

STRATEGIC THINKING ON INNOVATION PERFORMANCE: ROLE OF TECHNOLOGICAL CHANGE

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Abstract

This study investigates the influence of strategic thinking on innovation performance of Small and Medium Enterprises (SMEs) in Nigeria, with a focus on Sunseed Nigeria Limited in Zaria. It further explores the moderating role of technological change in this relationship. Innovation performance, a key driver of competitiveness, is hindered in many SMEs due to inadequate strategic orientation and limited technological adoption. The research employs a cross-sectional survey design, utilizing Structural Equation Modeling (SEM) to analyze data from 278 respondents within Sunseed Nigeria. The results indicate that strategic thinking, particularly organizational awareness, significantly enhances innovation performance. Technological change, however, moderates this relationship negatively when its pace surpasses the firm's capacity to adapt strategically. This suggests that while technological advancements offer opportunities for innovation, they may overwhelm SMEs with limited resources and readiness. The study contributes to the understanding of how SMEs can balance strategically with technological adaptation to sustain long-term innovation. It also highlights the need for tailored technological readiness programs and strategic agility to better direct rapid changes in the business environment. Future research should explore other dimensions of strategic thinking and investigate the role of digital infrastructure in supporting innovation in dynamic sectors.

Key words: Innovation performance, SME, Strategic thinking, Technological change

Introduction

Small and Medium Enterprises (SMEs) are under increased pressure in the current era of dynamic competition. SMEs in Nigeria economy, contributes about 90% and 48% to GDP as reported by Small and Medium Enterprises Agency of Nigeria (SMEDAN, 2023). Moreover, there have been a unanimous agreement in the literatures amongst scholars on the importance of SMEs as a developer of economy (Aksoy, 2017; Sarpong & Teirlinck, 2018; Muñoz-Pascual et al., 2019).

However, SMEs continue to face numerous challenges in achieving effective innovation for a better outcome (Eniola & Entebang, 2024). Innovation performance involves stages which starts from developing new ideas to it implementation that will enhance and give businesses a competitive advantage (Yu, et al, 2024). Hence, innovation performance is not just about generating ideas, but implementing the ideas successfully to achieve valuable outcome.

Furthermore, reports by World Bank (2024) indicate that just less than 30% of SMEs actively adopts technology into their innovation processes. Thus, potential transformation has not been fully leveraged on by SMEs. This lack of adaptation is mainly due to high cost of technological access, and low digital literacy among owner managers (Ebuka, et al., 2020). Typically, SMEs in Zaria metropolitan may have strong entrepreneurial initiative, nevertheless still lack either strategic thinking capability or technological orientation that can transform ideas into enhanced innovation performance.

Again, many SMEs generate novel ideas, but they commonly fail in translating these ideas into tangible, workable and impactful innovation which is due to inadequate strategic orientation (Ahmad et al., 2024). Moreover, strategic thinking is the ability of organizations to anticipate, and maintain flexibility as they initiate changes within the process that is central to guiding innovation in SMEs (Henriquez-Calvo, & Díaz-Martínez, 2023). Although, SMEs operate in informal or semi-structured environments, where business decisions are often reactive rather than strategically driven (Pablo, & London, 2020). As such, innovation efforts, developmental process and its improvement are frequently short lived due to limited technological adaptation, and unstable environmental conditions, (Eniola & Entebang, 2024; NBS, 2023).

Furthermore, technological change, is ideally to propel SMEs for innovation but it has presented both opportunities and challenges (Gun Jea Yu, Joon kyum Lee & Bumsoo Kim, 2024). Hence, it is seen as a double-edged sword that offers opportunity that gives room for innovation, and also present owner managers with a more complex and challenges in integration. This is particular to SMEs lack of maturity in digital applicability (2024; Deloitte, World Bank, 2022).

Similarly, in the agribusiness sector, strategic thinking remains a vital driver of innovation performance, particularly among firms confronting unstable supply chains, evolving consumer preferences, and ongoing technological disruptions (Ilić, Stanković, & Ostojić, 2024). Sunseed Nigeria Limited, as a major participant in the country's agro-processing industry, shows this challenge. Despite its diversified operations in feed production, commodity trading, and edible oil processing, the company's innovation efforts tend to be reactive rather than forward-looking, this limits its capacity to sustain a long-term competitive advantage. Consequently, existing research offers limited insight into how strategic thinking influences innovation performance, with technological change as a moderating factor.

