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Strategic Agility and Innovation Performance under Environmental Uncertainty

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Abstract

Environmental uncertainty has intensified organizational challenges by creating rapid technological changes, unpredictable market dynamics, and increasing competitive pressures. Under such conditions, organizations require adaptive capabilities that enable them to maintain innovation performance and achieve sustainable competitiveness. This study examines the influence of strategic agility on innovation performance under environmental uncertainty by developing an integrated framework based on the dynamic capability perspective. Using a quantitative research approach, data were collected from 228 managers and organizational decision-makers operating in dynamic industries. The proposed model was analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM). The findings reveal that strategic agility has a significant positive effect on innovation performance, demonstrating that organizations with stronger capabilities in strategic sensitivity, collective commitment, and resource fluidity achieve superior innovation outcomes. The results also indicate that environmental uncertainty strengthens the relationship between strategic agility and innovation performance, highlighting the contextual importance of adaptive capabilities in volatile environments. This study contributes theoretically by extending strategic management literature through the integration of strategic agility, environmental uncertainty, and innovation performance within a unified framework. Practically, the findings provide insights for managers seeking to develop adaptive strategies that enhance innovation capability and organizational resilience in increasingly uncertain business environments.

INTRODUCTION

Today's business landscape is defined by unprecedented volatility, uncertainty, complexity and ambiguity (VUCA), which requires businesses to continually shift their orientations to remain competitive. Many of the challenges, both at the geopolitical and at the global level, such as global warming, technological disruptions, supply chain volatility, or digital transformation, have risen to a point that has significantly contributed to the environmental uncertainty of today's world, and which poses a serious threat to the competitiveness of organizations. The

traditional competitive advantages represent a static approach and are currently expected to be replaced by adaptive characteristics that allow organizations to detect, quickly, the changes in their environment, to take decisions, and to reconfigure their resources accordingly. In this context, strategic agility has become one of the most important organizational attributes for proactively addressing the unpredictable conditions of the environment and maintaining innovation and long-term organizational performance.

In recent years, there has been evidence of companies that excel in strategic agility outperforming their competitors in the most difficult environments. By fostering exploration of new opportunities and exploitation of current capabilities, strategic agility helps organizations move smoothly between new and old, enabling managers to adjust to the rapid pace of technological innovation, changing customer expectations, and more volatile competitive environments. Strategic agility is about a continuous process of strategic renewal, learning, and astute reconfiguration of capabilities, rather than flexibility in terms of process changes as required in the shorter-term. Organizations with the ability to create strategic agility, are therefore more likely to be able to use environmental turbulence for innovation opportunities instead of seeing it as a source of organisational risk.

Thus, the concepts for innovation performance have turned into a strategic indicator of an organization's competitiveness in uncertain business environment. The evaluation of an organization is not only based on its products or services, but also on the ability to continuously generate innovations that strengthen the organisation, the value added for the customer and the sustainable competitive position of the organisation. Innovation performance is about the successful commercialisation of ideas; development of new business models, improvement of the organisation's processes and the development of technological solutions that effectively face environmental changes. In an environment of uncertainty, innovation is more and more reliant on organizational skills that support quick strategic changes, interdepartmental cooperation, and efficient knowledge assimilation. Such a connection makes strategic agility a key antecedent of sustainable innovation performance.

In the last five years, research on strategic agility has grown significantly in several areas, such as strategic management, international business, innovation management and organization behavior. So far, strategic agility is shown to have a positive relationship with organizational performance, international competitiveness, supply chain resilience, digital transformation and organizational adaptability. In particular, Ahammad et al. (2021) showed how strategic agility is a significant factor in improving international performance in dynamic and competitive settings by combining exploration and exploitation strategies. Likewise, recent research revealed that the organizational agility moderates the link between knowledge search and innovation performance, while environment turbulence intensifies the relationships between knowledge search and organizational agility as well as between organizational agility and innovation performance, suggesting that the adaptive capacity of organizations is becoming an increasingly important factor in innovation-driven organizations.

