves as an intermediary between managerial ability and company-level innovation achievement, it is predicted that:

H5: Innovation strategy mediates the relationship between managerial capabilities and innovation performance.

Relational capacities augment innovation performance by enabling collaboration and knowledge sharing, yet their contribution depends heavily on the existence of a clearly defined innovation strategy (Zardini et al., 2023). Empirical evidence shows that companies with robust relational networks are more likely to formulate more strategic innovation strategies, using external allies to lead innovative solutions and competitive advantage (Singh et al., 2023). Customer, supplier, and research institution collaborative relationships play a role in co-creating innovative ideas, but without a strategic framework, the efforts may not be directionally or efficiently (Pu et al., 2023). Existing literature attests that companies with well-defined innovation strategies are more likely to leverage relational capabilities for optimal innovation performance (Pan et al., 2023).

Empirical evidence also lends credence that innovation strategy acts as a mediator in the relational capability-innovation performance relationship through which external relationships are strategically mapped onto firm goals. Innovation strategy influences firms' innovation development of adaptive and market-focused innovations that better their performance overall (Madhavaram et al., 2023). In addition, innovation strategies enable companies to convert relational capital into material innovation results through organizing partnerships, intellectual property management, and sustainable innovation ecosystems (Shafiee et al., 2024). As an innovation strategy is a channel for which relational competencies drive success in innovation, it is speculated that:

H6: Innovation strategy mediates the relationship between relational capabilities and innovation performance.

Technological capabilities empower companies with innovation tools, yet their ability to contribute to innovation performance depends upon the existence of an effective innovation strategy (Borger et al., 2023). Literature suggests that highly advanced technological capability organizations attain enhanced innovation results in case their tech investments are clearly aligned with the objectives of their innovation (Chaudhuri et al., 2023). A formal innovation strategy allows companies to efficiently incorporate new technologies into their innovation activities so that technological progress leads to competitive gains (Khan et al., 2023). Evidence has repeatedly established that companies with mature innovation strategies are more capable of leveraging technological capabilities for long-term innovation performance (Bizami et al., 2023).

Empirical evidence also indicates that innovation strategy mediates technological capabilities' influence on innovation performance by establishing a systematic mechanism for technological adoption and utilization (Kastelli et al., 2022). Strategically embedding technology in firms' innovation structures enjoys enhanced agility, accelerated commercialization, and more efficient product development (Jiang et al., 2023). Considering the central position of innovation strategy in guaranteeing the successful utilization of technological capabilities, it is presumed that:

H7: Innovation strategy mediates the relationship between technological capabilities and innovation performance.

Learning capabilities allow for the development and application of new knowledge, but their influence on innovation performance is highly dependent on how they are integrated into a firm's innovation strategy (Bizami et al., 2023). Empirical studies show that companies with strong learning capabilities develop more adaptive and responsive innovation strategies, allowing them to continuously enhance their innovation processes (Audretsch & Belitski, 2023). Learning-oriented firms are more inclined to try out various innovation approaches, utilizing feedback mechanisms and organizational learning to refine their strategic direction (Alsulami, 2025; Chen & Kim, 2023). In addition, studies have demonstrated that learning-oriented innovation strategy firms experience better innovation performance since they can readily assimilate and leverage new knowledge in formulating innovative solutions (Harvey & Kudesia, 2023).

Additional empirical proof attests to the mediating function of innovation strategy in learning capabilities and innovation performance by showing that companies with formal learning processes attain higher innovation success when these are strategically incorporated into the innovation system (Audretsch & Belitski, 2023). Companies that apply learning capabilities to

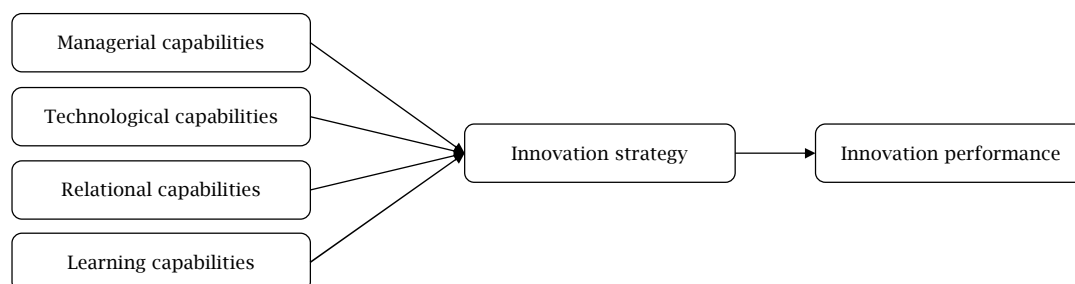
the innovation strategy gain enhanced problem-solving, knowledge spread, and ongoing enhancement, which increase innovation performance (Jiang et al., 2023). Because innovation strategy is the primary connection between learning capabilities and innovation success, the following hypothesis is made:

H8: Innovation strategy mediates the relationship between learning capabilities and innovation performance.

