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Fostering Innovation Resilience in Craft SMES: The Role of Triple Helix Collaboration and Toe Readiness in Indonesia

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Abstract

This research investigates the interaction between Triple Helix capability, Technology–Organization–Environment (TOE) readiness, organizational ambidexterity, and organizational resilience in enhancing innovation performance and achieving sustainable competitive advantage among craft-based Small and Medium Enterprises (SMEs) in East Kalimantan, Indonesia. This study aims to examine the collective influence of TOE readiness, organizational ambidexterity, and organizational resilience on innovation performance, assess the direct impact of TOE readiness, and investigate the mediating roles of ambidexterity and resilience. A quantitative research approach was employed using Partial Least Squares–Structural Equation Modeling (PLS-SEM) with data collected from 154 SME respondents. The study assessed the measurement model's validity and reliability, evaluated structural relationships, and applied Importance–Performance Map Analysis (IPMA) to identify strategic priorities for SME development. The results reveal that Triple Helix capability, TOE readiness, organizational ambidexterity, and organizational resilience significantly and positively influence SME innovation performance. TOE readiness acts as a complementary partial mediator between Triple Helix capability and innovation performance, while ambidextrous organization and resilience strengthen SMEs' adaptive capacity in dynamic market environments. IPMA results highlight TOE readiness as the primary construct requiring improvement to enhance innovation outcomes. Findings emphasize the need for continuous collaboration between government, academia, and industry to strengthen digital readiness, promote innovation capability, and ensure sustainable SME competitiveness. This study contributes a comprehensive integrative model linking the Triple Helix framework with TOE readiness and internal organizational capabilities—an area still limited in developing-country SME contexts—offering both theoretical enrichment and practical strategies for sustainable innovation-driven growth.

INTRODUCTION

The improvement in Indonesia's purchasing power is inseparable from the vital role of Small and Medium Enterprises (SMEs) in promoting and distributing their products (Aprilia et al., 2025; Cahya et al., 2025; Koesrianti & Tanega, 2024; Muhibbin et al., 2026). In 2021, Indonesia recorded a substantial increase in the number of SMEs, which significantly

contributed to labor absorption and the growth of Gross Domestic Product (GDP). However, this increase was not accompanied by corresponding improvements in export performance, as the contribution of SMEs to international trade remained relatively modest (Lukman Firdaus, Resti Amelia, & Hakim, 2024). According to Cahaya et al. (2024), the acceleration of the Technology–Organization–Environment (TOE) framework represents a major challenge for SMEs operating under limited business development strategies. Insufficient digital literacy and weak implementation of digital transformation are among the main factors hindering SMEs' competitiveness in increasingly dynamic markets.

The rapid evolution of digital technology has transformed consumer preferences and reshaped how businesses interact with their markets. The shift from traditional to digital media has driven enterprises to compete for consumer attention in new ways. Social media, as one of the key technological advancements, has become the dominant communication and marketing platform for both consumers and producers. Sellers have quickly seized this opportunity to expand into profitable online market segments. Nevertheless, the fast-paced transformation of the digital environment has also exposed a gap between the technological capabilities currently possessed by SMEs and those required to remain competitive. This gap has resulted in a decline in business performance and highlights the importance of performance evaluation in helping SMEs assess their strategic effectiveness in adapting to technological and environmental shifts.

Indonesia's economic orientation has recently shifted toward the creative industry sector, with crafts emerging as one of the leading subsectors. Craft products made from natural materials and reflecting Indonesia's cultural identity have gained significant attention in local, national, and international markets. However, limited product diversification and a lack of innovation continue to hinder the competitiveness of SMEs in this sector. Product innovation is a key determinant of consumer purchase decisions and serves as a strategic lever to improve SME performance (Dalimunthe, 2017; Khairul Saleh et al., 2021). The effectiveness of innovation is closely linked to the presence of dynamic capabilities, defined as a firm's ability to adapt to environmental changes (Farzaneh et al., 2022; Gupta & Gupta, 2019), reconfigure internal and external resources (Yulong Liu et al., 2020), and generate innovations that create consumer value (Teece et al., 2016).