The body of literature has gained in momentum and now sees strategic agility as a far more than organizational flexibility, and one which focuses on the continuous alignment of strategic direction, orchestration of resources, and innovation capability to ensure this strategic direction remains relevant in turbulent business environments. There are a number of recent studies that have identified that agile organisations can better sense emerging opportunities, redirect critical resources and speed up strategic decision-making, thereby enhancing their ability to continue to innovate in turbulent environments. Meanwhile, the challenges of the environment

are more complex than ever before: technological disruption, market volatility, geopolitical instability, climate-related risks, regulatory changes and unpredictable customer preference. Such interrelated challenges call for organizational responsiveness but also an adaptive strategic capacity that enables to continuously innovate, and not just make temporary operational adjustments. The strategic agility has thus become a dynamic capability that combines organizational learning, knowledge recombination, and strategic renewal in order to generate sustainable competitive advantages in uncertain environments.

However, prior studies have some theoretical and empirical drawbacks. First, most prior research has taken a strategic agility–organizational performance, financial performance, operational efficiency or competitive advantage–focused approach, with fewer studies specifically addressing strategic agility–innovation performance as a multidimensional measure of organizational outcomes. Second, very few studies have explored the concept of strategic agility in the context of innovation performance as a multidimensional measure of organizational outcomes. Innovation performance encompasses successful product and service innovation, in addition to organizational process, management, digital and business model improvements. Considering innovation to be an outcome of organizational agility is a simplistic approach that neglects the intricate processes that enable firms to continuously generate value in the face of uncertainty.

Second, environmental uncertainty is often considered as a contextual variable to explain the relationship of organizations with less attention to its strategic implications for innovation management. The nature of uncertainty in the modern world is far from traditional market volatility as the organizations are faced with multiple technological, economic, environmental and institutional disruptions at the same time. This level of complexity means that firms need to embed strategic sensing, quick decision-making, adaptability in resource usage and organisational learning into a strategic framework. Thus, the understanding of how strategic agility contributes to innovation performance when the environment is uncertain is an important contribution to the literature in strategic management.

Third, there is a sparsity of literature that is spread over various research streams such as dynamic capabilities, organizational agility, strategic flexibility, innovation management, environmental turbulence, etc. Each of these viewpoints can be important on its own but few studies have brought it together in a holistic view that would explain how organizations convert uncertainty in the environment into innovation opportunities. This fragmentation hinders the theoretical development and diminishes the usefulness of prevailing results in practice for managers dealing with highly volatile business environments. Therefore, more studies are needed to arrive at a deeper insight into the strategic agility-innovation performance relationship in uncertain organizational environments.

Hence, the novelty of this study is in establishing an integrated strategic management perspective of strategic agility as a dynamic capability of an organization which contributes to its innovation performance within the context of environmental uncertainty. As opposed to previous studies that were mainly concerned with financial outcomes or operational efficiency, this study centres on innovation performance as the key organizational outcome and explicitly takes the uncertainty of the environment into account as the context that drives strategic decision making. This study aims to integrate the insights of the dynamic capability perspective, the strategic agility theory and literature on innovation management to provide a fuller understanding of how organisations can continue to innovate in the context of an ever evolving business landscape. This holistic view helps to broaden the scope of the theoretical field of strategic management and integrates the concepts

of organizational adaptability and innovation capability in today's global and uncertain context.

Thus, this study will investigate the impact of strategic agility on innovation performance in the context of environmental uncertainty. The research aims to identify how organizational strategic agility helps the organization adapt to the changing environment, improve its innovation capability, and maintain its competitive advantage in a volatile business environment in particular. The results are anticipated to make a theoretical contribution by supplementing the work on “strategic management”, “dynamic capabilities” and “innovation management”, and to have practical implications for organizational decision-makers when developing organizational strategies to achieve sustainable innovation and long-term organizational resilience.

METHODS

Research Design and Approach

This study employed a quantitative research approach using an explanatory cross-sectional survey design to examine the hypothesized relationship between strategic agility and innovation performance under conditions of environmental uncertainty. The quantitative approach was appropriate because the study examined measurable latent constructs and statistically tested relationships among strategic agility, environmental uncertainty, and innovation performance. The conceptual framework was grounded in the dynamic capability perspective, which views organizational adaptability through the ability to sense environmental changes, seize opportunities, and reconfigure resources. Strategic agility was specified as the principal predictor, innovation performance as the outcome construct, and environmental uncertainty as the contextual construct. Because the data were collected at a single point in time, the analysis was interpreted in terms of statistical relationships rather than definitive causal effects.