2.6. Theoretical foundation

The resource-based view and dynamic capabilities theory provide a strong theoretical foundation for explaining the interconnections between managerial, relational, technological, and learning capabilities, innovation strategy, and innovation performance. The RBV contends that firms achieve a sustainable competitive advantage by leveraging unique, valuable, and imitable resources, such as managerial capabilities, strategic relationships, technological assets, and learning processes, which all contribute to improving innovation performance. But in dynamic and uncertain environments, possessing these abilities is insufficient; firms must develop dynamic capabilities — the ability to integrate, build, and reconfigure internal and external competencies to respond to shifting market conditions (Abdelwahed & Alshaikhmubarak, 2023; Teece, 2023). Managerial capabilities serve as a critical catalyst for innovation strategy development through effective resource allocation, risk management, and organizational vision alignment (Baía & Ferreira, 2024). Relational competencies facilitate organizations to obtain external knowledge, collaborate, and promote the efficiency of open innovation processes, which directly affect innovation outcomes (Singh et al., 2023). Technological competencies provide organizations with the ability to conceptualize and enact innovative technologies, but their accomplishment is highly contingent on an innovation strategy that is aligned with matching technological developments and market opportunities (Chen et al., 2023). Equally, learning capacities increase the firm's capacity for absorbing and using new knowledge to create a continuous innovation culture, which works best when it is led by an organized innovation strategy (Bizami et al., 2023). Evidence supporting the mediating effect of innovation strategy on these relationships exists in highlighting its role as a strategic plan that guides how the capabilities are leveraged to gain superior innovation performance (Robertson et al., 2023). By combining RBV and dynamic capabilities theory, this research model emphasizes the significance of both resource bases and strategic flexibility in propelling innovation success. Figure 1 illustrates the conceptual framework of the study.

Figure 1. Conceptual framework



3. METHODOLOGY

3.1. Research design

This research follows a quantitative approach to empirically test the connections between managerial, relational, technological, and learning capabilities, innovation strategy, and innovation performance. A hypothetic-deductive research approach was followed, allowing hypothesis testing derived from prior theoretical frameworks and empirical findings. Since the study aimed at developing cause-and-effect relations as well as estimating the influence of independent variables over the dependent variable via an intermediate process, a survey-based cross-sectional research design was followed. The cross-sectional design was employed because it enables data collection at a single point in time, providing information regarding the state of innovation capabilities, strategy, and performance of companies at a specific point in time. This is widespread practice within organizational studies, particularly in studies dealing with phenomena surrounding innovation (Hair & Alamer, 2022).

3.2. Population

The target population for this study comprises high-tech SMEs that are listed on the GEM of China. The GEM is a stock market listing in China for high-growth, high-tech firms, and as such, it provides a relevant context within which to explore the contribution of capabilities and strategy to innovation performance. SMEs that are technologically advanced in nature in this economy operate businesses such as biotechnology, information and communication technology, renewable energy technologies, advanced manufacturing technologies, and artificial intelligence technologies, which rely extensively on new technology development, strategic choice, and lifelong learning to fuel innovations. These types of businesses are typical of a dynamic, competitive business environment in which innovation is a powerful determinant of survival and performance.

3.3. Sample and sampling technique

This research selected a sample of 208 Chinese high-tech SMEs listed on the GEM market. Purposive sampling was utilized since it enables researchers to choose firms that best represent the aims of the study, i.e., firms with innovation activities and strategic management. Using this method, the sampled firms have the characteristics desired to investigate the interactions between capabilities, strategy, and innovation performance. The companies' sample size was calculated using guidelines for conducting partial least squares structural equation modeling (PLS-SEM) analysis, which suggests that a model should be estimated with a minimum of 10 times the highest number of structural paths to a dependent variable in order to get valid estimates (Hair et al., 2021).