To strengthen innovation performance, collaboration among the Triple Helix actors government, industry, and academia is essential. The Triple Helix model facilitates knowledge transfer, innovation system management, and policy synergy to enhance SME competitiveness (Durán-Romero et al., 2020). However, in Indonesia, particularly in regions distant from central administrative oversight, knowledge hubs have not functioned optimally. Academic institutions have played a limited role in mentoring or transferring knowledge to SMEs, resulting in weak innovation exploration and continued reliance on conventional business models. Strengthening the role of the Triple Helix is therefore crucial in supporting SMEs to develop sustainable competitive advantages. Achieving this goal requires organizational ambidexterity, which enables firms to balance short-term profitability with long-term innovation and business development (Prasetio et al., 2022).

Innovation ambidexterity refers to the ability of organizations to simultaneously pursue exploration developing new capabilities, technologies, and market opportunities and exploitation optimizing existing resources and competencies (Teece, Peteraf, & Leih, 2016). A central question emerges regarding the extent to which SMEs are able to enhance their

ambidextrous capabilities to foster business resilience and innovation capacity. East Kalimantan Province provides a compelling context for this issue. The province is known for its diverse craft-based industries, including rattan and bamboo furniture, handicrafts, bags, caping hats, and decorative bamboo products. These goods are in demand across domestic and international markets. However, the growing influx of imported craft products featuring more attractive designs and varied forms has reduced the competitiveness of local SMEs. Although several programs have been initiated by the government and academic institutions to enhance innovation, many East Kalimantan SMEs have yet to adopt digital transformation or systematic innovation strategies.

Previous studies have emphasized the importance of digital technology and social media in enhancing SME competitiveness. Social media has been identified as an effective tool for attracting customers and building brand reputation (Agnihotri et al., 2016; He et al., 2014). Stockdale, Ahmed, and Scheepers (2012) highlighted the role of social media in enhancing SME business value, while Wamba and Carter (2016) examined TOE-based technological adoption. Similarly, Mamorobela and Buckley (2018) and Abed (2020) explored the effectiveness of social media in improving SME knowledge and customer engagement. Despite these advantages, many SMEs still lack awareness of how social media can improve marketing performance. Limited understanding, digital skills, and resource constraints continue to hinder their ability to maximize its benefits.

Indonesian SMEs also face structural challenges related to limited innovation capacity, weak TOE readiness, and the absence of generational regeneration in entrepreneurship (Aini et al., 2024). The uneven distribution of knowledge and innovation transfer, combined with minimal academic engagement in mentoring and research collaboration, further limits innovation exploration among SMEs. Moreover, digital transformation strategies remain underdeveloped and fragmented (Anwar et al., 2023). These constraints collectively weaken SME competitiveness, especially in regions like East Kalimantan, where innovation ecosystems are less mature.

In response to these challenges, the present study focuses on data-driven innovation development among craft-based SMEs in East Kalimantan. It proposes an innovation performance framework that integrates TOE readiness, organizational ambidexterity, and organizational resilience, while emphasizing the role of Triple Helix collaboration as a key enabling mechanism. The study conceptualizes three interrelated pathways: (1) the influence of Triple Helix actors in enhancing TOE readiness to improve innovation performance; (2) the effect of TOE readiness on innovation performance mediated by ambidextrous organizational capabilities; and (3) the impact of ambidextrous capabilities on SME resilience and innovation performance.

Accordingly, this study aims to examine how TOE readiness, organizational ambidexterity, and organizational resilience collectively influence innovation performance, assess the direct impact of TOE readiness on the innovation performance of SMEs in Indonesia, and investigate the mediating roles of organizational ambidexterity and organizational resilience in the relationship between TOE readiness and innovation performance. This research is expected to provide both theoretical and practical benefits. Theoretically, the study enriches the literature on SME innovation by integrating the TOE framework with organizational ambidexterity and resilience, particularly in the context of developing

economies. It also extends the application of the Triple Helix model by demonstrating its role in strengthening technological and organizational capabilities for sustainable innovation. Practically, the findings offer strategic insights for SME owners, policymakers, and academic institutions to enhance innovation performance through targeted improvements in digital readiness, ambidextrous capabilities, and collaborative partnerships under the Triple Helix framework.

