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Dynamic Capabilities and Firm Performance: The Mediating Role of Product Innovation in Indonesian

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ABSTRACT
This study examines the relationship between dynamic capabilities and firm performance, with product innovation as a mediating variable. Grounded in the dynamic capabilities framework, this research focuses on three key dimensions: sensing, seizing, and transforming, within small and medium-sized enterprises (SMEs) in Central Java, Indonesia. A quantitative approach was employed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to analyze survey data collected from 204 SMEs. The results indicate that sensing capabilities have a significant positive effect on product innovation, which in turn enhances firm performance. However, the effects of seizing and transforming on product innovation are found to be statistically insignificant. Furthermore, product innovation demonstrates a significant positive relationship with firm performance, suggesting its important role as a mediating mechanism. These findings imply that dynamic capabilities do not uniformly influence innovation outcomes, and that sensing capability plays a more critical role in driving innovation among SMEs operating under resource constraints and environmental uncertainty. This study contributes to the literature by providing empirical evidence on the indirect relationship between dynamic capabilities and firm performance through product innovation in an emerging economy context. Practically, the findings suggest that SME managers should prioritize market sensing activities and innovation development to improve long-term performance.
***Keywords**: Dynamic Capabilities, Product Innovation, Firm Performance, Small and Medium Enterprises (SMEs), Indonesia*

INTRODUCTION

Small and medium-sized enterprises (SMEs) play a vital role in economic development by contributing to employment creation, innovation, and regional growth. In Indonesia, particularly in Central Java, SMEs dominate the business landscape and serve as a key driver of local economic resilience. Despite their importance, many SMEs face persistent challenges in sustaining performance, especially in environments characterized by rapid technological change, market uncertainty, and increasing competition. These challenges highlight the need for firms to develop strategic capabilities that enable them to adapt, innovate, and remain competitive over time.

The concept of dynamic capabilities has received considerable attention in the strategic management literature as a response to rapidly changing and uncertain business environments. Dynamic capabilities refer to a firm's ability to sense opportunities and threats, seize them effectively, and transform its resource base to adapt to environmental changes. Prior studies suggest that dynamic capabilities play a

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critical role in enhancing firm performance, particularly in volatile markets. However, empirical evidence regarding the direct relationship between dynamic capabilities and firm performance remains inconclusive, indicating the need to explore the underlying mechanisms through which these capabilities influence performance outcomes, in the literature on strategic management as a reaction to changing and unpredictable business contexts. The capacity of a company to recognize opportunities and dangers, take advantage of them, and adjust its resources to efficiently handle changes in the environment is referred to as dynamic capabilities. According to earlier research, dynamic talents are crucial for attaining greater company performance, especially in volatile markets. Further research into the processes by which dynamic capabilities affect performance outcomes is necessary, as empirical data about the direct relationship between dynamic skills and firm performance are still equivocal.

One important mechanism through which dynamic capabilities influence firm performance is innovation, particularly product innovation. Product innovation enables firms to respond to changing customer needs, differentiate themselves from competitors, and improve market performance. For SMEs, innovation is especially crucial due to limited resources, requiring firms to rely on flexibility and creativity rather than scale advantages. Although prior studies acknowledge the role of innovation, empirical evidence examining product innovation as a mediator in the relationship between dynamic capabilities and firm performance remains limited, particularly in the context of SMEs in emerging economies.. Innovation, particularly product innovation, enables firms to respond to changing customer needs, differentiate themselves from competitors, and enhance market performance. For SMEs, product innovation is especially critical, as resource limitations require firms to rely on strategic flexibility and creativity rather than scale advantages. Despite the extensive literature on dynamic capabilities and firm performance, several gaps remain. First, prior studies often treat dynamic capabilities as a single construct, with limited attention to its specific dimensions—sensing, seizing, and transforming—and their distinct roles in driving innovation. Second, while innovation has been recognized as a potential mediator, empirical findings on its mediating role, particularly in SME contexts, remain inconsistent. Third, most existing studies focus on developed economies, leaving emerging market contexts such as Indonesia relatively underexplored, as a mediating variable in the link between

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dynamic capacities and company performance, even though prior research has recognized the significance of innovation, especially in the setting of SMEs in emerging economies.

This study addresses this research gap by examining how dynamic capabilities specifically sensing, seizing, and transforming affect firm performance through product innovation among SMEs in Central Java, Indonesia. By employing a quantitative approach and structural equation modeling, this research aims to clarify whether dynamic capabilities directly enhance firm performance or operate indirectly through innovation. The findings are expected to offer both theoretical and practical contributions by refining the understanding of dynamic capabilities and providing insights for SME managers on how to leverage innovation as a strategic tool to improve performance in dynamic business environments. “Central java has shown significant progress in the development of SMEs (Small and Medium Enterprises). With around 4.2 million SMEs, the region plays a crucial role in Indonesia's overall economy, particularly due to its diverse and growing sectors such as trade, production (non-agricultural), and services. The province has fostered a conducive environment for these businesses to thrive, offering various support programs, government initiatives, and regional policies aimed at empowering entrepreneurs. Despite challenges, such as competition and access to funding, Central java SME sector remains resilient and continues to contribute to employment, innovation, and regional economic growth. Moreover, most of these businesses are micro-enterprises, which emphasizes the importance of supporting their development through capacity-building and financial assistance. Overall, the collaboration between local governments, institutions, and the private sector has helped strengthen the SME ecosystem, making it a key driver of economic vitality in the province.