3.4. Data collection method

Data were gathered using a standardized online questionnaire that was sent to senior managers, innovation managers, and R&D managers of the chosen SMEs. The questionnaire was constructed employing validated scales of measurement from

past literature to achieve content validity and reliability. Questionnaire administration via email and professional business networks ensured that only qualified respondents were contacted. To improve response validity, a cover letter was provided detailing the research purpose, confidentiality, and asking for honest answers. Several reminder follow-ups were dispatched to ensure high response rates. The data collection exercise took three months, whereby companies in various technological fields were evenly distributed. Responses were cleaned to remove missing values, straight-lining, and outliers, and only complete responses were analyzed for final use.

3.5. Data analysis

The data gathered was assessed with the help of SmartPLS 4.0, one of the best-managed PLS-SEM software, since it can handle complicated models, small and medium-sized samples, and non-normal distribution of data (Hair & Alamer, 2022). PLS-SEM was especially appropriate for the study, given its predictive nature, stability with formative and reflective constructs, and adaptability in terms of modeling mediation effects, central features consistent with the study's goal to investigate intricate relationships between several organizational capabilities and innovation performance. Furthermore, PLS-SEM is strongly recommended in exploratory research and nascent theory development settings, such as when investigating the mediating role of innovation strategy in high-tech SMEs. The testing of the analysis was done in two phases: 1) test of the measurement model and 2) test of the structural model. The construct validity of the measurement model, reliability (Cronbach's alpha [CA], composite reliability [CR]), and discriminant validity (Fornell-Larcker criterion, heterotrait-monotrait ratio of correlations [HTMT]) were tested to determine if the items on the questionnaire indeed measured the theoretical constructs as postulated. The structural model was then inspected to examine direct effects, mediation effects, and model fit overall with path coefficients, R^2 , and effect size measures (f^2). Bootstrapping was conducted with 5,000 resamples to determine hypothesized relationships for significance.

4. RESULTS

Table 1 shows the CA, CR, and average variance extracted (AVE) for all the constructs. The reliability and validity scores show the strength of the measurement model. CA scores are above 0.80 for all the variables, which show high internal consistency. CR scores are also above 0.89, further establishing the reliability of the constructs. AVE values are higher than the minimum threshold of 0.50, ensuring that each construct explains a substantial amount of variance in its indicators. Among all the constructs, managerial capabilities (MC) have the highest CA (0.913) and CR (0.935), reflecting high reliability, and innovation strategy has the lowest AVE (0.618), but still above the acceptable level. These findings ensure that the measurement model is reliable and valid.

Table 2 and Figure 2 show the outer loadings of every observed variable on the relevant latent construct. The results clearly show that all outer loadings are well above the 0.60 benchmark, assuring that indicators measure their corresponding constructs strongly. The outer loading is highest in

the case of managerial capabilities ($MC3 = 0.892$), second is relational capabilities ($RC2 = 0.880$), and third is innovation performance ($IP5 = 0.860$). Innovation strategy $IS4$ has the lowest outer loading (0.713), but it is still within the acceptable range.

The fact that the relatively high loadings on all constructs indicate that the chosen indicators truly capture the underlying theoretical constructs further adds to the robustness of the measurement model.

Table 1. Reliability and validity of constructs

Variables	CA	CR	AVE
Innovation performance (IP)	0.891	0.920	0.697
Innovation strategy (IS)	0.876	0.906	0.618
Learning capabilities (LC)	0.844	0.895	0.681
Managerial capabilities (MC)	0.913	0.935	0.742
Relational capabilities (RC)	0.876	0.915	0.729
Technological capabilities (TC)	0.847	0.892	0.626

Table 2. Outer loadings of constructs

Variables	Items	Outer loading
Innovation performance (IP)	IP1	0.813
	IP2	0.840
	IP3	0.823
	IP4	0.838
	IP5	0.860
Innovation strategy (IS)	IS1	0.764
	IS2	0.797
	IS3	0.831
	IS4	0.713
	IS5	0.811
	IS6	0.795
Learning capabilities (LC)	LC1	0.790
	LC2	0.808
	LC3	0.830
	LC4	0.871
Managerial capabilities (MC)	MC1	0.876
	MC2	0.845
	MC3	0.892
	MC4	0.817
	MC5	0.877
Relational capabilities (RC)	RC1	0.858
	RC2	0.880
	RC3	0.852
	RC4	0.823
Technological capabilities (TC)	TC1	0.838
	TC2	0.856
	TC3	0.788
	TC4	0.825
	TC5	0.627