While empirical evidence on the direct effect of strategic thinking on innovation performance remains limited, Halevy (2020) suggests that future research should explore the relevance of strategic thinking in different organizational contexts. The theoretical foundations of the present study indicate a meaningful connection. Therefore, this research examines the influence of strategic thinking on innovation performance and further explores the moderating role of technological change within Sunseed Company Nigeria Limited Zaria, Kaduna State.

Literature Review and Theoretical Framework

Innovation performance has become a core determinant of organizational competitiveness, particularly in dynamic and technology-driven business environments. Strategic thinking, characterised by foresight, creativity, and adaptability, it provides firms with the cognitive capability to align resources and strategies with emerging opportunities and threats. Prior studies emphasize that organizations engaging in strategic thinking are more likely to sustain

innovation outcomes through deliberate planning and flexibility in decision-making (Halevy, 2020). However, the strength of this relationship may vary depending on external forces such as technological change, which alters market conditions, consumer behavior, and production processes.

Moreover, technological change, as a moderating factor, can either influence or weakens how strategic intentions translate into innovative performance. It is observed that, when technological shifts are rapid, organizations with robust strategic thinking can better anticipate disruption, adopt new technologies, and maintain innovation effectiveness. Consequently, the moderating perspective aligns with the Innovation Diffusion Theory (Rogers, 2003), the theory explains how new technologies spread are adopted across firms, also Contingency Theory (Lawrence & Lorsch, 1967), posits that, organizational effectiveness depends on the fit between internal strategies and external environmental conditions.

Hence, the above aforementioned theories form the theoretical framework of this study, it integrates these perspectives to explain how technological change conditions the impact of strategic thinking on innovation performance, particularly in industries facing continuous technological evolution. Innovation performance represents a strategic evolution in organizational theory, linking innovation directly to improved performance outcomes. It extends beyond technological progress to include innovative practices across management, human resources, marketing, and operations that collectively enhance productivity and competitiveness (Al_Kasasbeh, 2024). As noted by Selçuk, Çörekcioglu, and Gungor (2025), innovation performance is multidimensional and dynamic, involving the deliberate application of novel strategies, processes, and technologies that improve organizational outputs.

Saemaldaher and Emeagwali (2025) further explain that performance innovation strengthens efficiency, adaptability, and long-term competitiveness in an increasingly volatile environment. In a knowledge-based economy, this integration of innovation with organizational performance has become a defining factor for survival, as firms that continuously innovate outperform those relying on conventional methods. According to Keya and Kinyua (2025), sustaining such advantage depends on developing dynamic capabilities that align innovation with real-time performance measurement, ensuring evidence-based decision-making and continuous improvement.

Scholars emphasize that innovation performance is both a capacity and an indicator of sustainable competitive advantage. Castaneda and Cuellar (2020) view it as a firm's ability to apply accumulated knowledge to achieve superior outcomes, while Orero-Blat et al., (2025) describe it as the product of ongoing skill and knowledge development aimed at strengthening performance. This conceptualization underscores innovation performance as a key determinant of long-term organizational sustainability, reflecting a firm's ability to transform inputs into superior outputs.

Earlier contributions by Wang and Lee (2018) and West and Anderson (1996) established that innovation strategies are essential for maximizing firm value and advancing organizational development. More recently, Ma et al. (2023) linked innovation performance to improved employee growth, stronger team cohesion, and enhanced communication, highlighting its role in continuous performance improvement. Although profitability and growth remain traditional measures (Coco, Colapinto, & Finotto, 2024), contemporary perspectives stress that innovation performance also encompasses the successful generation

and implementation of new ideas that yield lasting competitive advantages and better organizational outcomes.

Strategic Thinking and Innovation Performance

Strategic thinking mostly involves foreseeing future opportunities and formulating approaches to achieve long-term competitive advantage amid rapid and unpredictable change. The exertion arises because the future has remained an abstract concept, which is filled with uncertainty, particularly concerning emerging technologies and evolving business landscapes (Foss, & Klein, 2025). In contrast, the future cannot be reliably forecasted by extending present trends, as it is increasingly shaped by disruptive innovations and technological breakthroughs (Lee, 2023; Taylor & Hudson, 2024; Cheng, Novak, & Patel, 2025).