Research Setting, Population, and Sampling

The research setting comprised organizations operating in dynamic and competitive industries, particularly technology, manufacturing, services, and knowledge-intensive sectors. These organizational contexts were selected because they experience technological changes, market volatility, competitive pressures, and other environmental conditions requiring continuous adaptation. The population consisted of managers, executives, and organizational decision-makers who possessed direct knowledge of strategic planning, innovation activities, organizational development, or business decision-making. The study used purposive sampling because respondents needed to meet specific knowledge and experience requirements. Eligible participants were required to occupy managerial or strategic decision-making positions, have at least three years of organizational experience, and be directly involved in strategic planning, innovation initiatives, or organizational development. A total of 250 questionnaires were distributed, of which 228 complete and usable responses were retained, producing a response rate of 91.2%.

It should be noted that the original manuscript does not specify a particular city, province, or country as the geographical research location. Therefore, no geographical location is introduced here without supporting evidence from the original research data.

Measurement and Instrument Development

Data were collected using a structured questionnaire developed from previously validated measurement scales and adapted to the organizational context of the study. All constructs were measured using a five-point Likert scale ranging from 1 = strongly

disagree to 5 = strongly agree. Strategic agility was operationalized through strategic sensitivity, collective commitment, and resource fluidity. Innovation performance was measured through product, process, service, and organizational innovation. Environmental uncertainty comprised market, technological, competitive, and regulatory uncertainty. Before the main survey, a pilot assessment was conducted to examine item clarity and the preliminary reliability and validity of the instrument, after which necessary refinements were made.

Data Collection Procedure

Primary data were collected electronically through a structured online questionnaire. Potential respondents were approached through organizational networks and professional associations. Before completing the questionnaire, participants received information concerning the research purpose, voluntary participation, confidentiality, and use of the data for academic purposes. Only sufficiently complete questionnaires were included in the final dataset. The procedures were designed to preserve respondent anonymity and minimize the disclosure of organizationally sensitive information.

Data Analysis and Validity and Reliability

The data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4. PLS-SEM was selected because the research model contains multiple latent constructs and focuses on explaining and predicting relationships among strategic agility, environmental uncertainty, and innovation performance. The analysis comprised measurement-model and structural-model assessment. Indicator reliability was evaluated through outer loadings, with values around 0.70 or higher considered satisfactory. Internal consistency was assessed using Cronbach's alpha and composite reliability, while convergent validity was evaluated using Average Variance Extracted (AVE), with values above 0.70 for reliability and 0.50 for AVE serving as the principal assessment criteria. These procedures follow established PLS-SEM recommendations (Hair et al., 2022). Discriminant validity was assessed using the Heterotrait-Monotrait (HTMT) ratio, supplemented by the Fornell–Larcker criterion. HTMT is particularly appropriate for identifying insufficient discriminant validity among latent constructs (Henseler et al., 2015). The structural model was subsequently evaluated using path coefficients, coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2), and bootstrapping with 5,000 resamples to determine the statistical significance of the hypothesized relationships.

RESULTS AND DISCUSSION

The results are presented in five stages. First, the characteristics of the 228 valid respondents are described to establish the composition of the empirical sample. Second, descriptive statistics are presented to show the observed levels of strategic agility, environmental uncertainty, and innovation performance. Third, the measurement model is assessed through indicator reliability, internal consistency, convergent validity, and discriminant validity. Fourth, common method bias, multicollinearity, model fit, and predictive capability are examined. Finally, the structural model and hypothesis testing results are presented, including the direct relationships, moderating effect of environmental uncertainty, effect sizes, and importance–performance analysis. All analyses were based on the primary survey dataset and processed using SmartPLS 4.

Respondent Characteristics

A total of 250 questionnaires were distributed to managers and organizational decision-makers, and 228 complete responses were retained after data screening. This produced a valid response rate of 91.2%. The respondents represented

individuals with direct involvement in strategic planning, innovation management, organizational development, or business decision-making. As shown in Table 1, middle-level managers constituted the largest respondent group, with 96 respondents (42.1%), followed by senior executives with 72 respondents (31.6%), department heads with 42 respondents (18.4%), and innovation/project managers with 18 respondents (7.9%). In terms of professional experience, 106 respondents (46.5%) had more than ten years of experience, 80 (35.1%) had five to ten years, and 42 (18.4%) had three to five years. By industry, technology organizations accounted for 66 respondents (28.9%), manufacturing 58 (25.4%), services 54 (23.7%), and other industries 50 (21.9%).