Figure 2. Measurement model results (SmartPLS)

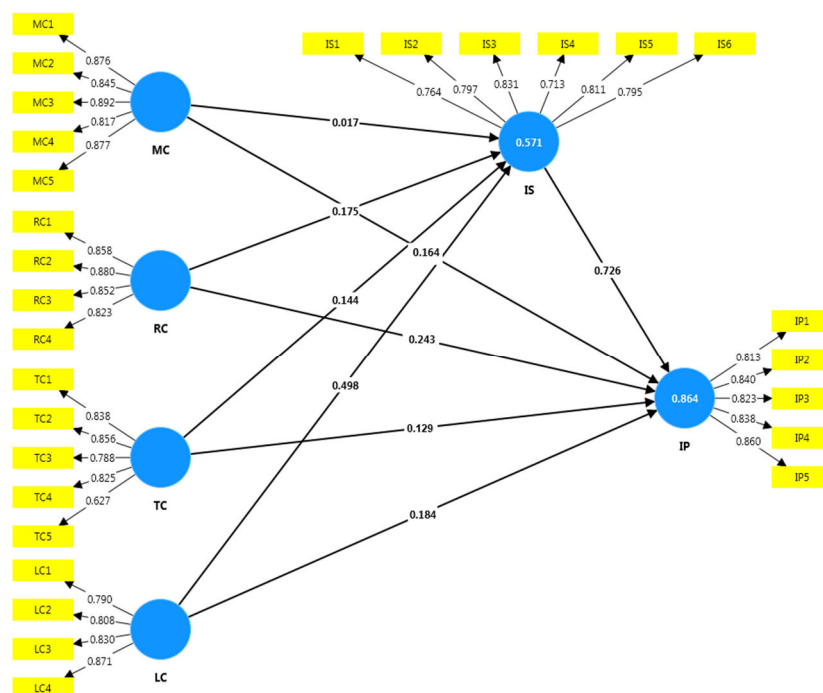


Table 3 shows the HTMT ratio of correlations, used to test discriminant validity between constructs. For discriminant validity to exist, HTMT values must be less than 0.85 (conservative criterion) or 0.90 (liberal criterion). The highest HTMT is between *LC* and *IS* (0.821), yet it is within the acceptable threshold. The HTMT values reveal

that all the constructs have discriminant validity, meaning that they are measuring distinct theoretical constructs. This is in favor of the premise that the constructs are not highly correlated and each measures independent dimensions of capabilities, strategy, and *IP*.

Table 3. Heterotrait-monotrait ratio of correlations criterion discriminant validity

Variables	<i>IP</i>	<i>IS</i>	<i>LC</i>	<i>MC</i>	<i>RC</i>	<i>TC</i>
<i>IP</i>	1					
<i>IS</i>	0.318	1				
<i>LC</i>	0.477	0.821	1			
<i>MC</i>	0.714	0.673	0.737	1		
<i>RC</i>	0.732	0.707	0.710	0.637	1	
<i>TC</i>	0.781	0.752	0.807	0.515	0.630	1

Table 4 presents the R^2 , adjusted R^2 , Q^2 predict, and standardized root mean square residual (SRMR) values, which measure the explanatory power of the model and predictive significance. The R^2 value for *IP* is 0.864, meaning that the independent variables and mediating factor (*IS*) collectively explain 86.4% of *IP* variance, which is large. The R^2 for *IS* is 0.571, indicating that *MC*, *RC*, *TC*, and *LC*

account for 57.1% of its variance. The Q^2 predict values are greater than 0.00, affirming the predictive validity of the model. The SRMR value of 0.070 is less than the suggested limit of 0.08, showing a good fit of the model. These findings offer strong empirical evidence for the hypothesized relations and the explanatory power of the structural model.

