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Synergizing Innovation: Examining the TOE Readiness Influence, Ambidextrous Capabilities, Organization Resilience on Craft SMEs

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Abstract

This study examines how technology-organization-environment (TOE) readiness (TR), ambidextrous organization (AO), and organizational resilience (OR) influence innovation performance (IP) and competitive advantage (CA) in small and medium-sized enterprises (SMEs), focusing on craft-based firms operating in dynamic and uncertain environments. A quantitative research design was chosen to collect survey data from 200 Indonesian craft-based SME owners and managers. Structural equation modelling (SEM) was employed to analyze the data and examine both direct and indirect relationships among the proposed constructs. The findings demonstrate that TR, AO, and OR each have a significant positive effect on IP. In turn, IP has a strong positive effect on CA, highlighting its key role in converting organizational capabilities into market success as well as a complementary mediating mechanism linking TR, AO, and OR to competitive outcomes. The novel contribution of this study is the empirical integration of TR with internal dynamic capabilities, namely AO and OR, in a single structural model that explains how SMEs transform innovation-related capabilities into CA. This integrative perspective contributes to the literature on SME innovation and offers practical implications for managers and policymakers seeking to strengthen innovation-driven competitiveness and long-term sustainability amid turbulent environmental conditions in emerging market contexts.

Keywords:

Ambidexterity;

Resilience;

TOE Readiness;

Innovation Performance;

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1- Introduction

Small- and medium-sized enterprises (SMEs) are fundamental drivers of Indonesia's economic development, contributing significantly to employment creation, regional growth, and cultural sustainability. Craft-based SMEs, in particular, play a dual role by supporting local economies while preserving traditional knowledge and creative heritage. Despite their strategic importance, Indonesian SMEs continue to exhibit relatively weak innovation performance (IP) and limited competitive advantage, especially in comparison with SMEs in more digitally mature economies [1, 2]. The relationship between market approach and entrepreneurship with dynamic capabilities and business performance is explained in study [2], but other factors that also have the potential to influence SME performance, such as technological readiness and organizational resilience, have not been examined. This condition highlights a persistent challenge in transforming innovation-related capabilities into sustainable market advantages. Despite extensive research on SME innovation and performance, prior studies predominantly examined technological readiness, organizational capabilities, or environmental pressures, all of which were conducted in isolation. Limited empirical attention has been given to how these contextual and internal factors interact to shape innovation-driven CA, particularly in craft-based SMEs operating in emerging economies. Moreover, the mediating mechanisms through which these capabilities are translated into

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competitive outcomes remain underexplored. Given the technological constraints, informal organizational structures, and strong environmental pressures typically faced by craft-based SMEs in emerging economies, the Technology–Organization–Environment (TOE) framework provides a particularly suitable lens for capturing these multidimensional innovation readiness factors. This study addresses these gaps by proposing an integrative framework that links the TOE readiness (TR), Ambidextrous Organization (AO), and Organizational Resilience (OR) to CA through IP. Existing studies have rarely examined how TR interacts simultaneously with AO and OR through IP, particularly in craft-based SMEs in emerging economies.

Recent studies emphasize that IP is a key determinant of SME competitiveness, growth, and long-term sustainability [3-5]. Nevertheless, innovation among Indonesian SMEs remains constrained by limited digital readiness, insufficient managerial capability, weak access to external networks, and low investment in research and development [6-8]. These limitations are particularly pronounced in craft-based SMEs, where traditional production methods and incremental innovation dominate, thereby reducing firms' ability to respond effectively to environmental turbulence and market uncertainty. As a result, understanding the drivers of IP and their role in fostering CA is essential for strengthening SME competitiveness in emerging economies. Given these multifaceted challenges involved, a comprehensive framework is required to capture not only internal organizational conditions but also technological readiness and external environmental pressures. The TOE framework is particularly suitable for craft-based SMEs, as it enables the analysis of innovation readiness by simultaneously considering technological infrastructure, organizational capabilities, and contextual constraints commonly faced by SMEs in emerging economies.