Central Java represents one of the most important SME hubs in Indonesia, with approximately 4.2 million business units contributing significantly to regional economic development. According to data from the Cooperatives and SMEs Office of Central Java Province, the number of assisted SMEs reached 191,689 by the second quarter of 2024. The majority of these businesses operate in trade, services, and non-agricultural

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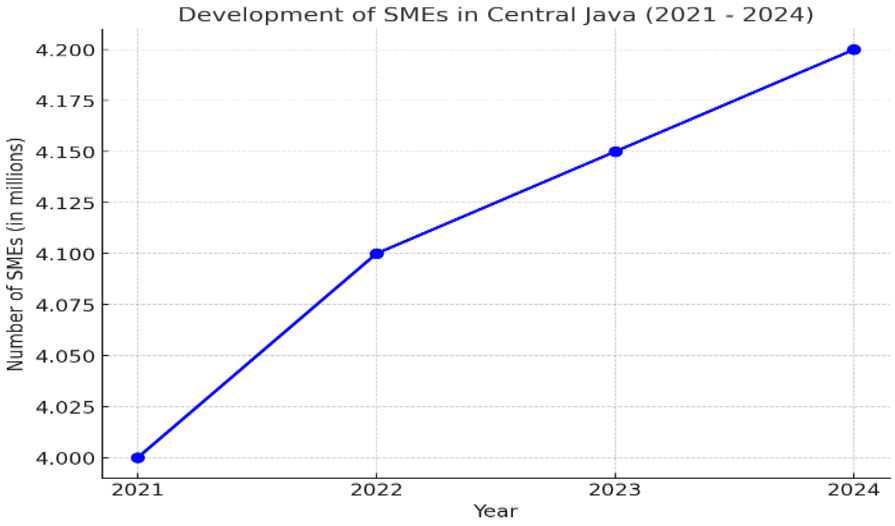
production sectors, highlighting the strategic role of SMEs in employment creation and economic resilience.



Source: BPS Central Java

Figure 1 : Development of SMEs in Cebtral Java

Technological progress, shifting consumer preferences, and market disruptions have underscored the need for firms to develop strategic capabilities that ensure their survival and growth. One approach that has emerged to tackle these challenges is the concept of dynamic capabilities. This refers to a company's ability to detect opportunities and threats, capitalize on those opportunities, and reconfigure both internal and external resources to generate value and maintain a competitive edge (Teece et al., 1997)(Siregar et al., 2024)

Whether it involves product development, process improvements, or new business models, innovation enables companies to differentiate themselves in the market, enhance operational efficiency, and address the changing demands of customers (Kamal et al., 2023; Zahra & George, 2002). Innovations driven by dynamic capabilities enable companies to develop solutions that not only enhance performance but also establish a lasting competitive advantage.

Previous studies have indicated that the connection between dynamic capabilities and firm performance is often mediated by innovation. In other words, companies that can identify opportunities, manage resources, and integrate innovation into their operations are more likely to achieve improved performance outcomes. (Eisenhardt & Martin, 2000; KARACA et al., 2018a). Additionally, in an environment

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characterized by technological uncertainty, dynamic capabilities become progressively more crucial in assisting companies to manage risks and adapt to market changes more rapidly.

This introduction emphasizes the significance of comprehending how dynamic capabilities influence firm performance through innovation. The study not only adds value to academic literature but also offers practical insights for companies in formulating strategies that address challenges and leverage opportunities in a constantly changing and uncertain business environment.

Dynamic capabilities refer to an organization's distinctive abilities to adapt, reconfigure, and refresh its internal and external resources to navigate a dynamic business landscape. These capabilities develop from long-term behavioral patterns in how companies respond to changes, concentrating on how a company's resources can be transformed into competitive advantages(Mugo, 2022; Teece et al., 1997). However, dynamic capabilities do not directly influence firm performance; their effect is mediated by more concrete abilities such as innovation, which contributes to the creation of new value configurations(Gnizy et al., 2014; Zhang et al., 2023).

Innovation plays a crucial role in mediating the connection between dynamic capabilities and firm performance. By fostering innovation, companies can develop new products or processes that align with market demands, enhance efficiency, and distinguish themselves from competitors(Zahra & George, 2002). Companies with robust dynamic capabilities are better positioned to capitalize on innovation opportunities, leading to the development of products or services that boost competitiveness and improve firm performance(Rehman & Saeed, 2015; Zhang et al., 2023).

In this context, product innovation serves as a vital link between dynamic capabilities and firm performance. Innovation enables companies not only to survive but also to thrive in an environment marked by technological uncertainty. This uncertainty compels companies to continuously innovate in order to address the changing demands of the market(Windasari Rachmawati, 2023). By harnessing dynamic capabilities, companies can expedite the innovation process, improve product value, and solidify their competitive standing in the global market. Furthermore, innovation impacts not only products and processes but also the company’s business model. By bolstering

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dynamic capabilities, innovation aids companies in developing new strategies in marketing, distribution, and operational management, thereby increasing the likelihood of achieving optimal performance. This is particularly significant in today's digital era, where technologies like cloud computing, big data, and machine learning act as essential enablers in driving the innovation process (Posen et al., 2023; Prasad et al., 2018; Shi et al., n.d.). These technologies enable companies to quickly access information, optimize resource utilization, and expedite strategic decision making.

Against this backdrop, this study seeks to explore how dynamic capabilities influence firm performance through innovation as a mediator. The research will offer both theoretical and practical insights into the significance of developing dynamic capabilities and leveraging innovation as a strategic tool to achieve sustainable firm performance in the face of an ever evolving business environment. Companies are under increasing pressure to adapt to these changes in order to stay competitive and sustainable.

The study centers on dynamic capabilities, a crucial concept that allows firms to identify opportunities and threats, capitalize on them effectively, and transform internal resources into value. Given the high level of technological uncertainty and market dynamics, understanding how dynamic capabilities impact firm performance, particularly through product innovation, is of urgent importance. This research is especially valuable in assisting organizations in crafting strategies that address these challenges and capitalize on opportunities in a rapidly changing business environment. Therefore, this study aims to examine the effect of dynamic capabilities specifically sensing, seizing, and transforming on firm performance, with product innovation as a mediating variable among SMEs in Central Java, Indonesia. This research contributes to the literature by providing a more nuanced understanding of the role of individual dimensions of dynamic capabilities in driving innovation and performance. Practically, the findings offer insights for SME managers in developing innovation-oriented strategies to enhance competitiveness in dynamic business environments.

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THEORETICAL BACKGROUND

Resource-Based View (RBV) Theory

(Wernerfelt, 1984; Zheng & Ge, 2022) was a key pioneer in the development of the Resource-Based View (RBV) theory. RBV emphasizes the importance of a company's resources and capabilities as the primary foundation for building competitive advantage and firm performance. RBV focuses on how companies can compete with rivals and manage their resources effectively to achieve a competitive advantage. In the context of business competition, the sustainability of competitive advantage can be achieved by implementing fast and precise strategies (Nam & Yi, 2020).

RBV is closely related to dynamic capabilities. According to (Rehman & Saeed, 2015), dynamic capabilities can be measured through the integration of elements such as individual expertise within the organization, culture, orientation, leadership, and company strategy. This aligns with the view that companies can achieve sustained competitive advantage if they possess superior dynamic capabilities."