Table 4. Goodness of fit statistics for the model

Construct	R^2	Adjusted R^2	Q^2 predict	SRMR
<i>IP</i>	0.864	0.860	0.821	0.070
<i>IS</i>	0.571	0.562	0.498	

Table 5. Path analysis of hypotheses

Statement	Coefficients (β)	Standard errors	<i>t</i> -values	<i>p</i> -values
<i>H1</i>	0.164	0.055	3.285	0.000
<i>H2</i>	0.243	0.064	7.961	0.000
<i>H3</i>	0.129	0.064	2.290	0.000
<i>H4</i>	0.184	0.051	3.642	0.000
<i>H5</i>	0.178	0.053	3.363	0.001
<i>H6</i>	0.161	0.050	3.221	0.002
<i>H7</i>	0.194	0.057	3.401	0.001
<i>H8</i>	0.169	0.051	3.315	0.001

Figure 3. Structural model results (SmartPLS)

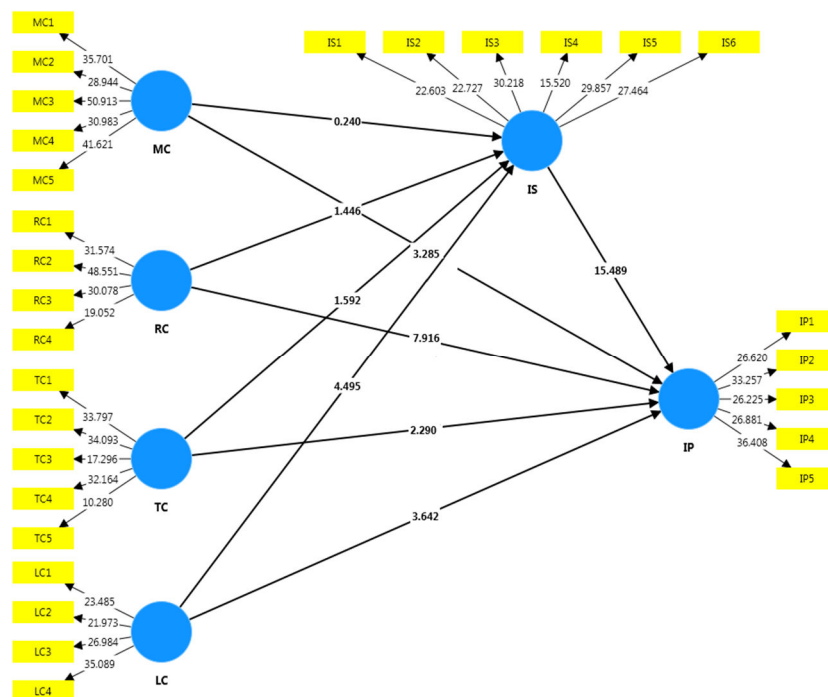


Table 5 and Figure 3 display the structural path coefficients (β), standard errors, t-values, and p-values, which prove the significance of the hypothesized relations. It can be observed from the findings that *MC* ($\beta = 0.164$, $p = 0.000$), *RC* ($\beta = 0.243$, $p = 0.000$), *TC* ($\beta = 0.129$, $p = 0.000$), and *LC* ($\beta = 0.184$, $p = 0.000$) all positively affect *IP*. The most significant direct effect is found for relational abilities, emphasizing the role of external alliances in innovation.

The mediation effects are also statistically significant, and *IS* mediates the links between all four capabilities and *IP*. The most significant mediation effect is found between *TC* and *IP* ($\beta = 0.194$, $p = 0.001$), which means that companies utilizing technology effectively need to have a well-formulated *IS* to achieve optimal performance. These results validate that *IS* plays an important mechanism that amplifies the effect of organizational capabilities to influence *IP*, highlighting strategic coordination between external and internal resources to achieve consistent innovation success.

5. DISCUSSION

Innovation has been viewed as a significant source of competitive excellence for a long period, but achieving success depends on the ability of a firm to use and integrate various organizational capabilities effectively. This current study explores the intricate dynamics of managerial, relational, technological, and learning capacities and accentuates their powerful influences on innovation performance (*IP*). However, the report also pinpoints that the abilities, as such, are not sufficient. They acquire relevance when they find their place within a properly worded innovation strategy (*IS*). With epochs of quick transformation of technology and shifting market circumstances, organizations should ensure not just high competencies within, but also develop strategic pathways for converting the capabilities into tangible innovation achievements.