Furthermore, strategic thinking is seen as a vital cognitive process that combines creativity, foresight, and insight to envision and shape the future of a firm. Foresight refers to anticipating trends and potential outcomes before they materialize, while insight involves uncovering novel approaches that create value and drive future direction (Khamis, 2025). These capacities are essential in environments where innovation is a key performance indicator.

Moreover, organizations that engage in strategic thinking are better positioned to identify emerging opportunities, adapt to dynamic environments, and enhance their innovation performance (Mueller-Saegebrecht, & Walter, 2025). Strategic thinking requires a deliberate research, in-depth analysis, and thoughtful planning to guide organizational decisions and actions (Training, 2011; O'Shannassy, 1999). Thus, Strategic thinking is typically associated with creative and divergent thinking styles, (Heracleous, 1998). Strategic thinking is crucial when considering innovation that thrives in flexible and imaginative organizational cultures more often nurtured performance.

However, the literature presents varying perspectives on the nature and utility of strategic thinking. Tavakoli and Lawton (2005), building on Stumpf (1989) study, which emphasize that strategic thinkers possess the ability to interpret and reorganize information in multiple configurations, thereby generating innovative strategic options. Hence, flexibility and adaptability are critical drivers of innovation performance, especially in rapidly changing or competitive environment.

Moreover, Graetz (2002) highlights that strategic thinking involves temporal integration linking past experiences, present realities, and future possibilities. This orientation allows firms to continuously innovate by drawing from a comprehensive understanding of trends and evolving market needs. Thus, the following hypothesis is observed.

H01 Strategic thinking does not have a significant effect on innovation performance

Technological Change as a Moderator and Innovation Performance

Technological change plays a vital role in improving firms' innovation performance by fostering process efficiency and strengthening competitive advantage. Empirical evidence across diverse sectors has consistently shown that technological change significantly affects innovation outcomes, particularly when integrated with strong organizational capabilities and strategic alignment (Sabherwal et al., 2019; Ravichandran, 2018; Cui et al., 2015). Studies in high-technology industries further support this position. Zhang and Zhu (2020) found that Chinese firms with greater research and development (R&D) investment and diverse technological portfolios achieved superior innovation outcomes.

Similarly, Ho et al., (2005) examined electronics firms in Hong Kong and revealed that firms with structured R&D departments, effective resource allocation, and innovation-oriented cultures demonstrated higher levels of innovation performance. Gunday et al. (2011) concluded that technological change enhances innovation, which subsequently contributes to firm performance. Similarly, Müller et al. (2020) also confirmed a positive relationship between intense technological change and innovation performance.

However, other studies offer contrasting perspectives on this relationship. Zhao, Liu, and Deng (2019; Tavakoli and Lawton 2005; Oliveira and Martins, 2011) emphasized that both internal technological readiness and external pressures shape the extent to which firms adopt and utilize new technologies to drive innovation. More recent studies reveal the synergistic effect of technological change (Graetz and Michaels, 2018; Dellermann et al, 2023) further suggested that technological change is evolving toward intelligent and adaptive systems that transform how innovation is generated. Although technological change generally contributes to innovation performance, its effects are contingent on industry type, organizational readiness, and strategic vision.

Thus, this study conceptualizes technological change not merely as a complementary factor but as a moderating variable that reinforces the relationship between strategic thinking and innovation performance. This theoretical stance strengthens contextual relevance, especially within the agribusiness sector. However, the assumption that all technological advancements uniformly enhance innovation overlooks key contingency factors such as industry characteristics, organizational readiness, cultural adaptability, and strategic orientation. While firms operating in service-oriented or digitally advanced economies may experience immediate benefits from technological change, those in developing economies often lack the infrastructural capacity and strategic flexibility to effectively integrate such changes. Consequently, the benefits of technological advancement are not evenly distributed across sectors or regions, highlighting the need for a more context-sensitive understanding of technology's influence on innovation performance.

Although previous studies have expanded understanding of the relationship between technological change and innovation performance, many have not sufficiently examined the mechanisms that facilitate effective technological utilization. To enhance theoretical integration, This conceptual clarification provides stronger theoretical grounding and aligns more closely with the operational realities of the agribusiness sector, where technological adaptation and strategic decision-making are essential for sustaining innovation and competitiveness.