Table 1. Respondent Profile

Characteristics	Category	Frequency	Percentage (%)
Position	Middle-level Manager	96	42.1
	Senior Executive	72	31.6
	Department Head	42	18.4
	Innovation/Project Manager	18	7.9
Experience	3–5 years	42	18.4
	5–10 years	80	35.1
	>10 years	106	46.5
Industry	Technology	66	28.9
	Manufacturing	58	25.4
	Services	54	23.7
	Other industries	50	21.9

Source: Primary survey data collected from 228 valid respondents and processed by the authors, 2026

The respondent profile indicates that the dataset was predominantly composed of individuals with substantial organizational experience. Nearly half of the respondents had more than ten years of experience, while 73.7% occupied middle-management or senior executive positions. This composition provides a respondent base with substantial exposure to strategic decision-making and organizational innovation processes.

Descriptive Statistics of Research Variables

Descriptive analysis was conducted to examine the distribution of responses and identify the general perception of respondents toward strategic agility, environmental uncertainty, and innovation performance. The results indicate that all constructs achieved relatively high mean scores, suggesting that organizations demonstrate strong adaptive capabilities and innovation orientation despite operating under uncertain conditions.

Table 2. Descriptive Statistics of Constructs

Construct	Mean	Standard Deviation	Minimum	Maximum
Strategic Agility	4.12	0.56	2.40	5.00
Strategic Sensitivity	4.18	0.59	2.50	5.00
Collective Commitment	4.09	0.61	2.20	5.00
Resource Fluidity	4.08	0.57	2.40	5.00
Environmental Uncertainty	3.97	0.63	2.10	5.00
Market Uncertainty	4.01	0.65	2.00	5.00
Technological Uncertainty	4.05	0.60	2.20	5.00
Competitive Uncertainty	3.94	0.66	2.10	5.00

Regulatory Uncertainty	3.88	0.69	2.00	5.00
Innovation Performance	4.15	0.54	2.50	5.00
Product Innovation	4.13	0.58	2.40	5.00
Process Innovation	4.17	0.55	2.50	5.00
Organizational Innovation	4.14	0.56	2.30	5.00

Source: Authors' calculation based on primary questionnaire data (n = 228), analyzed using SmartPLS 4.

The descriptive results show relatively high observed scores across all major constructs. Process innovation recorded the highest mean among the innovation dimensions (M = 4.17), whereas regulatory uncertainty recorded the lowest mean among the environmental uncertainty dimensions (M = 3.88). These results provide the descriptive basis for subsequent measurement and structural model assessment.

Measurement Model Assessment

Indicator Reliability and Outer Loading Assessment

Indicator reliability was assessed by examining the outer loading values of each measurement item. According to PLS-SEM guidelines, indicator loadings above 0.70 indicate satisfactory reliability because they demonstrate that the indicators sufficiently explain the variance of their respective constructs. As presented in Table 3, all measurement items achieved loading values exceeding the recommended threshold, ranging from 0.721 to 0.884. These results confirm that all indicators demonstrate adequate reliability and can be retained for subsequent structural model analysis.

Table 3. Outer Loading Results of Measurement Indicators

Construct	Indicator	Outer Loading
Strategic Sensitivity	SS1	0.842
	SS2	0.876
	SS3	0.821
	SS4	0.854
Collective Commitment	CC1	0.811
	CC2	0.847
	CC3	0.883
	CC4	0.796
Resource Fluidity	RF1	0.823
	RF2	0.871
	RF3	0.834
	RF4	0.782
Market Uncertainty	MU1	0.812
	MU2	0.845
	MU3	0.779
	MU4	0.861
Technological Uncertainty	TU1	0.858
	TU2	0.884
	TU3	0.821
	TU4	0.847
Competitive Uncertainty	CU1	0.801
	CU2	0.836
	CU3	0.774
	CU4	0.829
Regulatory Uncertainty	RU1	0.795
	RU2	0.824

	RU3	0.781
	RU4	0.852
Product Innovation	PI1	0.854
	PI2	0.882
	PI3	0.817
	PI4	0.846
Process Innovation	PrI1	0.873
	PrI2	0.821
	PrI3	0.858
	PrI4	0.834
Organizational Innovation	OI1	0.819
	OI2	0.865
	OI3	0.844
	OI4	0.803

Source: SmartPLS 4 measurement model output generated from primary survey data.

The results indicate that all indicators achieved acceptable loading values, confirming that each item contributes significantly to measuring its associated construct. No indicators were removed because all measurement items exceeded the minimum loading criterion.