METHOD

The Structural Equation Modeling (SEM) approach was employed to examine the relationships among multiple variables within the proposed research model and to test the study's hypotheses. Specifically, the Partial Least Squares Structural Equation Modeling (SEM-PLS) technique was adopted, as it is particularly suitable for assessing complex relationships among conceptual constructs, especially when the model includes composite variables.

The theoretical framework of this study comprises four constructs, each of which was measured through indicators previously validated for reliability and validity. All questionnaire items were measured using a five-point Likert scale. Data processing was conducted using SmartPLS version 4.0. In SEM analysis, model evaluation was carried out through two stages: the outer model (measurement model) and the inner model (structural model). The outer model was assessed in terms of reliability, validity, and multicollinearity among latent variables. Reliability was determined using Cronbach's Alpha with a minimum acceptable value of 0.7, while indicator reliability was confirmed when outer loadings exceeded 0.7. Convergent validity was examined through the Average Variance Extracted (AVE) with a threshold value above 0.5. Discriminant validity was verified when each indicator's cross-loading on its intended construct was higher than its loadings on other constructs. Additionally, multicollinearity was assessed using the Variance Inflation Factor (VIF), with a value below 10 considered acceptable (Harwiki & Malet, 2020).

The R^2 test was used to assess the explanatory power of endogenous variables within the structural model, while the Q^2 test evaluated the model's predictive relevance and its ability to reproduce observed data. Furthermore, the t-test was applied to determine the significance of relationships between exogenous and endogenous variables, with statistical significance accepted at $p < 0.05$. The overall model fit was evaluated using the Goodness of Fit (GoF) index, where values approaching 1 indicate a strong model fit.

RESULTS AND DISCUSSION

Data analysis

The data collected from respondents were processed and analyzed using **SmartPLS 3.0**. The correlations between variables were assessed using **factor loadings** and **Average Variance Extracted (AVE)** values. As shown in **Table 2**, the constructs of **TOE Readiness (TR)**, **Organizational Ambidexterity (OA)**, and **Innovation Performance (IP)** demonstrate satisfactory levels of validity and reliability. Moreover, the **Q^2 value** indicates that the proposed model exhibits strong **predictive relevance**, with 89.5% of data variability explained by the model.

Table 1. SEM test results

Variable	Cronbach's Alpha	Composite Reliability	AVE*	R^2	Q^2	SRMR**
A	0.873	0.884	0.724			
G	0.925	0.929	0.769			
I	0.810	0.811	0.637			
TR	0.831	0.887	0.663	0.398	0.895	0.081
OR	0.742	0.852	0.658	0.285		
AO	0.757	0.890	0.802	0.206		
IP	0.894	0.919	0.653	0.424		

Source: Authors own work

** Average Variance Extracted; ** **Standardized Root Mean Square Residual***

Table 2. Direct effect, indirect effect, and total effect

No	Variables	Direct Effect	P-Values	Indirect Effect	P-Values	Total Effect	P-Values	Description
1	A->TR	0.263	0.008	No path	-	0.263	0.008	significant
2	G->TR	0.284	0.003	No path	-	0.284	0.003	significant
3	I -> TR	0.181	0.007	No path	-	0.181	0.007	significant
4	TR-> AO	0.454	0.000	No path	-	0.454	0.000	significant
5	TR-> OR	0.210	0.021	No path	-	0.394	0.000	significant
6	AO->OR	0.405	0.263	No path	-	0.405	0.263	significant
7	TR -> IP	0.190	0.284	No path	-	0.446	0.284	significant
8	OR -> IP	0.383	0.181	No path	-	0.383	0.181	significant
9	AO -> IP	0.233	0.016	0.155	0.016	0.388	0.000	significant
10	A -> AO	0.120	0.017	-	-	0.120	0.017	significant
11	A -> IP	0.117	0.016	-	-	0.117	0.016	significant
12	A -> OR	1.104	0.023	-	-	1.104	0.023	significant
13	G -> AO	0.129	0.007	-	-	0.129	0.007	significant
14	G - > IP	0.127	0.009	-	-	0.127	0.009	significant
15	G -> OR	0.112	0.010	-	-	0.112	0.010	significant
16	I -> AO	0.082	0.024	-	-	0.082	0.024	significant
17	I -> IP	0.081	0.033	-	-	0.082	0.024	significant
18	I -> OR	0.071	0.047	-	-	0.071	0.047	significant
19	TR -> IP	0.257	0.000	0.139	0.000	0.446	0.000	significant