HO₂ Technological change does not moderate the relationship between strategic thinking and innovation performance.

Theoretical framework (underpinning theory)

Dynamic Capabilities Theory (DCT) by Teece, Pisano, & Shuen, (1997) emphasizes on an organization's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments. In the context of Sun Seed Nigeria limited as an organization in the agro-processing sector facing technological volatility and market unpredictability. DCT provides a robust lens to understand the impact of strategic thinking on innovation performance and how technological change moderates the relationship.

Theoretical Application to the Variables under Study

Innovation performance (DV) can be seen as a performance outcome resulting from how well an organization can reconfigure and deploy its capabilities that can be measured through improved seeds processing techniques and the enhancement of productivity. Also, strategic thinking (IV) is a higher order dynamic capability that allows the organization to sense opportunities, forecast on technological change that aligns with the firms' innovative strategies. Thus, in Sun Seed strategic thinking can involve a long-time market planning, foresight in product development, and technological scanning. Similarly, technological change as a moderator deals with the external dynamic factor that requires Sun Seed to renew their internal capabilities for better competitive edge, it also requires the company to strategically adapt to technological advances in seed genetics and machinery.

The moderating role of technological change in DCT is seen as a force that triggers Sun Seed to mobilize their dynamic capabilities that will enable strategic thinking to enhance innovation performance. However, its effectiveness on the relationship relies much on the level at which technology effect changes in the organization. Moreover, when technological change is high and the organization possess a strategic foresight the innovation performance will significantly improve, like wise in a low condition of technological change no matter the strong strategic thinking it may still yield a limited innovation outcome. Hence, the research model is presented below;

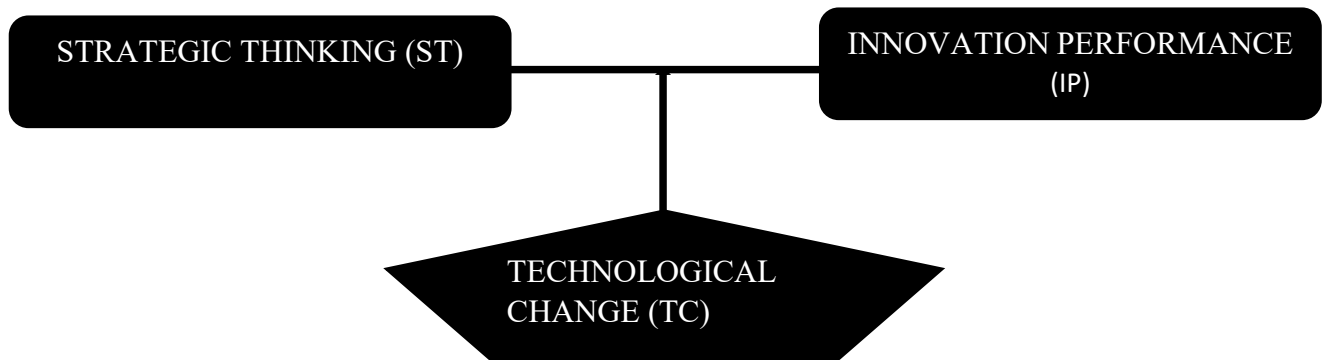


Figure 1 Research Model

Materials and Method

This study is cross-sectional and we employed survey research design, where data were sourced using a well-structured instrument adapted from previous studies. The questionnaires were randomly and purposively distributed within the firm. A sample size of 214 was proposed as suitable for the given parameters, considering the population of 400, using Krejcie and Morgan sample size table (Krejcie, & Morgan, 1970). However, for the need to achieve greater statistical power, reduce margin of error, and improve the reliability of the result under study, a 30% increase in the sample size was added to the initial sample size of 214 which made the total sample size at 278. In quantitative research, larger sample sizes reduce sampling error and increase the precision of parameter estimates, thereby improving the robustness of inferential assumptions (Cohen, 2018). Hair et al. (2021), posits that, in employing variance-based structural equation modeling PLS-SEM, and includes multiple constructs, indicators, and moderating effects a larger sample helps to ensure model stability.

Measurement and Instruments

Out of the 278 questionnaires distributed to top, middle and lower-level managers, 272 were correctly completed and returned, representing a valid response rate of 97.84%. According to Baruch and Holtom (2008), the average response rate for organizational studies is approximately 52.7%, while a rate above 70% is considered excellent (Babbie, 2007). Hence, the response rate obtained in this study is regarded as satisfactory and sufficient for quantitative analysis, minimizing potential non-response bias (Dillman et al., 2014).