Dynamic Capabilities

The dynamic capabilities approach is highly relevant for studying the influence of information systems or specific capabilities on organizations (Caputo et al., 2018; Volungevičiūtė-Trinkūnienė & ..., 2023). This concept explains how companies can respond to changes through their ability to integrate, build, and reconfigure internal and external resources. Dynamic capabilities are also derived from the combination and reconfiguration of managerial processes that are continuously developed through organizational learning routines. These capabilities enable organizations to understand environmental changes and adjust their activities accordingly (Kaur, 2023; Tallott & Hilliard, 2016).

In an era where technology and markets are evolving at an unprecedented pace, one of the key questions in strategic management literature is how companies can consistently enhance their performance to stay ahead of competitors. Given the high levels of uncertainty, frequent changes, and the rapid advancement of digital technologies, companies must identify and adopt new ideas and technologies to not only attain superior performance but also ensure their survival. (Kim & Lee, 2018) (Pohlmann, 2005);(KARACA et al., 2018b; Kaur, 2023) . Many studies have been

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conducted to seek answers to how to outperform competitors, and various theories and perspectives have been developed.

One such perspective is the Resource-Based View (RBV)(Arora & Siddiqui, 2022; *Barney1991*, n.d.) . The Resource-Based View (RBV) suggests that companies can attain superior performance and sustain a Competitive Advantage by leveraging valuable, rare, inimitable, and unique resources and capabilities. However, this perspective has faced several criticisms, including being viewed as static, overly ambiguous, tautological, and failing to account for dynamic and changing environmental factors. (Eisenhardt & Martin, 2000; Wilden et al., 2016). Emerging from the Resource-Based View (RBV), the dynamic capabilities perspective seeks to clarify how companies attain superior performance and maintain a sustainable competitive advantage in rapidly changing environments. (Teece et al., 1997). Dynamic capabilities are defined as abilities that enhance a company's value by converting resources into new strategies that generate value. (Eisenhardt & Martin, 2000), and they have become a major subject of interest in strategic management literature since they were first mentioned.

Although there has been much attention, theoretical studies, and empirical research, there is still no clear conclusion about what dynamic capabilities are and their impact. While the relationship between dynamic capabilities and firm performance is a topic that has attracted significant attention, the details of this relationship remain unclear because most of the research is conceptual, and empirical studies have not reached consistent conclusions (Baía & Ferreira, 2024; Protogerou et al., 2012). Nevertheless, understanding this relationship is essential for advancing theoretical knowledge and assisting organizations in gaining a competitive edge in real world applications.

In addition to the direct relationship between dynamic skills and firm performance, another area that needs more research is the indirect relationship that is mediated by a third variable. (Baía & Ferreira, 2024). Since innovation and dynamic capabilities are closely related, it makes sense to propose that innovation might act as a mediator in the relationship between dynamic capabilities and firm performance. New information that goes beyond the company's current understanding is required for product innovation. This information may be recognized, obtained, and transformed into

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a useable form via dynamic capabilities. In this regard, it is expected that dynamic capacities would positively influence product innovation. Product innovation is therefore a strong contender to mediate the relationship between dynamic capacities and firm performance.

Environmental uncertainty plays a crucial role in shaping the relationship between dynamic capabilities, innovation, and performance. (Teece et al., 1997). In environments with high uncertainty, the importance of dynamic capabilities, especially in the sensing dimension, becomes more pronounced. The quicker and more accurately a company can detect environmental changes, the greater its potential to outperform competitors (Haarhaus & Liening, 2020). In the innovation process, technological uncertainty plays a particularly crucial role. In environments with high technological uncertainty, identifying and seizing opportunities becomes significantly more challenging. As a result, in such environments, the impact of successful product innovation on performance is expected to be much more substantial (Bodlaj et al., 2012; de la Torre & De la Vega, 2025). (de la Torre & De la Vega, 2025; Winter, 2003)Dynamic capabilities are described as activities involving expanding, modifying, and creating. By synthesizing various approaches from the literature, they have been categorized into sensing, learning, integration, and coordination. However, the most widely accepted and comprehensive classification in the literature is the one proposed by (de la Torre & De la Vega, 2025; Teece et al., 1997), The concept of dynamic capabilities as three core capabilities—sensing, seizing, and transforming is primarily associated with (Teece et al., 1997). He proposed this framework in his work on dynamic capabilities, emphasizing how firms can sense opportunities and threats, seize opportunities, and transform their resources and capabilities to adapt to changing environments (Leemann & Kanbach, 2022) . n this reseach, dynamic capabilities are also explored within the context of sensing, seizing, and transforming, as outlined by(de la Torre & De la Vega, 2025; Teece et al., 1997)

Sensing involves identifying and assessing both internal and external opportunities and risks. This process requires an understanding of the environment, market conditions, customers, potential customers, competitors, and other external factors.(de la Torre & De la Vega, 2025; Pisano & Teece, 2007).Seizing pertains to how swiftly a company

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can act on recognized opportunities or threats. Transforming involves continuous renewal by reorganizing and integrating current resources to take advantage of previously identified opportunities.

First, the direct relationship between dynamic capabilities and firm performance has been empirically tested. However, it is evident that this relationship requires further empirical investigation, as there are varying theoretical perspectives from earlier studies in the literature regarding the existence of such a direct link. ((Eisenhardt & Martin, 2000); (Aripin et al., 2024; Teece et al., 1997), and due to contradictory empirical findings that have emerged in recent years (Dash & Paul, 2021); (Casero et al., 2013) Second, Additionally, the relationship between dynamic capabilities and product innovation, as well as the mediating role of product innovation in the connection between dynamic capabilities and firm performance, is also explored. According to (James & Joseph, 2015; Siregar et al., 2024), The relationship between dynamic capabilities and firm performance should be studied with the inclusion of a mediating variable. While there is evidence suggesting that innovation mediates this relationship, further research is needed to explore and confirm the role of mediators in connecting dynamic capabilities to firm performance. (Cruz-Sánchez et al., 2026; Zhou et al., 2016), No reseach has specifically examined this relationship in the context of product innovation. However, product innovation is a variable that can effectively mediate this relationship, as it represents a more concrete outcome tied to the company's processes. This reseach seeks to empirically test whether the relationship between dynamic capabilities and firm performance is direct or indirect, and to explore the role of product innovation in this connection."