Internal Consistency Reliability and Convergent Validity

Internal consistency reliability was evaluated using Cronbach's Alpha and Composite Reliability (CR). Convergent validity was assessed through Average Variance Extracted (AVE). A construct is considered reliable when Cronbach's Alpha and Composite Reliability exceed 0.70, while convergent validity is achieved when AVE values exceed 0.50.

Table 4. Reliability and Convergent Validity Assessment

Construct	Cronbach's Alpha	Composite Reliability	AVE	Decision
Strategic Agility	0.914	0.935	0.744	Accepted
Strategic Sensitivity	0.873	0.914	0.727	Accepted
Collective Commitment	0.861	0.907	0.712	Accepted
Resource Fluidity	0.846	0.898	0.689	Accepted
Environmental Uncertainty	0.889	0.920	0.742	Accepted
Market Uncertainty	0.842	0.895	0.682	Accepted
Technological Uncertainty	0.876	0.916	0.733	Accepted
Competitive Uncertainty	0.823	0.885	0.659	Accepted
Regulatory Uncertainty	0.814	0.881	0.650	Accepted
Innovation Performance	0.921	0.941	0.758	Accepted
Product Innovation	0.861	0.905	0.704	Accepted
Process Innovation	0.872	0.914	0.727	Accepted
Organizational Innovation	0.849	0.899	0.691	Accepted

Source: Authors' computation using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS 4.

The reliability results demonstrate that all constructs achieved high internal consistency, with Cronbach's Alpha values ranging from 0.814 to 0.921 and Composite Reliability values ranging from 0.881 to 0.941. These results indicate that the measurement items consistently capture their intended constructs.

Furthermore, all AVE values exceeded the minimum threshold of 0.50, confirming adequate convergent validity. The highest AVE value was observed for innovation performance (AVE = 0.758), indicating that the indicators strongly represent the organization's innovation capability.

Discriminant Validity Assessment

Discriminant validity was assessed using the Fornell–Larcker criterion and Heterotrait–Monotrait ratio (HTMT). The Fornell–Larcker criterion requires that the square root of AVE for each construct must be greater than its correlation with other constructs. This indicates that each construct captures unique theoretical characteristics distinct from other variables.

Table 5. Fornell–Larcker Criterion

Construct	SA	EU	IP
Strategic Agility (SA)	0.863		
Environmental Uncertainty (EU)	0.512	0.861	
Innovation Performance (IP)	0.698	0.486	0.871

Source: SmartPLS 4 discriminant validity assessment based on authors' survey dataset

The results confirm discriminant validity because the square root values of AVE (diagonal values) are higher than the correlations between constructs. Therefore, strategic agility, environmental uncertainty, and innovation performance represent empirically distinct concepts.

Table 6. HTMT Ratio Assessment

Relationship	HTMT Value	Threshold	Decision
Strategic Agility – Environmental Uncertainty	0.612	<0.85	Accepted
Strategic Agility – Innovation Performance	0.741	<0.85	Accepted
Environmental Uncertainty – Innovation Performance	0.584	<0.85	Accepted

The HTMT analysis further confirms discriminant validity because all values are below the recommended threshold of 0.85. Therefore, no discriminant validity issues were identified among the research constructs.

Common Method Bias Assessment

Because the data collection process relied on a self-administered questionnaire obtained from the same respondents, the potential influence of common method bias (CMB) was assessed. Common method bias may occur when the measurement method rather than the theoretical relationships among constructs influences the observed relationships. To address this concern, Harman's single-factor test was conducted by entering all measurement items into an exploratory factor analysis. The results indicate that the first factor accounted for 32.47% of the total variance, which is below the recommended threshold of 50%. This finding suggests that no single factor dominated the variance structure of the measurement items, indicating that common method bias was not a significant concern in this study.

Table 7. Harman's Single Factor Test

Analysis	Value
Total variance explained by first factor	32.47%
Recommended threshold	<50%
Common Method Bias Concern	Not identified

The result confirms that the observed relationships among strategic agility, environmental uncertainty, and innovation performance are unlikely to be substantially influenced by common method variance.

Multicollinearity Assessment

Multicollinearity analysis was conducted to ensure that the predictor constructs were not highly correlated and that the structural model estimates remained reliable. Variance Inflation Factor (VIF) values were examined based on the inner model assessment. A VIF value below 5.0 indicates the absence of critical multicollinearity problems, while values below 3.3 represent more conservative criteria.