Prior to analysis, the data underwent preliminary screening to ensure accuracy and consistency. Missing values were treated using series mean substitution, and 7 extreme outliers were identified and removed to maintain data integrity, The final dataset of 268 responses was retained for further analysis. Multicollinearity diagnostics revealed that all Variance Inflation Factor (VIF) Data was collected through a well-structured questionnaire that were developed on a 5 Likert scale 5-point Likert scale ranging from "strongly disagree" to "strongly agree." validated instrument. The items that measure innovation performance were adapted from previous study. Although strategic thinking is a multidimensional construct with Reflection, Organization awareness, Trend analysis, and Pattern recognition. The study operationalized strategic thinking through organizational awareness, as it represents the most contextually relevant to the research context.

Theoretically, organizational awareness best represents the perception capability described in the Dynamic Capabilities Theory (Teece, 2007). Within dynamic and technology-driven environments such as agribusiness, a firm's ability to perceive internal and external changes, interpret signals, and align actions which is fundamental to innovation performance. The emphasis on organizational awareness also provides a parsimonious thus far theoretically grounded approach that ensures conceptual clarity while capturing the essential cognitive dimension of strategic thinking.

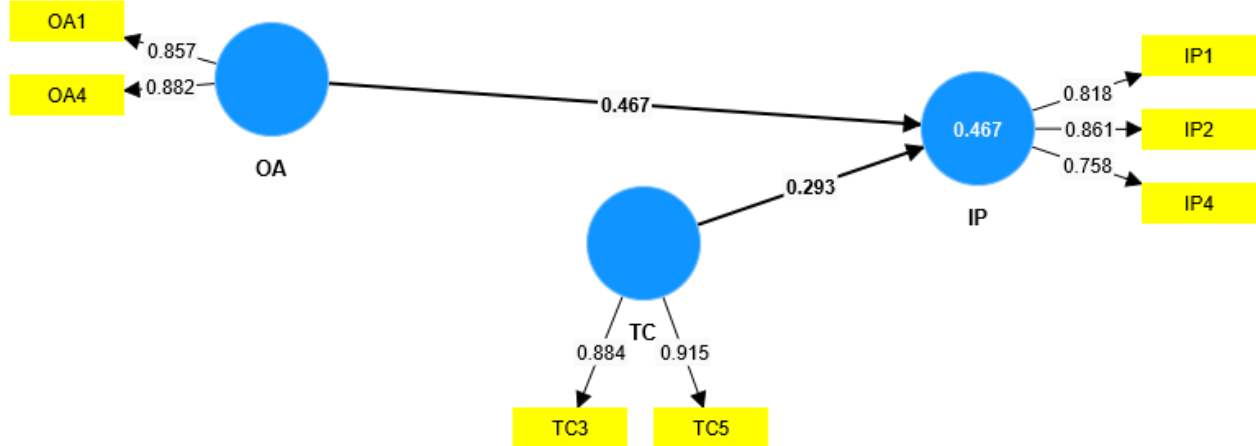
Strategic thinking therefore, was seen as organizational awareness taken from one of its dimensions with four items scale by (Sanjay Dhir, Swati Dhir, & Payel Samanta, 2018). Innovation performance construct was measured using four items by Brettel and Cleven (2011) as a self-reported satisfaction with innovation performance outcome. Technological change was measured using sixteen items by Parasuraman & Colby (2015), Reliability assessment using Cronbach's alpha indicated satisfactory internal consistency, with all constructs exceeding the 0.70 threshold recommended by Nunnally (1978; and Hair et al. (2021).

Data Analysis and Measurement and Structural Model

Data analysis was conducted using Structural Equation Modeling (SEM) via the Partial Least Squares (PLS) approach. PLS-SEM was chosen due to its suitability for complex models and relatively moderate sample sizes (Hair et al., 2021). This method allows for simultaneous assessment of the measurement and structural models, providing both confirmatory and predictive insights (Baron & Kenny, 1986; Frazier et al., 2004). The measurement model evaluated item reliability, internal consistency, convergent validity, and discriminant validity, which were all within the acceptable range, confirming the adequacy of the measurement model (Becker et al., 2012; Ringle et al., 2012). While the structural model tested the hypothesized relationships, through the moderating effect of Technological Change on the link between Strategic Thinking and Innovation Performance.