Product Innovation

The creation of new or greatly enhanced products that satisfy consumer demands and boost competitiveness is referred to as product innovation. According to (Bodlaj et al., 2012), product innovation enables firms to differentiate their offerings and respond proactively to environmental turbulence. In the context of SMEs, (Gnizy et al., 2014; Hadi & Ali, 2025; Zehir & Vural, 2024a)highlight that innovation is a critical mechanism through which small firms overcome resource constraints and achieve competitive advantage.

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Product innovation is a strategic mediator as well as a consequence, according to recent studies. (Zehir & Vural, 2024a)show that the link between dynamic capacities and firm performance is mediated by product innovation, especially in technologically unpredictable situations. According to this research, the main way that dynamic capabilities improve performance is via encouraging innovation.

Firm Performance

Firm performance is commonly assessed through financial and non financial indicators such as profitability, market share growth, and operational efficiency.(*Barney1991*, n.d.; Hadi & Ali, 2025) argues that firms achieve superior performance when they effectively leverage valuable and rare capabilities. Empirical studies by (Rehman & Saeed, 2015; Zehir & Vural, 2024a) and (Casero et al., 2013; Cruz-Sánchez et al., 2026; Febrianto & Rufaidah, 2026)confirm that dynamic capabilities and innovation are significant drivers of firm performance, especially in competitive and uncertain environments.

In SME contexts, performance outcomes are often closely tied to innovation capabilities rather than scale advantages. (Haarhaus & Liening, 2020; Uyanik & Koc, 2025) find that SMEs with stronger strategic sensing and innovation capabilities exhibit better adaptability and performance sustainability.

Research Gap

Even while dynamic capabilities, innovation, and firm performance have all been thoroughly studied in the past, there is still little empirical data on how certain aspects of dynamic capabilities affect firm performance through product innovation, especially in SMEs in emerging nations. The SME setting is understudied because the majority of current research focuses on developed markets or large corporations. Thus, by empirically investigating the mediating function of product innovation in the link between detecting, seizing, and transforming capacities and firm performance among Indonesian SMEs, this study aims to close this gap.

METHOD, DATA AND ANALYSIS

Research Paradigm and Approach

In order to explain causal interactions among variables, this study uses a positivist

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research paradigm, which places an emphasis on objective measurement and hypothesis testing. To investigate the connections among dynamic capacities, product innovation, and firm success, a quantitative research methodology is utilized. This method is suitable for applying statistical tools to validate empirical relationships and test theoretical theories.

The research used a cross-sectional survey approach, gathering information from small and medium-sized businesses (SMEs) at one particular moment. This architecture makes it possible to examine structural interactions between constructs in the context of SMEs in an effective manner.

Unit of Analysis and Sample

The unit of analysis in this study is the firm. The research focuses on small and medium-sized enterprises (SMEs) operating in Central Java, Indonesia. SMEs are selected due to their economic significance and their vulnerability to environmental uncertainty.

The population consists of approximately 4.2 million SMEs in Central Java. A sample of 204 SMEs was determined using a finite population sample size formula with a margin of error of 7 percent. The sampling technique employed is purposive sampling, with the following criteria:

1. the firm has been in operation for at least two years, and
2. the firm employs a minimum of two workers.

Respondents include owners, managers, or senior decision-makers who possess sufficient knowledge regarding the firm's strategic capabilities, innovation activities, and performance.

Data Collection Procedure

An organized survey was used to gather primary data. Depending on the availability of the respondents, both in-person and online surveys were used to distribute the questionnaire. A five-point Likert scale, with 1 denoting "strongly disagree" and 5 denoting "strongly agree" was used to score each item.

To verify the instrument's clarity, dependability, and content validity, a pilot test was carried out before all data was collected. Small phrasing changes were made in response to pilot study comments.=.

Measurement of Variables

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According to the concept put forward by (Pisano & Teece, 2007(Cruz-Sánchez et al., 2026)), three aspects are used to quantify dynamic capabilities: perceiving, seizing, and changing. To fit the SME setting, measurement items were modified from earlier empirical investigations.

Product innovation is measured using indicators related to new or improved product development, R&D activities, production and design processes, and commercialization success, adapted from (Zehir & Vural, 2024b).

Firm performance is assessed using both financial and non-financial indicators, including operational efficiency, market share growth, profitability, and sales growth. Measurement items were also adapted from (Zehir & Vural, 2024b).

All measurement scales were adapted from peer reviewed journals. Minor contextual modifications were applied to ensure relevance to Indonesian SMEs, without altering the conceptual meaning of the original constructs.

Data Analysis Technique

Partial Least Squares Structural Equation Modeling (PLS-SEM), which was built using SmartPLS software, was used to analyze the data. Because PLS-SEM can handle complicated models, relatively small sample sizes, and non-normal data distributions, it is appropriate for our investigation (Hair et al., 2011).

There were two steps in the analyzing process. Indicator reliability, internal consistency reliability (Cronbach's Alpha and Composite Reliability), convergent validity (Average Variance Extracted), and discriminant validity (Fornell–Larcker criteria) were the first factors examined in order to assess the measurement model. Second, a bootstrapping process with 5,000 resamples was used to analyze path coefficients, t-statistics, and p-values in order to evaluate the structural model.

The mediating effect of product innovation was tested using indirect effect analysis, following the bootstrapping approach recommended by (Hair et al., 2011). This method allows for robust assessment of mediation without relying on normality assumptions.

Ethical Considerations

Throughout the whole study procedure, ethical guidelines were closely adhered to. All respondents gave their informed consent, participation was entirely voluntary, and

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data confidentiality was guaranteed. Every piece of information was utilized only for academic research. In order to examine the connections between dynamic capacities, product innovation, and firm success in small and medium-sized businesses (SMEs) in Central Java, Indonesia, this study uses a quantitative research technique. Four hypotheses will be tested by the design of the study:

H1: A significant relationship exists between dynamic capabilities and firm performance.

H2: A significant relationship exists between dynamic capabilities and product innovation.

H3: A significant relationship exists between product innovation and firm performance.

H4: Product innovation mediates the relationship between dynamic capabilities and firm performance.

To accomplish this, primary data will be gathered via a structured survey distributed to SME owners, managers, or leaders in four regencies of Central Java: Kendal, Semarang City, Jepara, and Rembang. The selection criteria for these SMEs include being operational for a minimum of two years and employing at least two individuals.