The TOE framework has been widely adopted to explain organizational readiness for technology adoption and innovation [9, 10]. Empirical evidence suggests that technological infrastructure, organizational support, and environmental pressures, such as competition and government regulation play a critical role in shaping innovation outcomes and firm performance [2, 9, 11]. However, most of the existing literature treats TR as a direct antecedent of innovation, without sufficiently considering how internal organizational capabilities condition or amplify its effects. As a result, TOE-based explanations of SME innovation often remain incomplete, especially in emerging economy contexts. The TOE framework is particularly well-suited for craft-based SMEs in emerging economies because it captures technological constraints, organizational capability gaps, and institutional pressures that jointly shape innovation readiness.

Based on a dynamic capability perspective, OA and OR have gained increasing attention due to the critical internal capabilities they possess that enable firms to innovate and compete under uncertainty. OA allows firms to balance exploration and exploitation, thereby enhancing strategic flexibility and innovation outcomes [6, 12, 13]. OR, meanwhile, reflects a firm's capacity to absorb shocks, adapt to environmental change, and sustain performance during periods of disruption [14, 15]. Recent empirical studies confirm that both ambidexterity and resilience positively influence IP and CA, especially in volatile market environments [16-18]. Nevertheless, prior research rarely integrates TR, AO, and OR within a single analytical framework, overlooking their potential complementarities.

Regardless of expanding interest in these constructs, prior studies rarely integrate TR, AO, and OR within a single analytical framework. Most research examines these factors in isolation, overlooking their potential complementarities. Moreover, the mediating role of IP in translating contextual readiness and internal capabilities into CA remains underexplored, particularly in craft-based SMEs operating in developing economies. This gap limits both theoretical understanding and practical guidance for SMEs seeking sustainable competitiveness. Despite extensive research on SME innovation and performance, prior studies predominantly examine technological readiness, organizational capabilities, or environmental pressures in isolation. Limited empirical attention has been given to how these contextual and internal factors interact to shape innovation-driven CA, particularly in craft-based SMEs operating in emerging economies. Moreover, the mediating mechanisms through which these capabilities are translated into competitive outcomes remain underexplored.

This study addresses these gaps by proposing and empirically testing an integrative model that links TR, AO, and OR to CA through IP. This study is among the first to examine the synergistic effects of these three capabilities simultaneously in a single structural model applied to craft-based SMEs in an emerging economy. Using survey data from Indonesian craft SMEs and Structural Equation Modelling (SEM), this study aims to: (1) examine the direct effects of TR, AO, and OR on IP; (2) analyze their direct effects on CA; and (3) investigate the mediating role of IP in these relationships. By integrating contextual readiness with internal dynamic capabilities, this research extends the SME innovation literature and provides actionable insights for policymakers and practitioners seeking to strengthen innovation-driven competitiveness in turbulent market environments.

This study was conducted by starting with a pre-study of 145 craft SMEs in Indonesia on the influence of the triple helix, ambidextrous organization, technological readiness, and organizational resilience on IP. This follow-up study involved 200 craft SMEs and used different questionnaire attributes, with the aim of measuring the impact of these variables on companies' ability to generate unique value and CA. The follow-up study involved 200 craft SMEs and used different questionnaire attributes.

2- Methods

In planning the research methodology, there are four parts, namely: (i) respondents and procedures, (ii) measurement approach and data analysis, (iii) ethical considerations, and (iv) consent to participate statement. This study employed a quantitative research design using a survey-based approach. The overall research process consisted of several sequential stages, including literature review, conceptual model development, questionnaire design, data collection, and data analysis using Structural Equation Modeling (SEM). To provide a clear overview of the methodological workflow, Figure 1 presents the research methodology flowchart used in this study.