Below diagram explain the measurement model, as part of SEM model that describes the relationships among the latent variables and their indicators (Becker et al. 2012), and the outer model parameter estimates consist of the loadings (Ringle et al. 2012).

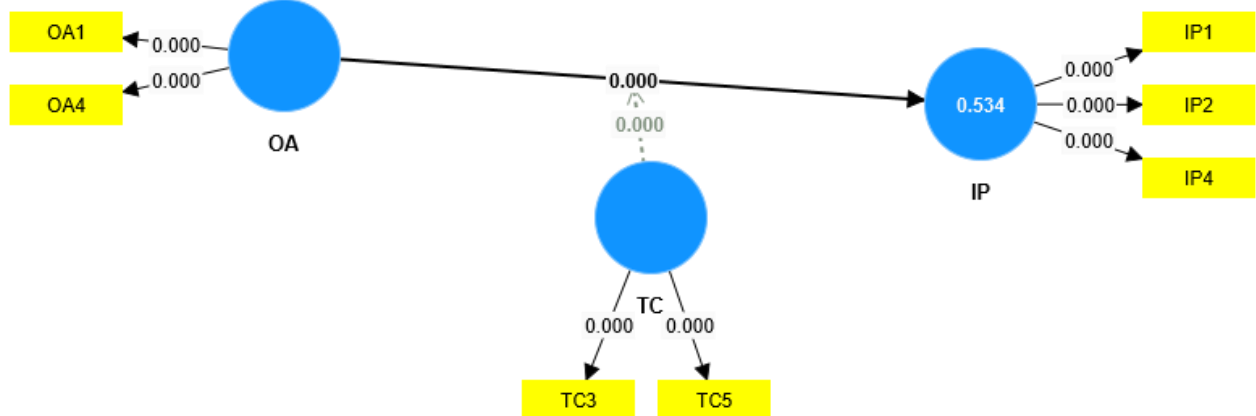
Figure 2 Measurement Model



Source: Smart PLS version 4, 2025

The measurement model above shows the latent variables and the endogenous variable with all the loadings. The above model has shown that all loadings are above the threshold of 0.7 as recommended by (Hair, et al, 2022; Ringle, et al, 2020; Hulland, 1999). Though, some items were removed because they fail to load within or above 7.0. Items removed are; organizational awareness 2 item, technological change 7 items, and innovation performance 1 item which make a total of 10 items removed from measurement model loadings.

Figure3; Structural Model



Source: Smart PLS version 4, 2025

Above figure depict the structural model of the study. The model has shown the direct and indirect effect of the exogenous and endogenous variables and its significant level.

R-Squared

The coefficient of determination (R^2) illustrates the amount of variance in the endogenous constructs. It indicates that the threshold value of 0.25 (as weak), 0.5 (as moderate) and 0.7 (as substantial respectively) (Chin 1998). Thus, below is the R square value for the study.

Table 1: Coefficient of Determination

R Square	R Square	R Square Adjusted
EP	0.467	0.464

Source: Smart PLS version 4, 2025

Above shows the R^2 value at 0.467. Hence, it explains the amount of variance from the exogenous variable to the endogenous variable at 46.7% variation.

The measurement model analysis demonstrated satisfactory psychometric robustness and theoretical coherence. The measurement model results divulged all indicator loadings exceeds the recommended threshold of 0.70, ranging between 0.758 and 0.915, thus confirming adequate convergent validity. Equally, the internal consistency measures, including Cronbach’s alpha values between 0.679 and 0.766 and composite reliability coefficients ranging from 0.854 to 0.895, fall within acceptable limits, indicating stable and reliable constructs. Although the Cronbach’s alpha value for organizational awareness (0.679) was marginally below the conventional 0.70 threshold, it remains acceptable for exploratory research settings (Nunnally & Bernstein, 1994; Hair et al., 2021). This level of internal consistency is considered satisfactory given the contextual nature of the construct and the study’s focus on behavioral dimensions. Moreover, the construct’s composite reliability (0.861) and average variance extracted (0.756) exceeded the recommended limits, confirming that the indicators adequately represent the latent variable. Hence, the reliability of the measurement model remains acceptable.