The research employs a cross-sectional design and utilizes a survey method for data collection. The survey tool consists of a structured questionnaire aimed at collecting self-reported data from respondents regarding their firm's dynamic capabilities, product innovation efforts, and overall performance. Data will be gathered either through face to face or online surveys, depending on what is most convenient for the respondents. A sample size formula for finite populations is used to determine the required sample size. With a population of 4,174,210 and a sampling error of 7%, the calculated sample size is approximately 204 respondents. This sample size will ensure that the collected data is statistically significant and adequately represents the SME population in the study area.

Table 1 : Operational Definition and Variable Measurement

Variable	Indicator	Operational Definition	Source

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Dynamic Capabilities (Independent Variable)	**Sensing**	The ability to recognize and assess opportunities and threats in the environment, including market trends, technology, and competitors, is referred to as *sensing*. This is a key component of dynamic capabilities, as it enables firms to identify changes and adapt to evolving external conditions.	(Pisano & Teece, 2007; Teece et al., 1997)
	Seizing	The ability to respond quickly to identified opportunities or threats.	(Zehir & Vural, 2024b)
	Transforming	The ability to continuously update and restructure internal resources to seize identified opportunities.	(Zehir & Vural, 2024b)
Product Innovation (Mediating Variable)	**PROIN1**: Developing new or improved products	The process of creating new or improved products to meet market needs and improve differentiation.	(Zehir & Vural, 2024b)
	PROIN2: Incorporating R&D efforts	Integration of research and development activities to innovate and enhance product offerings.	(Zehir & Vural, 2024b)
	PROIN3: Production and design processes	Modification of production methods and product design to improve quality and market competitiveness.	(Zehir & Vural, 2024b)
	PROIN4: Effective management strategies	Application of innovative management practices to improve product performance and market reach.	(Zehir & Vural, 2024b)
	PROIN5: Marketing and commercial success	The ability to market and successfully commercialize innovative products, leading to increased market share.	(Zehir & Vural, 2024b)
Firm Performance (Dependent Variable)	**FIRMP1**: Overall operational efficiency	The measure of how efficiently a firm utilizes its resources in operations, including cost control and process optimization.	(Zehir & Vural, 2024b)

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	FIRMP2: Market share growth	The percentage increase in the firm's market share relative to competitors over a specific period.	(Zehir & Vural, 2024b)
	FIRMP3: Return on investment (ROI)	The ratio of net profit to total investment, which measures the firm's financial performance, is commonly referred to as the *Return on Investment (ROI)*. It indicates how efficiently a company is utilizing its investments to generate profit.	(*Barney1991*, n.d.; Zehir & Vural, 2024b)
	FIRMP4: Return on sales (ROS)	The measure of profitability relative to sales, showing how much profit a firm generates from its sales.	(Zehir & Vural, 2024b)
	FIRMP5: Profit growth	The increase in a firm's profit over a specific period, demonstrating financial growth.	(*Barney1991*, n.d.; Zehir & Vural, 2024b)
	FIRMP6: Return on assets (ROA)	The ratio of net income to total assets, which measures the firm's ability to generate profit from its assets, is known as *Return on Assets (ROA)*. This ratio indicates how effectively a company is utilizing its assets to produce earnings.	(Zehir & Vural, 2024b)
	FIRMP7: Sales growth	The increase in total sales revenue over a specific period, indicating market expansion.	(Zehir & Vural, 2024b)

The questionnaire will be developed to measure three key variables:

1. Dynamic Capabilities: This includes assessing the firm's abilities to sense, seize, and transform opportunities, as well as its market, technological, and regulatory adaptations. It also considers organizational culture, leadership, and internal resource integration.
2. Product Innovation: This will measure the firm's efforts in developing new or improved products, including R&D activities, product design, and the introduction of innovative features to meet market needs.

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3. Firm Performance: This will be assessed based on key indicators such as operational efficiency, market share growth, profitability, return on investment, and sales growth.

To summarize demographic information and broad patterns in the important variables, the data will be examined using descriptive statistics. Correlation analysis will be used to test hypotheses and investigate the connections among business performance, product innovation, and dynamic capacities. Furthermore, both direct and indirect correlations between the variables will be examined using structural equation modeling (SEM), with a focus on evaluating the mediating function of product innovation in the link between dynamic capacities and firm performance.

A pilot research will be carried out with a limited sample of respondents to improve the survey in order to guarantee its validity and reliability. Reliability will be assessed using Cronbach's Alpha, and construct validity will be assessed using component analysis. The instrument's content validity will also be evaluated by subject-matter experts.

The study will adhere to ethical guidelines, which include getting each participant's informed permission, maintaining confidentiality, and safeguarding their privacy. The goal of the study and the fact that participation is optional will be explained to the respondents. The information will only be utilized for scholarly research.

To sum up, the study approach seeks to offer a comprehensive grasp of how dynamic capabilities impact firm performance and product innovation in SMEs. The results will provide insightful information on how, in dynamic business environments, dynamic skills may promote competitive advantage and support organizational success.

RESULTS

Measurement Model Evaluation

The measurement model was assessed using Cronbach’s Alpha, Composite Reliability (CR), and Average Variance Extracted (AVE). As presented in Table 1, most constructs demonstrate acceptable internal consistency reliability, with Composite

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Reliability values generally approaching or exceeding the recommended threshold of 0.70.

Although several constructs report AVE values below the recommended threshold of 0.50, this condition can still be considered acceptable in exploratory research contexts. According to Hair et al. (2011), convergent validity may still be established when Composite Reliability remains adequate, even if AVE values are slightly below 0.50.

The relatively lower AVE values observed in this study may reflect the heterogeneous characteristics of SMEs, where variations in managerial practices, innovation processes, and performance measurement are inherently diverse. This is particularly relevant in emerging market contexts, where measurement scales adapted from prior studies may not fully capture local business dynamics.

However, it is important to note that the transforming construct exhibits comparatively lower reliability, suggesting that its measurement should be interpreted with caution in the context of this study.