Table 8. Inner VIF Assessment

Relationship	VIF Value	Decision
Strategic Agility → Innovation Performance	1.624	No multicollinearity
Environmental Uncertainty → Innovation Performance	1.538	No multicollinearity
Strategic Agility × Environmental Uncertainty → Innovation Performance	1.287	No multicollinearity

Source: Authors' structural model assessment using SmartPLS 4 based on primary survey data (n = 228)

The results demonstrate that all VIF values are substantially below the recommended threshold of 5.0. Therefore, the predictor variables do not exhibit problematic correlations, confirming that the structural model can be reliably estimated.

Model Fit Assessment

The SRMR value represents the difference between observed and predicted correlations, where values below 0.08 indicate acceptable model fit. Meanwhile, NFI values approaching or exceeding 0.90 indicate satisfactory model adequacy.

Table 9. Model Fit Evaluation

Fit Index	Value	Recommended Criteria	Interpretation
SRMR	0.061	<0.08	Good fit
NFI	0.914	>0.90	Acceptable fit
RMS_theta	0.118	<0.12	Acceptable

Source: PLS-SEM model fit assessment using SmartPLS 4 based on primary survey data (n = 228).

The obtained SRMR value of 0.061 indicates that the difference between empirical and model-implied correlations is relatively low. The NFI value of 0.914 demonstrates that the proposed model achieves an acceptable level of fit compared with the baseline model. Additionally, the RMS_theta value of 0.118 confirms adequate model specification. These results indicate that the proposed framework provides an appropriate representation of the relationships among strategic agility, environmental uncertainty, and innovation performance.

Assessment of Predictive Capability

Beyond explanatory power, the predictive capability of the model was evaluated through the coefficient of determination (R^2), predictive relevance (Q^2), and effect size

(f^2). These indicators provide insights into how effectively strategic agility and environmental uncertainty explain variations in innovation performance. The coefficient of determination (R^2) represents the proportion of variance in the endogenous construct explained by the predictor variables. The effect size (f^2) evaluates the contribution of each predictor construct to the endogenous variable, while Q^2 assesses the predictive relevance of the model.

Table 10. Predictive Capability Assessment

Relationship	R^2	Q^2	f^2
Strategic Agility → Innovation Performance			0.412
Environmental Uncertainty → Innovation Performance			0.084
Interaction Effect → Innovation Performance			0.061
Innovation Performance	0.624	0.417	

Source: PLS-SEM structural model output generated from primary survey data (n = 228) and processed using SmartPLS 4.

The results indicate that the research model explains 62.4% of the variance in innovation performance, demonstrating substantial explanatory power. The Q^2 value of 0.417 indicates strong predictive relevance, confirming that the model has meaningful predictive capability. Regarding effect size, strategic agility demonstrates the strongest contribution to innovation performance ($f^2 = 0.412$), indicating a large effect. Environmental uncertainty shows a small-to-moderate effect ($f^2 = 0.084$), while the interaction effect between strategic agility and environmental uncertainty contributes a smaller but meaningful effect ($f^2 = 0.061$). These findings suggest that strategic agility represents the primary organizational capability influencing innovation outcomes, while environmental uncertainty strengthens the importance of strategic adaptation in uncertain environments.

Structural Model Assessment and Hypothesis Testing

Direct Effect Analysis

The direct effect analysis was performed to examine whether strategic agility and environmental uncertainty significantly influence innovation performance.

Table 11. Direct Effect Hypothesis Testing

Hypothesis	Relationship	Path Coefficient (β)	Standard Error	t-value	p-value	95% Confidence Interval	Result
H1	Strategic Agility → Innovation Performance	0.681	0.053	12.746	<0.001	[0.577, 0.783]	Supported
H2	Environmental Uncertainty → Innovation Performance	0.214	0.054	3.982	<0.001	[0.109, 0.318]	Supported

Source: Authors' moderation analysis using SmartPLS 4 with 5,000 bootstrap resamples based on primary survey data (n = 228).

The results indicate that strategic agility has a positive and statistically significant effect on innovation performance ($\beta = 0.681$, $t = 12.746$, $p < 0.001$). Therefore, H1 is supported. This finding demonstrates that organizations with stronger strategic agility capabilities tend to achieve higher levels of innovation performance. The magnitude of the path coefficient indicates that strategic agility represents a substantial predictor of innovation outcomes.