The Average Variance Extracted (AVE) values, which range from 0.662 to 0.809, further support convergent validity, suggesting that each construct explains more than 50 percent of the variance in its observed indicators. The structural model results reveal that Organizational Awareness exerts a moderate and significant positive effect on Innovation Performance ($\beta = 0.263$), while its influence on Technological Change ($\beta = 0.104$) appears comparatively weaker. This outcome suggests that organizational awareness contributes more directly to innovation performance by enhancing environmental sensing and decision-making capacity than to the adoption or adaptation of new technologies. Generally, these findings are consistent with the propositions of the Dynamic Capabilities Theory, which emphasizes the role of sensing, seizing, and transforming capabilities in sustaining innovation and competitiveness within dynamic environments.

Table 2: Test of Hypotheses

	Original sample	Standard deviation	T statistics	P values
OA -> IP	0.312	0.066	4.728	0.000
TC -> IP	0.171	0.046	3.712	0.000
TC x OA -> IP	-0.174	0.031	5.683	0.000

Table 1: Discriminant Validity HTMT

	IP	OA	TC
IP			
OA		0.893	
TC		0.751	0.831

Source: Smart PLS version 4, 2025

The structural model results demonstrate statistically significant relationships among the key constructs, indicating strong predictive validity and theoretical coherence. The direct path

from Strategic Thinking through Organizational Awareness (OA) to Innovation Performance (IP) is positive and significant ($\beta = 0.312$, $t = 4.728$, $p < 0.001$), suggesting that firms with higher levels of awareness of their internal and external environments tend to achieve superior innovation outcomes. Similarly, Technological Change (TC) shows a positive and significant effect on Innovation Performance ($\beta = 0.171$, $t = 3.712$, $p < 0.001$), implying that technological adaptation and advancement enhance innovation capacity. However, the interaction term ($TC \times OA \rightarrow IP$) reveals a significant negative moderating effect ($\beta = -0.174$, $t = 5.683$, $p < 0.001$), indicating that at high levels of technological change, the positive influence of organizational awareness on innovation performance diminishes. This suggests that rapid or disruptive technological transitions may strain firms' strategic sensing and decision-making capabilities, thereby reducing the effectiveness of awareness-driven innovation.

In terms of discriminant validity, the HTMT ratios ($OA-IP = 0.893$; $TC-IP = 0.751$; $TC-OA = 0.831$) are all below the conservative threshold of 0.90 (Henseler, Ringle, & Sarstedt, 2015), confirming satisfactory discriminant validity among the constructs. This demonstrates that Strategic Thinking through Organizational Awareness, Technological Change, and Innovation Performance are empirically distinct but conceptually related constructs. Overall, the findings align with the Dynamic Capabilities Theory, highlighting that while awareness and technological adaptability independently promote innovation, excessive technological dynamism can weaken the strategic benefits of awareness within dynamic environments.

Discussion of Findings

The measurement model exhibited strong psychometric properties, with all indicator loadings well above 0.70 and composite reliability values ranging from 0.854 to 0.895, indicating stable and reliable constructs. Convergent validity was confirmed by AVE values between 0.662 and 0.809, and discriminant validity was supported by HTMT ratios below 0.90. Notably, the Cronbach's alpha for organizational awareness was 0.679, slightly under 0.70, but acceptable for exploratory research in this contextual setting. In the structural model, the exogenous variables explained 46.7% of the variance in innovation performance ($R^2 = 0.467$). The path coefficients reveal a significant positive effect of organizational awareness (the strategic thinking dimension) on innovation performance ($\beta = 0.312$, $t = 4.728$, $p < 0.001$), and a significant positive effect of technological change on innovation performance ($\beta = 0.171$, $t = 3.712$, $p < 0.001$). Thus, Hypothesis 1 H_{01} that strategic thinking would have no significant effect on innovation is rejected, since organizational awareness clearly boosts innovation performance. Likewise, Hypothesis 2 H_{02} that technological change would not moderate the relationship is rejected: the interaction term ($TC \times OA$) was significant and negative ($\beta = -0.174$, $t = 5.683$, $p < 0.001$), indicating that higher levels of technological change weaken the positive effect of organizational awareness on innovation. In summary, the structural results demonstrate that both strategic awareness and technology adoption individually drive innovation, but rapid or disruptive technological change can attenuate the strategic impact on innovation outcomes.