Reliability Statistics

The reliability of the measurement scales was assessed using Cronbach's Alpha, rho_A, Composite Reliability, and Average Variance Extracted (AVE) for each construct.(Hair et al., 2011) The results are presented in the table below:

Table 2 : Reliability Statistics

Variable	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Firm Performance	0.708	0.776	0.780	0.349
Product Innovation	0.661	0.784	0.702	0.368
Seizing	0.665	0.885	0.799	0.595
Sensing	0.599	0.826	0.712	0.357
Transforming	0.415	0.429	0.045	0.252

Cronbach's Alpha values show good reliability for most constructs, as values greater than 0.7 are generally considered acceptable. However, the Transforming construct exhibits a low Cronbach's Alpha value of 0.415, indicating that this scale may need refinement to improve its internal consistency.

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Composite Reliability values are generally strong, indicating that the scales for each construct are consistent and reliable. The Seizing construct, for instance, has a Composite Reliability value of 0.799, suggesting a high level of reliability.

The majority of the constructs' Average Variance Extracted (AVE) values fall below the suggested cutoff point of 0.50, indicating that the constructs could profit from increased construct validity. The Transforming construct, in particular, has the lowest AVE value (0.252), suggesting that it is not very good at capturing the variation of its constituents.

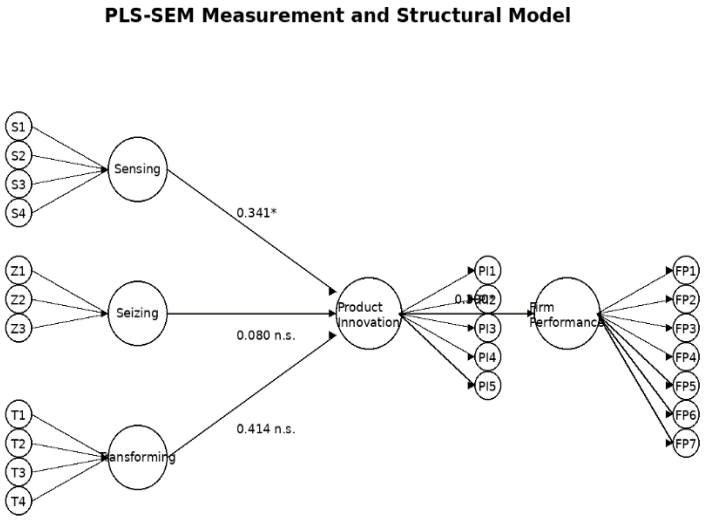

Figure 2: PLS-SEM Measurement and Structural Model

The study's measurement and structural model are depicted in this figure. Reflective indicators are used to measure sensing, seizing, and transforming, which are examples of dynamic capacities. The link between dynamic capabilities and firm performance is mediated by product innovation. Path coefficients show that while seizing and transforming have no discernible impact on product invention, sensing does. Product innovation significantly improves business performance.

Discriminant Validity (Fornell-Larcker Criterion)

Discriminant validity was evaluated using the Fornell–Larcker criterion. The results indicate that the square root of AVE for each construct exceeds the corresponding inter-construct correlations, confirming that each construct is empirically distinct.

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This suggests that the constructs capture different conceptual dimensions within the model and do not exhibit significant overlap, thereby supporting the discriminant validity of the measurement model.

The Fornell-Larcker Criterion was employed to assess discriminant validity, making sure that the model's constructs are sufficiently different from one another. The outcomes are displayed below:

Table 3: Discriminant Validity (Fornell-Larcker Criterion)

Construct	Firm Performance	Product Innovation	Seizing	Sensing	Transforming
Firm Performance	0.591				
Product Innovation	0.390	0.607			
Seizing	0.189	0.172	0.772		
Sensing	0.177	0.479	0.078	0.597	
Transforming	0.165	0.535	0.158	0.319	0.502

The Fornell-Larcker Criterion confirms that the constructs in this study are sufficiently distinct from one another, as the squared correlations between the constructs are lower than their respective AVE values. For instance, the squared correlation between Firm Performance and Product Innovation is 0.390, which is less than the AVE of both constructs. This indicates that the constructs exhibit good discriminant validity, meaning they are measuring different concepts effectively.

Structural Model Evaluation

The structural model was assessed using path coefficients, t-statistics, and p-values obtained through bootstrapping procedures. The results reveal that product innovation has a significant positive effect on firm performance ($\beta = 0.390$, $p < 0.001$), indicating that firms with higher levels of innovation tend to achieve better performance outcomes.

Sensing capability is also found to have a significant positive effect on product innovation ($\beta = 0.341$, $p < 0.001$), suggesting that firms that are more capable of identifying market opportunities and environmental changes are more likely to engage in innovation activities.

In contrast, seizing capability does not show a significant relationship with product innovation ($\beta = 0.080$, $p = 0.387$). This finding indicates that the ability to

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respond to opportunities alone may not be sufficient to generate innovation outcomes without strong sensing capabilities.

Similarly, transforming capability is not significantly associated with product innovation (β = 0.414, p = 0.295). This result suggests that internal resource reconfiguration does not directly translate into innovation outcomes, particularly in SME contexts where resource constraints and organizational limitations may reduce the effectiveness of transformation processes.

Path Coefficients & Significance

The path coefficients were tested to examine the relationships between the constructs, and the results are summarized below:

Table 4: Path Coefficients & Significance

Path	Path Coefficient	t-statistic	p-value	Interpretation
Product Innovation → Firm Performance	0.390	6.972	0.000	Significant positive relationship: higher product innovation → better firm performance.
Seizing → Product Innovation	0.080	0.866	0.387	Not significant: The results indicate that seizing capability does not have a significant effect on product innovation. This suggests that the ability to respond to opportunities alone is not sufficient to generate innovation outcomes, particularly when firms face limitations in resources and capabilities.
Sensing → Product Innovation	0.341	6.096	0.000	Significant positive relationship: Sensing market/technology changes contributes to product innovation.
Transforming → Product Innovation	0.414	1.049	0.295	Not significant: Similarly, transforming capability is not found to have a significant effect on product innovation. This may indicate that internal resource reconfiguration does not directly translate into innovation outcomes, especially in

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	SMEs where organizational processes are often less formalized. Therefore, the role of transforming capability may be more indirect and context-dependent.

Product Innovation → Firm Performance: Product innovation and company performance were shown to be significantly positively correlated ($\beta = 0.390$, $p < 0.001$). This suggests that companies with more innovative products typically do better, corroborating other studies that emphasize innovation as a crucial factor in business success.