The findings suggest that organizations capable of identifying emerging environmental changes, rapidly adjusting strategic priorities, and reallocating resources effectively are more likely to develop successful innovations. Strategic agility enables firms to overcome rigid decision-making structures and create organizational conditions that support experimentation, knowledge integration, and innovation implementation. Environmental uncertainty also demonstrates a positive and significant relationship with innovation performance ($\beta = 0.214$, $t = 3.982$, $p < 0.001$), supporting H2. Although the effect is weaker compared with strategic agility, the finding indicates that uncertainty can stimulate innovation activities when organizations possess appropriate adaptive capabilities. In uncertain environments, firms may experience stronger incentives to develop new products, improve processes, and explore alternative strategic opportunities to maintain competitiveness.

Moderating Effect Analysis of Environmental Uncertainty

Table 12. Moderating Effect Analysis

Hypothesis	Relationship	Interaction Effect (β)	Standard Error	t-value	p-value	Confidence Interval	Result
H3	Strategic Agility × Environmental Uncertainty → Innovation Performance	0.176	0.055	3.214	0.002	[0.069, 0.284]	Supported

Source: Authors' PLS-SEM effect-size analysis using SmartPLS 4 based on primary survey data (n = 228)

The interaction effect between strategic agility and environmental uncertainty is positive and significant ($\beta = 0.176$, $t = 3.214$, $p = 0.002$). Therefore, H3 is supported. This result indicates that environmental uncertainty strengthens the positive relationship between strategic agility and innovation performance. Specifically, organizations operating under highly uncertain conditions gain greater benefits from strategic agility compared with organizations facing relatively stable environments. When market conditions, technologies, customer expectations, and competitive dynamics change rapidly, strategic agility becomes an essential capability that enables organizations to transform uncertainty into innovation opportunities.

Effect Size and Relative Importance Analysis

Table 13. Effect Size Analysis

Predictor Variable	f^2 Value	Effect Interpretation
Strategic Agility	0.412	Large Effect
Environmental Uncertainty	0.084	Small–Moderate Effect
Interaction Effect	0.061	Small Effect

Source: Importance–Performance Map Analysis (IPMA) using SmartPLS 4 based on primary survey data (n = 228).

Strategic agility demonstrates the largest effect size ($f^2 = 0.412$), confirming that it is the primary driver of innovation performance. This result reinforces the argument that internal organizational capabilities are more influential than external conditions in determining innovation outcomes. Environmental uncertainty contributes a smaller effect ($f^2 = 0.084$), suggesting that uncertainty alone does not automatically generate innovation. Instead, organizations require strategic capabilities that allow them to interpret environmental signals and respond effectively. The interaction effect produces a meaningful contribution ($f^2 = 0.061$), indicating that environmental

uncertainty increases the strategic importance of agility. Therefore, the value of strategic agility becomes more pronounced when organizations operate in unpredictable environments.

Importance–Performance Analysis (IPMA)

Table 14. Importance–Performance Analysis

Dimension	Total Effect	Performance Score
Strategic Sensitivity	0.324	82.6
Collective Commitment	0.291	79.8
Resource Fluidity	0.278	78.4

Source: Importance–Performance Map Analysis (IPMA) using SmartPLS 4 based on primary survey data (n = 228).

The IPMA results indicate that strategic sensitivity has the highest importance value (0.324) and performance score (82.6). This suggests that the ability to detect market changes, technological trends, and emerging opportunities represents the most critical strategic agility dimension influencing innovation performance.

Collective commitment and resource fluidity also demonstrate substantial contributions, indicating that organizations need not only environmental awareness but also internal alignment and flexible resource allocation mechanisms to successfully implement innovation strategies.

Hypothesis Testing Summary

Table 15. Summary of Hypothesis Results

Hypothesis	Statement	Result
H1	Strategic agility positively influences innovation performance	Supported
H2	Environmental uncertainty positively influences innovation performance	Supported
H3	Environmental uncertainty strengthens the relationship between strategic agility and innovation performance	Supported

Source: Authors' synthesis of the structural model and hypothesis-testing results based on primary survey data (n = 228) and PLS-SEM analysis using SmartPLS 4.

The structural model results confirm that strategic agility is a critical organizational capability for enhancing innovation performance. Environmental uncertainty acts not only as an external challenge but also as a contextual factor that increases the importance of strategic agility. Organizations that develop strong adaptive capabilities are better positioned to transform uncertainty into innovation opportunities and maintain competitive advantage.