These findings are theoretically consistent with Dynamic Capabilities Theory. The positive effect of organizational awareness on innovation performance harmonises with the idea that firms with greater environmental sensing and strategic foresight can better identify opportunities and align resources for new-product development. In dynamic, technology-driven environments like Nigerian agribusinesses, the ability to perceive and interpret internal and external changes is fundamental to innovation. The direct positive effect of technological change also fits prior evidence that updating technology and processes generally enhances

innovative capacity. However, the observed negative moderation suggests a boundary condition, in the resource constrained SMEs in Nigeria like the agro-processing firms, rapid technological turbulence may overwhelm firms' capabilities. Many Nigerian SMEs have low digital literacy and limited access to modern infrastructure, so when technology shifts too quickly, their organizational awareness and strategic planning may not keep pace. This double-edged nature of technology is reflected in the literature, while technology investments can empower innovation, their benefits depend on contextual factors. As Zhao et al. (2019) and others note, internal readiness and external pressures shape how firms leverage new technologies.

In line with the above, recent studies emphasize that technological change generally contributes to innovation performance, but its effects are contingent on industry type, organizational readiness, and strategic vision. In other words, without sufficient readiness on digital skills, infrastructure, intense technological change may strain strategic processes. Thus, our results suggest that in the Nigerian agribusiness SME context, technological dynamism can partly undermine the innovation benefits of strategic awareness, highlighting the importance of matching the pace of change to firm capabilities.

The positive link between strategic thinking and innovation performance found here echoes recent empirical work. Mueller-Saegbrecht and Walter (2025) argue that firms engaging in strategic thinking are better positioned to identify emerging opportunities, adapt to dynamic environments, and enhance their innovation performance. Similarly, Henriquez-Calvo and Díaz-Martínez (2023) emphasize strategic thinking as a key driver of SME growth and innovation in emerging economies. On the technological side, the finding that technological change has a positive direct effect on innovation performance is in line with studies showing that R&D investment and tech intensity boost innovation outcomes (e.g. Zhang & Zhu, 2020; Müller et al., 2020). However, our finding of a negative interaction contrasts with some literature on technology turbulence. For instance, Ba Awain et al. (2025) report that technological turbulence positively moderates the relationship between supply-chain capabilities and product innovation in Omani SMEs ($\beta = 0.454, p < 0.01$)

In their context, high technological turbulence may spur firms to innovate proactively. The divergence suggests contextual contingencies, in better-resourced environments, tech change can amplify innovation efforts, whereas in our context it might overwhelm SMEs' limited capabilities. Overall, while our core results align with the dynamic capabilities perspective and previous SME research, they also underscore the nuanced finding that excessive technological dynamism can dampen the strategic benefits of awareness-driven innovation a nuance that recent studies on technology readiness and innovation (e.g. Dellermann et al., 2023) have begun to highlight.\

Suggestions for Further Study

Future research should treat strategic thinking as a truly multi-dimensional capability rather than focusing on a single facet. Pisapia (2006) conceptualizes strategic thinking in terms of four core dimensions reflection, organizational awareness, trend analysis, and pattern recognition. Since the present study only examined the organizational awareness dimension, subsequent work should include all dimensions of strategic thinking and examine how each uniquely contributes to innovation performance. Each dimension may play a different role: for instance, trend analysis or pattern recognition might be more strongly linked to innovation under certain conditions than reflection or awareness. Testing all four dimensions will clarify whether some aspects of strategic cognition drive innovation more than others (or perhaps interact synergistically) in ways not captured by the current study.

Future studies should unpack the paradoxical role of technological change by identifying the conditions under which it strengthens or weakens the strategic thinking innovation relationship. The present finding of a negative but significant moderating effect suggests that rapid technological change does not uniformly benefit strategic initiatives. Contingency theory implies that environmental turbulence can alter the effectiveness of a firm's capabilities

Future research could examine whether factors like digital infrastructure or absorptive capacity explain this effect, firms with high digital readiness or agile leadership can leverage technological shifts to amplify innovation, whereas less prepared firms find rapid change overwhelming. In other words, scholars should test moderating variables like organizational agility that might flip the sign of the technology change effect, thereby clarifying why technological change sometimes inhibits rather than accelerates the benefits of strategic thinking.

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