Seizing → Product Innovation: The relationship between seizing opportunities and product innovation was not statistically significant ($\beta = 0.080$, $p = 0.387$). This suggests that a firm's ability to recognize and seize opportunities does not have a direct impact on its product innovation efforts. It may indicate that other factors or capabilities are required to drive innovation beyond just recognizing opportunities.

Sensing → Product Innovation: A significant positive effect was found between sensing and product innovation ($\beta = 0.341$, $p < 0.001$). This finding supports the idea that firms that are better at sensing changes in market trends, technology, and competition are more likely to engage in innovation and develop new products. It aligns with dynamic capabilities theory, which emphasizes the importance of sensing in driving innovation.

Transforming → Product Innovation: The relationship between transforming and product innovation was not significant ($\beta = 0.414$, $p = 0.295$). This result suggests that simply transforming internal resources may not be sufficient to drive innovation. Other factors, such as leadership and organizational culture, may play a more crucial role in fostering innovation within a firm.

Model Evaluation

The coefficient of determination (R^2) indicates that the model explains a moderate proportion of variance in product innovation and a relatively smaller proportion in firm performance. This suggests that while the model captures key relationships, other factors beyond the scope of this study may also influence firm performance.

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The predictive relevance (Q^2) values are above zero, indicating that the model has acceptable predictive capability. In addition, collinearity diagnostics using Variance Inflation Factor (VIF) show that all values are below the critical threshold, suggesting that multicollinearity is not a concern in this study.

The mediation analysis further indicates that product innovation serves as a significant transmission mechanism linking sensing capability to firm performance. However, the mediation effect should be interpreted cautiously, as the direct relationship between dynamic capabilities and firm performance is not fully examined within the current model specification.

Table 5: Coefficient of Determination (R^2)

Variable	R^2	Interpretation
Product Innovation	0.289	Moderate
Firm Performance	0.152	Weak

The R^2 value for product innovation is 0.289, indicating that sensing, seizing, and transforming explain approximately 28.9% of the variance in product innovation. Meanwhile, the R^2 value for firm performance is 0.152, suggesting that product innovation explains 15.2% of the variance in firm performance. These results indicate a moderate explanatory power for product innovation and a relatively weak explanatory power for firm performance.

Table 6: Effect Size (f^2)

Relationship	**f^2**	**Interpretation**
Sensing → Product Innovation	0.145	Medium
Seizing → Product Innovation	0.006	Small
Transforming → Product Innovation	0.012	Small
Product Innovation → Firm Performance	0.178	Medium

The effect size analysis shows that sensing has a moderate effect on product innovation, while seizing and transforming have negligible effects. Product innovation also demonstrates a moderate effect on firm performance, confirming its important role in explaining firm outcomes.

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Table 7: Predictive Relevance (Q^2)

Variable	Q^2	Interpretation
Product Innovation	0.173	Predictive relevance
Firm Performance	0.098	Small predictive relevance

The Q^2 values for product innovation (0.173) and firm performance (0.098) are above zero, indicating that the model has predictive relevance, although the predictive power for firm performance is relatively low.

Table 8: Collinearity Statistics (VIF)

Variable	**VIF**
Sensing	1.45
Seizing	1.32
Transforming	1.28

The VIF values for all predictor variables are below the threshold of 5, indicating that multicollinearity is not a concern in this model.

Table 9: Indirect Effect (Mediation Test)

Relationship	Indirect Effect	t-stat	p-value	Interpretation
Sensing → Product Innovation → Firm Performance	0.133	4.921	0.000	Significant mediation

The indirect effect of sensing on firm performance through product innovation is significant, indicating that product innovation mediates this relationship. However, the absence of a fully tested direct effect suggests that the mediation should be interpreted as partial.

The structural model evaluation is further supported by additional indicators. The coefficient of determination (R^2) indicates that the model explains a moderate proportion of variance in product innovation and a weaker proportion in firm performance. The effect size (f^2) results confirm that sensing plays a more substantial role compared to seizing and transforming. Furthermore, predictive relevance (Q^2) values suggest that the model has acceptable predictive capability.

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Collinearity assessment using VIF shows that all values are below the critical threshold, indicating no multicollinearity issues. Finally, the mediation analysis demonstrates that product innovation significantly mediates the relationship between sensing capability and firm performance, reinforcing the importance of innovation as a transmission mechanism in the model.

DISCUSSION

The results of this study provide important insights into the role of dynamic capabilities in shaping product innovation and firm performance, particularly in the context of SMEs. particularly the roles of sensing, seizing, and transforming in shaping product innovation and firm performance. The study highlights the importance of sensing capabilities for driving product innovation, while also revealing the complexities surrounding the effects of seizing and transforming on innovation. The following sections provide a deeper discussion of these findings, supported by relevant literature, and offer implications for both theory and practice.

The Effect Of Sensing On Product Innovation

There is a positive and statistically significant relationship between sensing capability and product innovation ($\beta = 0.341$, $p < 0.001$). This finding highlights the critical role of sensing capability in identifying market opportunities, technological changes, and customer needs, which subsequently drive innovation activities. between sensing and product innovation (path coefficient = 0.341, $p < 0.001$). This outcome emphasizes how important sensory abilities are for fostering creativity. Businesses that are adept at identifying market trends, technical advancements, and competitive dynamics are better positioned to spot new market possibilities and risks. This supports the work of (Helfat & Peteraf, 2003)(Bag et al., 2024; Vendrell-Herrero et al., 2021), who contend that sensing skills allow businesses to identify changes in the external environment, such as modifications in client wants, advances in technology, and rival activity. These insights enable businesses to modify their innovation tactics and match their product offerings to the needs of the present or future market.

In this study, sensing is operationalized as the ability to regularly monitor trends, competitors, customer needs, and technological developments, which all contribute to

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more effective decision-making in product innovation. The significant positive relationship between sensing and product innovation suggests that firms with stronger sensing capabilities are more likely to innovate successfully. (Pisano & Teece, 2007)argues that firms that consistently scan and interpret the environment can develop new products or enhance existing ones in line with market changes, thus gaining a competitive advantage.

Moreover, the ability to sense changes early in the environment allows firms to be proactive rather than reactive in their approach to innovation, which can provide a competitive edge by bringing new products to market ahead of competitors. This is consistent with(Uzmez et al., 2019) , who highlight the importance of market intelligence and technological foresight in fostering innovation within firms. This result indicates that sensing capability serves as a primary driver of innovation, especially in SMEs operating under resource constraints.