Source: Authors own work

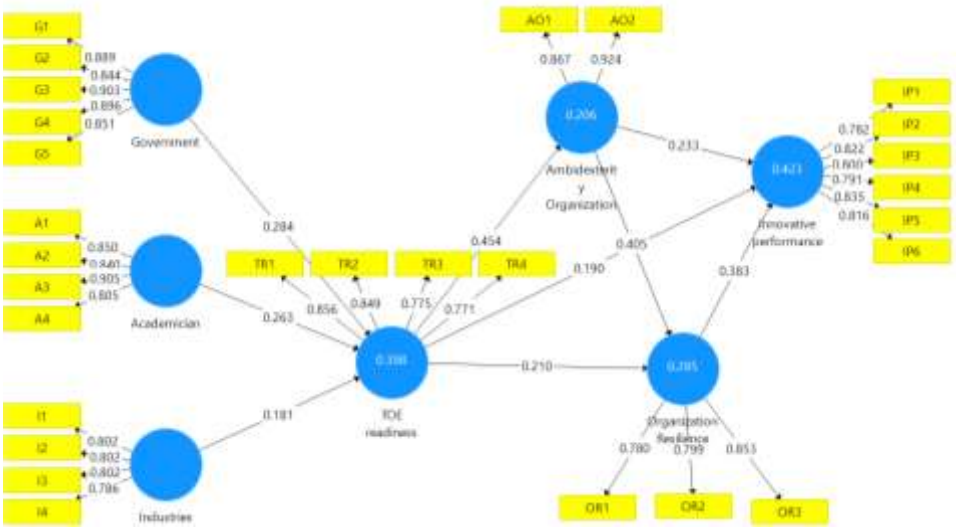

Figure 1. Path Analysis Model for predicting innovation performance

Source: Authors own work

Subsequently, a **bootstrapping procedure** with 154 samples was conducted to generate **p-values, which were used to evaluate the research hypotheses. As presented in** Table 2**, the** Standardized Root Mean Square Residual (SRMR) **value of < 0.10 (Hooper et al., 2008) suggests that the model demonstrates an acceptable level of** goodness of fit**.**

To examine the direct relationships among variables, path coefficients**,** t-statistics**, and** p-values **were analyzed. A relationship is considered statistically significant when the** p-value < 0.05 **and the** t-statistic > 1.96**. The results, depicted in** Figure 2 **and** Table 3**, reveal that the following hypotheses are supported:** A → TR (H1)**,** A → TR (H2)**,** I → TR (H3)**,** TR → AO (H4)**,** TR → OR (H5)**,** OA → OR (H6)**,** OA → OR (H7)**,** OR → IP (H8)**, and** OA → IP (H9)**.**

Furthermore, PLS-SEM enables the identification of mediation effects among constructs within the model. In the mediation procedure diagram proposed by Hair et al. (2017), if the indirect relationship between the independent variable and the dependent variable through the mediating variable is significant, while the direct relationship also remains significant, the mediator is classified as exhibiting partial mediation. **The results demonstrate that** TOE Readiness (TR) **serves as a** partial mediator **between** G → IP**,** A → IP**, and** I → IP**. Similarly,** Organizational **Ambidexterity (AO)** acts as a **partial mediator** between **TR → IP**, while **Organizational Resilience (OR)** also functions as a **partial mediator** in the **TR → IP** relationship.