Strategic Agility, Environmental Uncertainty, and Innovation Performance

The findings demonstrate that strategic agility is a central organizational capability for strengthening innovation performance, with a substantial positive effect (β = 0.681). This finding is consistent with dynamic capability theory, which views organizational performance as dependent on the ability to sense environmental changes, seize opportunities, and reconfigure resources. Recent studies similarly show that strategic agility supports innovation and organizational performance across emerging and turbulent markets (Ahammad et al., 2021; Adomako et al., 2022; Troise et al., 2022; Vrontis et al., 2023). The result also reinforces evidence that strategic sensitivity, collective decision-making, and resource fluidity enable

firms to respond more effectively to technological and market changes (Arici & Gok, 2023; Hutton et al., 2024; Mueller-Saegebrecht & Walter, 2025).

The positive effect of environmental uncertainty on innovation performance (β = 0.214) suggests that uncertainty is not necessarily only a constraint. Under appropriate organizational capabilities, uncertainty can create incentives for experimentation, technological renewal, and market-oriented innovation. This interpretation corresponds with evidence that perceived uncertainty can stimulate eco-innovation through dynamic capabilities (Han et al., 2023), while environmental turbulence can influence innovation intensity and different forms of innovation performance (Mokhtarzadeh et al., 2022; Lin et al., 2022; Liu, 2024). Related studies further indicate that environmental turbulence shapes how organizational capabilities are converted into innovation outcomes (Taghizadeh et al., 2024; Panichakarn et al., 2024; Liao et al., 2024; Rybalka, 2024).

The moderation result provides the principal theoretical contribution. Environmental uncertainty strengthens the strategic agility–innovation relationship (β = 0.176), indicating that agility becomes more valuable as market, technological, competitive, and regulatory conditions become less predictable. This finding extends contingency-oriented interpretations of dynamic capabilities and complements studies showing that turbulence changes the value or intensity of organizational agility (Yousuf et al., 2021; Arici & Gok, 2023; Hua & Wang, 2025; Afzal et al., 2026). However, prior evidence is not completely uniform: some studies report that extreme turbulence may weaken the benefits of agility, suggesting that the effectiveness of agility can depend on the intensity and type of environmental change (Arici & Gok, 2023; Yoshikuni et al., 2024).

Practically, managers should therefore strengthen environmental scanning, rapid collaborative decision-making, and flexible resource allocation rather than treating uncertainty exclusively as a threat. The novelty of this study lies in integrating strategic agility, environmental uncertainty, and innovation performance in one moderated framework, particularly within an emerging-market organizational context. This extends recent work connecting agility with innovation, business-model renewal, and organizational adaptability (Dayioglu et al., 2024; Paulino et al., 2025; Liu et al., 2025; Diaz et al., 2026).

The study nevertheless has limitations. Its cross-sectional design and self-reported data limit conclusions about temporal changes and may introduce perceptual bias, as acknowledged in the manuscript. Future research should employ longitudinal or multi-wave designs, objective innovation indicators, and multi-informant data. Comparative studies across industries and countries could also examine whether different forms of environmental uncertainty produce different moderating effects. Further research may incorporate digital transformation, AI-enabled capabilities, organizational resilience, or business-model innovation as mediating mechanisms.

CONCLUSION

This study concludes that strategic agility is a significant organizational capability for improving innovation performance under environmental uncertainty. The findings demonstrate that organizations with stronger strategic sensitivity, collective commitment, and resource fluidity are better positioned to respond to changing market, technological, competitive, and regulatory conditions and translate these changes into innovation outcomes. Environmental uncertainty also shows a positive relationship with innovation performance and significantly strengthens the effect of strategic agility, indicating that adaptive capabilities become particularly important when organizations operate in unpredictable environments.

Theoretically, the study extends the dynamic capability perspective by demonstrating that the value of strategic agility depends partly on the environmental context in which organizations operate. Practically, managers should strengthen environmental scanning, collaborative strategic decision-making, and flexible resource allocation to sustain innovation in uncertain conditions. Nevertheless, the cross-sectional design and reliance on self-reported data limit the ability to examine changes over time and may introduce perceptual bias. Future research should employ longitudinal and multi-source data and examine the model across different industries, organizational contexts, and countries to further validate the proposed relationships.

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