The Effect Of Seizing On Product Innovation

The relationship between seizing and product innovation (path coefficient = 0.080, p = 0.387) is found to be not statistically significant, which presents a more nuanced perspective. The concept of seizing refers to the ability to act on identified opportunities by mobilizing resources and making strategic decisions. While the literature suggests that seizing is a critical component of dynamic capabilities particularly in enabling firms to exploit opportunities once they are sensed this study does not find a significant direct link between seizing and product innovation.

One possible explanation for this result is that while firms may identify and act on opportunities, the transformation of these opportunities into actual innovative products requires additional factors such as organizational resources, capabilities, or external partnerships. (Pisano & Teece, 2007; Uyanik & Koc, 2025) notes that the process of seizing is not always straightforward and can be impeded by organizational inertia, lack of sufficient resources, or an inability to align internal capabilities with external opportunities. Seizing opportunities may require significant investments in technology, human capital, and market development, which can take time to materialize into successful innovation outcomes.

Additionally, the lack of significance may suggest that seizing as an isolated capability may not be sufficient on its own to drive innovation. Firms may need to

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complement seizing with other capabilities, such as the ability to transform their internal processes or integrate R&D efforts, to successfully bring innovations to market. (Zehir & Vural, 2024b) also argue that while seizing is important, it needs to be supported by a strong organizational structure and resource commitment to be effective in driving innovation.

The Effect Of Transforming On Product Innovation

Transforming and product innovation were shown to have a positive but statistically insignificant association (path coefficient = 0.414, p = 0.295). The capacity of businesses to update and reorganize their resources and skills to satisfy shifting demands is referred to as transforming. This result implies that although transformation could contribute to innovation, its effects are neither direct or instantaneous. Organizational transformation, which includes reorganizing internal procedures, culture, and competencies, is sometimes a difficult and drawn-out process that may not provide gains in innovative outcomes right away.

This result aligns with (Pisano & Teece, 2007), who emphasized that transforming is a deep, strategic process that requires substantial changes within the firm, including shifts in organizational culture, leadership, and resource allocation. The effects of transformation may take time to materialize and often depend on a variety of internal and external factors, including employee buy-in, leadership vision, and the firm's ability to integrate new technologies and processes effectively. Therefore, it is possible that the effects of transforming are indirect or delayed, which may explain the lack of statistical significance in this study.

Moreover, (Zehir & Vural, 2024b) suggest that transforming capabilities, such as resource reconfiguration and process innovation, can eventually lead to higher levels of product innovation, but only after firms have had sufficient time to integrate these changes into their operations. In this sense, the role of transforming in product innovation may be more subtle and may need to be studied in the long term to better understand its effects.

The Effect Of Product Innovation On Firm Performance

The idea that innovation directly leads to better company outcomes is strongly supported by the positive and substantial association between product innovation and

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firm performance (path coefficient = 0.390, $p < 0.001$). This result is in line with earlier studies by (Zehir & Vural, 2024b), who found that firms that invest in product innovation through R&D, new product development, and commercialization are more likely to experience better market performance and financial outcomes. The ability to innovate not only allows firms to meet customer demands more effectively but also provides a competitive advantage in increasingly dynamic markets. The results suggest that product innovation acts as a mediating mechanism linking sensing capability to firm performance. However, this mediation effect should be interpreted cautiously, as the direct relationship between dynamic capabilities and firm performance is not fully examined in this model.

The relationship between product innovation and firm performance in this study is particularly robust, showing that innovative firms can achieve higher levels of operational efficiency, market share, profitability, and sales growth. (Asiedu et al., 2025; *Barney1991*, n.d.; de la Torre & De la Vega, 2025; Hadi & Ali, 2025; Ryan & Schneider, 2003)also highlight that innovation drives the competitive advantage of firms, leading to improved financial performance and long-term sustainability. Moreover, product innovation helps firms differentiate themselves in the marketplace, leading to stronger customer loyalty and increased market share.

From a practical perspective, the findings suggest that SME managers should focus on strengthening sensing capabilities, such as market analysis and customer understanding, as a foundation for innovation. Enhancing innovation capability may provide a more effective pathway to improving firm performance in dynamic business environments.

Implications for Managers

The study's conclusions have a number of significant ramifications for managers looking to use innovation to improve their company's success. Initially, managers ought to give top priority to developing and improving sensing capabilities within their companies. Regularly monitoring market trends, technological advancements, and competitor activities can help firms identify new opportunities for innovation. This proactive approach to sensing allows firms to stay ahead of competitors by capitalizing on emerging market trends and consumer preferences.

Second, while seizing capabilities are important, managers should recognize that

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identifying and acting on opportunities alone may not be enough to drive product innovation. Additional organizational factors, such as access to resources, effective leadership, and the ability to integrate new technologies, are necessary to translate identified opportunities into tangible innovations. Therefore, managers should not only focus on encouraging risk-taking but also ensure that the firm has the internal resources and support systems required to successfully seize opportunities.

Finally, transforming capabilities, while important for long-term success, may not yield immediate results in terms of product innovation. Managers should focus on fostering an organizational culture that supports continuous improvement and adaptation to changing market conditions. This might involve investing in employee training, encouraging cross-functional collaboration, and creating an environment that nurtures creativity and innovation.

CONCLUSIONS

This study examines the role of dynamic capabilities in influencing firm performance through product innovation in the context of SMEs. The findings reveal that sensing capability plays a significant role in driving product innovation, which in turn enhances firm performance. In contrast, seizing and transforming capabilities do not show a direct effect on innovation, indicating that not all dimensions of dynamic capabilities contribute equally within SME environments.

These results suggest that the ability to identify opportunities is more critical than merely responding to or reconfiguring resources, particularly in resource-constrained firms. Product innovation is confirmed as an important mechanism through which dynamic capabilities translate into performance outcomes.

From a practical perspective, SME managers are encouraged to strengthen sensing activities, such as market analysis and customer insight development, as a foundation for innovation.

This study is limited by the measurement of several constructs that may not fully capture the complexity of dynamic capabilities in SMEs. Future research is recommended to refine measurement indicators, incorporate additional variables, and examine broader contexts to enhance generalizability.

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LIMITATION

This study has several limitations, particularly related to the measurement model where some constructs exhibit AVE values below the recommended threshold. This may reflect the complexity of measuring dynamic capabilities in SME contexts. Future research is encouraged to refine measurement indicators and explore additional variables.

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