4.1.2. Importance Performance Map Analysis (IPMA)

The **Importance Performance Matrix Analysis (IPMA)**, an extension of SEM-PLS, was employed to evaluate the relative importance and performance of each construct. IPMA provides insights into which dimensions and indicators contribute most significantly to the outcome variable and highlights areas that require managerial improvement. The analysis plots constructs across four quadrants, where the **vertical axis** represents **performance** and the **horizontal axis** represents **importance**, as shown in **Table 3**.

Table 3. Indicator and variable performance and importance (total effects)

Variable	Innovative performance	importance (total effects)	Indicator	Innovative performance	importance (total effects)
Academician	57.675	0.117	A1	61.526	0.031
			A2	50.433	0.032
			A3	51.948	0.04
			A4	66.667	0.035
			G1	60.877	0.025
Government	61.851	0.127	G2	63.474	0.028
			G3	59.416	0.032
			G4	59.091	0.031
			G5	66.558	0.029
Industries	77.248	0.081	I1	82.305	0.024
			I2	78.896	0.025
			I3	77.435	0.027
			I4	70.563	0.025
Ambidexterity Organization	75.281	0.388	AO1	73.052	0.188
			AO2	76.786	0.244
Organization Resilience	78.277	0.383	OR1	76.786	0.137
			OR2	79.545	0.146
			OR3	78.409	0.186
			TR1	62.662	0.149
TOE readiness	53.259	0.446	TR2	60.552	0.151
			TR3	34.632	0.112
			TR4	48.377	0.136
Average	**67.265**	**0.257**	Average	**65.454**	**0.083**

Source: Authors own work

Following the approach of Hair et al. (2017), the quadrants are interpreted as follows: **Quadrant I (Keep up the good work)**: Variables that are both important and perform well should be maintained. **Quadrant II (Possible overkill)**: Variables that perform well but are less important may represent excessive resource allocation. **Quadrant III (Low priority)**: Variables with low importance and performance require minimal attention. **Quadrant IV (Concentrate here)**: Variables that are highly important but underperform should become a strategic focus.

Figure 2. IPMA Variable Graph

Source: Authors own work

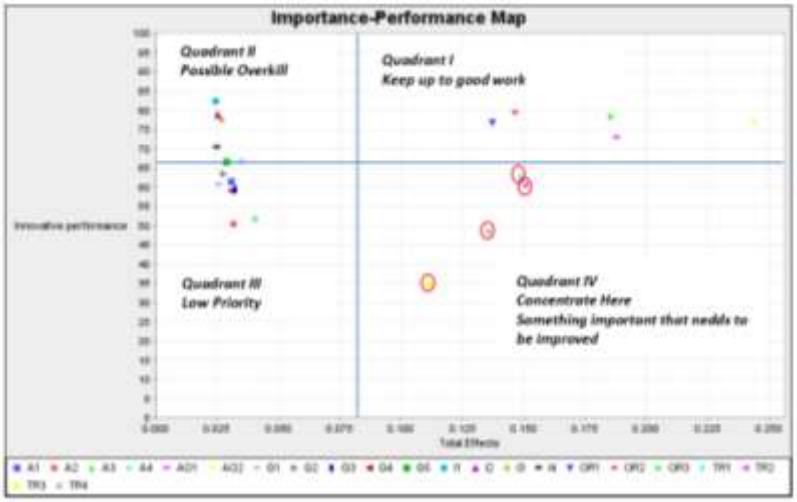

Figure 3. IPMA Indicator Graph

Source: Authors own work

As illustrated in Figure 3, the TOE Readiness (TR) construct is positioned in Quadrant IV, indicating that it requires prioritized development. This finding suggests that although TR is crucial to the innovation performance of SMEs, its performance remains relatively low. Figure 4 further demonstrates that indicators TR1, TR2, TR3, and TR4 fall within the low-performance but high-importance zone, emphasizing the need for improvement through enhanced SME business strategies.

The questionnaire analysis indicates that many craft-based SMEs remain complacent with existing production methods and show limited awareness or adoption of new technologies. This condition stems largely from inadequate managerial guidance and the absence of generational renewal among artisans. Consequently, these deficiencies hinder responsiveness to technological and organizational developments, underscoring the need for SME management to strengthen their readiness in technology, organization, and environmental adaptation.