The findings of this study confirm again that managerial abilities have a significant impact on innovation performance, supplementing the existing research on the role of leadership and strategic decision-making in creating innovation. Effective managerial abilities enable firms to allocate resources in the best possible way, articulate a clear vision for innovation, and foster an environment to take risks and solve problems creatively (Daradkeh et al., 2023). These conclusions are in consonance with the findings of other studies to the extent that the organizational managerial leadership facilitates higher levels of innovation output through its capability to implement smooth innovation processes, as well as encouraging cross-functional integration (Harvey & Kudesia, 2023). The research also supports evidence that relational competences are prime determinants of innovation performance, as this supports ongoing literature on innovation activity roles performed by external networks. Companies that make an active investment in collaborative collaborations with buyers, suppliers, and research institutions have increased access to diverse pools of knowledge, market insights, and technological advancements (Gama & Magistretti, 2025). The findings corroborate the open innovation paradigm, which presumes that firms applying external collaborations enjoy superior innovation performance due to greater knowledge sharing and co-creation (Li et al., 2023).

The significant impact of technological capabilities (*TC*) on innovation performance is also in support of the contention that firms must continue to invest in and maintain their technological assets in a state of readiness to compete. The conclusions of this study are in agreement with previous research that shows technology improves when strategically integrated into innovation practices, efficiency, product differentiation, and market competitiveness (Chen & Kim, 2023). Organizations with superior technology capabilities are well placed to more effectively absorb industry disruptions as well as leverage new opportunities arising through the creation of innovative, advanced solutions (Gama & Magistretti, 2025). The study justifies that learning capabilities (*LC*) result in innovation performance, citing critical roles undertaken in driving innovation success by knowledge acquisition, organizational learning, and ongoing improvement. These results align with absorptive capacity theory, in which it is argued that companies with high learning capacities are able to recognize, absorb, and exploit new knowledge effectively to innovate (Harvey & Kudesia, 2023). The findings also support previous research that evidence indicates firms with learning-oriented strategies achieve superior innovation performance due to their ability to capitalize on prior experience, enhance problem-solving capabilities, and encourage knowledge-sharing cultures (Jiang et al., 2023). In addition, organizations with an emphasis on exploratory and exploitative learning exhibit a higher degree of flexibility, which allows them to enhance existing processes as well as develop breakthrough innovations.

The results of this research validate that managerial competencies are mediated by innovation strategy in their relationship to innovation performance, validating the intuition that leadership alone will not be enough to spearhead innovation without being guided through a robust innovation strategy. This is congruent with the research that exists wherein it was cited that managerial capabilities (*MC*), which include strategic vision, decision-making, and use of resources, bring forth only innovation performance upon the direction from a clear-cut innovation roadmap (Audretsch & Belitski, 2023). The strategic responsibilities of a manager are the deployment of creative work, formulating creativity culture, and deploying the activities meant for innovation on top of strategic goals of a firm (Kunz & Sonnenholzner, 2023). The study also substantiates that strategy for innovation functions as a mediator of relational capabilities (*RC*) and innovation performance, stating that external collaborations by themselves are not bound to generate successful innovation without the existence of a strategic perspective. This finding conforms with earlier studies showing that even as firms benefit from knowledge exchange from the outside, the level of success such alliances achieve relies on the scope of integration into the firm's strategy (Madhavaram et al., 2023). Those firms that establish good relational skills by working alongside suppliers, clients, and research institutes should, in turn, also embrace strategies of innovation that transform such relations with the external environment into important innovation outcomes (Singh et al., 2023). The results affirm that firms with well-defined innovation strategies can leverage external networks more effectively for technology transfer, joint R&D, and co-creation of

new products, which synchronizes the external knowledge with internal capabilities for enhanced innovation performance.

In addition to that, the study confirms that innovation strategy mediates between technology capabilities and innovation performance, thus demonstrating that technological advancement by itself will not guarantee success in innovation if it lacks a proper strategy. This is in line with evidence that technology capabilities empower companies to create world-class products and enhance operational performance, but their impact on innovation performance is subject to strategic use of technology by the company (Robertson et al., 2023). The study indicates that companies with excellent technological capacities but poor innovation strategies are not in a position to commercialize innovations efficiently or match them with market requirements (Tang et al., 2023). Lastly, the research confirms that innovation strategy is a mediating factor between learning capabilities and innovation performance, but also further affirms the function of strategic congruence in maximizing organizational learning potential. These findings confirm earlier research that has demonstrated learning capabilities, such as knowledge acquisition, absorptive capacity, and continuous improvement, to be effective at improving innovation performance when situated within a clearly defined innovation strategy (Shaik et al., 2023). While companies with high learning capabilities are more capable of adjusting to market changes and testing new ideas, the success of converting learning into effective innovation results relies on the existence of a clearly defined innovation strategy (Khan et al., 2023). The research confirms that companies whose attention is attracted towards exploratory and exploitative learning have higher success in innovation, as their learning activity is directed toward specific innovation targets.