Collectively, the IPMA findings provide actionable insights for SME stakeholders. The results identify TOE Readiness as the most critical factor requiring immediate intervention, supporting the notion that technological awareness and adaptive capabilities play a pivotal role

in sustaining competitiveness. The findings align with Hair et al. (2017), who argue that IPMA serves as a strategic diagnostic tool, enabling organizations to prioritize resource allocation effectively for enhanced performance outcomes.

Integration with Existing Literature

This study investigates the interaction between Triple Helix (TH) capabilities, Technology–Organization–Environment (TOE) readiness, organizational ambidexterity (OA), and organizational resilience (OR) in shaping the innovation performance (IP) of craft-based SMEs in East Kalimantan, Indonesia. By adopting a quantitative approach using Partial Least Squares Structural Equation Modeling (PLS-SEM), this study identifies the key factors influencing SME innovation capacity and strategic adaptability. The results confirm that the Triple Helix collaboration, supported by TOE readiness, ambidextrous organizational structures, and resilient capabilities, collectively enhances innovation performance, even under resource and technological constraints.

These findings align with prior studies emphasizing the importance of TOE readiness in driving business value creation and digital adoption among SMEs (Chen, 2010; Valdebenito & Quelopana, 2019), as well as the critical role of organizational resilience (Zabłocka-Kluczka & Sałamacha, 2023) and ambidextrous capabilities in sustaining innovation (Trieu et al., 2024; Samat et al., 2024). The results reaffirm that SMEs' readiness in technological, organizational, and environmental aspects supported by the active involvement of Triple Helix actors at both exploration and exploitation levels strengthens their resilience in addressing competitive challenges and enhances their innovation performance, particularly within Indonesia's creative industries.

The analysis further reveals that Hypotheses 6, 7, and 8 exhibit weaker levels of significance than anticipated. The lower significance of Hypothesis 6 suggests that the ambidextrous organizational capacity of SMEs remains constrained when attempting to pursue exploration and exploitation simultaneously, primarily due to limited resources. This supports prior research asserting that true ambidexterity requires a balance between both activities (Clauss et al., 2021; Raisch et al., 2009). Similarly, the weaker result for Hypothesis 7 indicates that SMEs' readiness for TOE is unevenly distributed and hindered by insufficient digital transformation capabilities, consistent with previous findings that SMEs often face limitations in digital infrastructure and funding (Wibawa et al., 2022; Sugandini et al., 2024).

The weak relationship observed in Hypothesis 8 between organizational resilience and innovation performance may stem from limited ambidextrous capabilities within SMEs, which affect their adaptive potential. This observation supports prior research emphasizing that resilience enhances SMEs' adaptability and that management strategies should continuously strengthen TOE-related capacities (Aboelmaged, 2014). Such capabilities are particularly crucial within Indonesia's creative industry, where short product cycles and niche markets demand rapid innovation.

In summary, this study highlights the necessity of synergizing Triple Helix collaborations to foster sustainable SME growth. It underscores the importance of developing TOE readiness as a strategic foundation for digital transformation and resilience, thereby improving innovation performance. TOE readiness acts as a strategic enabler that facilitates organizational exploration and exploitation in dynamic markets. Consequently, strategic management roles

ranging from skill development and policy support to fostering product diversification and digital service competencies are essential to strengthening SME competitiveness in both domestic and global contexts.

Theoretical Implications

The findings of this study extend theoretical understanding of the determinants of innovation performance among craft SMEs in developing economies. Grounded in organizational learning theory, the study provides empirical evidence from East Kalimantan, Indonesia, emphasizing how the integration of Triple Helix collaboration and TOE readiness can enhance ambidextrous capabilities and resilience.

Previous research by Khouroh et al. (2021) highlighted that synergy among Triple Helix actors fosters innovation power and strengthens SME competitiveness. Similarly, Octoviani (2023) emphasized that Triple Helix interactions stimulate creativity and innovation through research-based product development, while Wijiharjono (2021) incorporated social capital into Triple Helix dynamics to enhance intellectual capital and marketing capabilities in creative economy SMEs. These perspectives converge on the notion that scientific collaboration between academia and industry is vital for sustaining innovation ecosystems (Octoviani, 2023).

This study contributes theoretically by reinforcing the pivotal role of the government, academia, and industry in shaping SME innovation systems. The government plays a central role in enhancing TOE readiness and fostering ambidexterity by offering continuous training, establishing business clinics, and assigning mentors to SMEs. Academic institutions influence TOE readiness by conducting applied research, transferring knowledge through training, and providing capacity building in areas such as product development, intellectual property, and digital marketing. SME owners themselves play a transformative role by cultivating leadership, organizational culture, and creative team dynamics that support open innovation and cross-sector collaboration.

Theoretically, the findings confirm a significant relationship between TOE readiness and SME ambidexterity. The more SMEs invest in TOE-related capabilities, the greater their ability to balance exploration (innovation, new product development, and market creation) and exploitation (improving existing products and operational efficiency). However, this study also observes that simultaneous pursuit of both strategies remains difficult for many SMEs due to resource limitations. Those that successfully engage in both exploration and exploitation tend to exhibit higher innovation performance and resilience, corroborating the theoretical view that ambidextrous organizations are more capable of sustaining competitive advantage in turbulent environments.

Practical Implications

From a practical standpoint, this study underscores the importance of continuous collaboration among craft-based SMEs, government institutions, and academic actors in developing technological, organizational, and environmental readiness in a sustainable and effective manner. The enhancement of these elements must be accompanied by a strong focus on product innovation and market responsiveness.

SME owners cannot advance their businesses in isolation; sustainable growth requires close synergy with other stakeholders. To address the generational gap and limited innovation

capacity, artisans should collaborate with younger innovators to rejuvenate product creativity. The government should maintain comprehensive SME databases across East Kalimantan to ensure ongoing supervision, technical assistance, and marketing guidance. This will enable SMEs to access broader national and international markets. Meanwhile, academics should engage in participatory research and community service projects that facilitate knowledge transfer and the adoption of innovative business models.

The constructs of TOE Readiness (TR), Organizational Ambidexterity (OA), Organizational Resilience (OR), and Innovation Performance (IP) serve as critical levers for improving competitiveness and ensuring SME sustainability. SMEs must strengthen collaboration and actively acquire knowledge, skills, and resources from the government, academia, and peer entrepreneurs. They must also remain sensitive to environmental trends, consumer preferences, and technological changes achievable through systematic data collection, ongoing learning, and managerial adaptability.

These practices will significantly enhance SMEs' innovation performance, improve product competitiveness, and promote sustainable business resilience. Ultimately, the study provides actionable insights for SME managers, policymakers, and academics, highlighting the necessity of strategic alignment between exploration, exploitation, and environmental adaptability to achieve long-term innovation success.

Conclusions

The results of this study provide comprehensive insights into the factors influencing innovation performance among SMEs and their role in shaping sustainable organizational development. In addressing the question of how to foster effective and enduring innovation performance, this research focused on four key constructs: triple helix capability, TOE readiness, organizational ambidexterity, and organizational resilience. Although the study concentrates on these dimensions, it does not rule out the possibility that other internal and external factors may also make significant contributions to the formation of innovation excellence. Reliability and validity analyses confirmed that the research instrument demonstrates robust measurement accuracy. The application of the SEM-PLS approach revealed that the innovation performance of craft-based SMEs in East Kalimantan, Indonesia, is strongly influenced by the synergy of triple helix actors government, academia, and business in fostering technological, organizational, and environmental readiness. Additionally, the willingness and capability of SMEs to pursue ambidextrous strategies enhance their organizational resilience, enabling them to adapt and respond effectively to challenges and emerging threats. This research extends current understanding of the interaction between internal capabilities and external readiness within the SME context, particularly in developing regions. However, while the findings offer valuable theoretical and practical implications, the results remain context-specific and should be interpreted with caution due to the study's methodological and contextual constraints.

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