The findings verify that managerial, relational, technological, and learning capabilities each significantly impact innovation performance, sustaining prior research on the significance of internal competency and external networking. Most crucially, though, the research indicates that innovation strategy functions as a critical link between these capacities and actual innovation outcomes. Without a strategic context, even the most advanced technological resources or extensive external collaborations can be incapable of achieving sustainable innovation success. These findings have significant implications for industry and academia alike, underlining the necessity for firms to build not just strong capabilities but also a strategic vision to guide their innovation efforts. In the future, organizations will have to keep renewing their innovation strategies to catch up with shifting market trends so that their investments in managerial leadership, relationships, technology, and learning reap benefits in the form of long-term competitive edge and industry leadership.

6. CONCLUSION

This study provides a comprehensive image of how managerial, relational, technological, and learning capabilities contribute to innovation performance, with emphasis on the role of innovation strategy as a mediating variable. The findings validate that while these capabilities are central to generating innovation, their real impact is realized only when

they are incorporated strategically into an explicit innovation framework. Managerial skills drive innovation by shaping strategy and decision-making, relational skills bring innovation through effective external collaborations, technological skills provide the means for innovation-led transformation, and learning skills ensure ongoing adaptation and knowledge application. However, the research highlights that without an effectively integrated innovation strategy, even the most dominant skills will be unable to contribute to ongoing innovation success. By assuming the mediating function of innovation strategy, this research draws attention to the way firms must not only develop their internal and external capabilities but also align these with a coordinated innovation blueprint. Theoretical contributions of this paper consolidate existing literature by integrating various insights into capabilities and innovation strategy, while its practice implications provide actionable guidance for companies seeking to maximize their innovations. While it has its weaknesses, the study leaves room for follow-up studies to explore additional mediators, moderators, and sector differences in the innovation process. Ultimately, this study corroborates the idea that continued success at innovation is as much a function of resources and capabilities as it is of the strategic mechanisms through which they are leveraged effectively so that firms remain competitive and responsive in an increasingly dynamic business environment.

While this study yields important insight into how innovation strategy is affected by managerial, relational, technological, and learning capabilities to drive innovation performance, it has some shortcomings. First, the research uses a quantitative approach, which, as useful as it is in demonstrating statistical correlations, can ignore the nuanced, contextual dynamics that determine innovation results. Future studies can utilize qualitative methods like case studies or in-depth interviews to investigate how these capabilities interact with one another within various organizational contexts. Moreover, the cross-sectional design restricts the capacity to evaluate the long-term impacts of these capabilities on innovation performance. Due to the dynamic character of innovation, longitudinal research might be able to shed more light on how such relationships change over time and whether innovation strategy still acts as a mediator. The analysis also deploys innovation performance as an overarching concept, without making the differentiation between types, e.g., incremental vs. radical or product vs. process innovation, something that subsequent studies should investigate. As digital transformation continues to influence processes of innovation, the inclusion of variables like artificial intelligence, big data analytics, and Industry 4.0 technologies might add depth to understanding how digitalization affects capabilities, strategy, and performance. Finally, as this research focuses on the firm as the unit of analysis, future studies might broaden to explore dynamics at the ecosystem level, such as collaborative ventures among firms, governments, and research institutions. Overcoming these limitations will not only make theoretical models more precise but also provide organizations with useful insights into how innovation can be improved in fast-changing environments.

This research provides important theoretical and practical contributions through demonstrations of how managerial, relational, technological, and learning capabilities influence innovation performance through the mediating effect of innovation strategy. It advances the RBV and dynamic capabilities theory by offering an integrated model in which several capabilities, driven by strategic intent, contribute more substantially to innovation than when examined individually. The results also validate absorptive capacity and open innovation concepts, highlighting how external relationships and learning, if managed strategically, increase innovation returns.

In practice, the study emphasizes that capabilities are not sufficient in themselves; firms require a defined innovation strategy to turn them into outcomes. Strategic leadership must be developed by managers, external partnerships established, technology investments aligned with innovation strategy, and learning fostered. Policymakers can assist this by formulating focused policies stimulating capability development in accordance with the innovation strategy. In the end, the study gives a guideline for companies to improve innovation performance and remain competitive in rapidly changing markets.

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