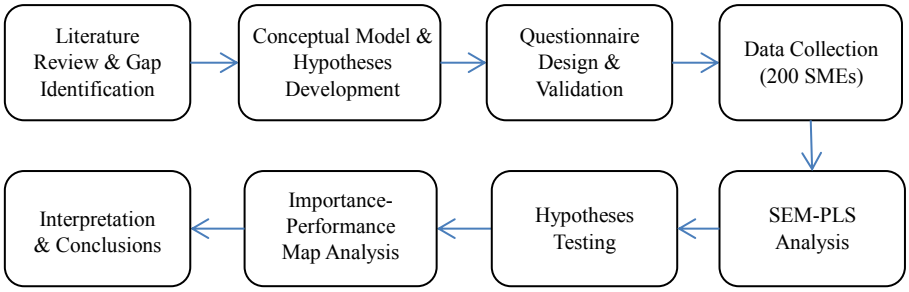

Figure 1. Research methodology workflow

2-1- Respondents and Procedure

The respondents in this study consisted of craft artisans and distributors located across several regions in East Kalimantan, Indonesia, including Samarinda, Balikpapan, Bontang, Kutai Kartanegara, Kutai Barat, Mahakam Ulu, Penajam Paser Utara (PPU), and Berau. 200 participants were surveyed using a structured questionnaire. Participation in the study was voluntary, and there was no coercion during the data collection process.

The demographic characteristics of the respondents were categorized based on their age, type of business owned, years of business operation, and the number of employees. Table 1 presents the demographic characteristics of respondents, categorized by age group, type of business, years in operation, and number of employees. The distribution indicates that the majority of respondents (83 individuals) fall within the 41–50 age group, highlighting that most SMEs/craft artisans are in their mid-adulthood to older age categories. Such an age distribution could pose challenges for the rapid development of the craft sector SMEs, as productivity, creativity, and learning capacity tend to differ compared to younger entrepreneurs.

Table 1. Distribution of respondent data

Respondent Group	Number of Respondents	Percentage (%)	Respondents Group	Number of Respondents	Percentage (%)
Age			***Length of time in business***		
21-30 years old	24	12	1- 5 years	93	46.5
31-40 years old	51	25.5	6-10 years	48	24
41-50 years old	83	41.5	11- 15 years	27	13.5
51-60 years old	42	21	16-20 years	28	14
			21-25 years	4	2
Type of business			***Number of employees***		
rattan, bamboo, eceng gondok weaving	56	28	1 - 5	162	81
Wood craft	44	22	6 - 10	33	16.5
carving	26	13	>10	5	2.5
batik, ulap doyo	36	18			
furniture	23	11.5			
Others	15	7.5			

2-2- Ethical Approval

Ethical considerations were carefully observed throughout the data collection process. Participation was voluntary, informed consent was obtained from all respondents, and anonymity and confidentiality were strictly ensured. In this study, there were no elements that could be considered highly dangerous or impactful on the safety of the respondents, as the questions asked were only concerned with organizational management. Although formal ethical approval was issued after data collection, the study adhered to standard ethical research principles in accordance with institutional guidelines and international research ethics standards.

2-3- Measurement and Data Analysis Approach

This study employed a survey-based quantitative design to collect responses from SME participants. The conceptual framework consisted of four main constructs, OA, OR, TR, and IP, with CA serving as the outcome variable. Each construct was operationalized through multiple indicators adapted from previously validated measurement scales and assessed using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Data were analyzed using SEM with SmartPLS 3.0, as it is efficient in examining complex models involving composites and hierarchical causal relationships. Partial Least Squares Structural Equation Modelling (PLS-SEM) was employed due to its suitability for exploratory research, complex models with multiple constructs and mediation effects, and relatively moderate sample sizes. Additionally, PLS-SEM is particularly useful for prediction-oriented studies and does not impose strict normality assumptions, making it very suitable for SME research contexts. The validity and reliability of the measurement model were assessed using several criteria. Convergent validity was evaluated through the Average Variance Extracted (AVE), with values above 0.50 indicating satisfactory validity. Discriminant validity was confirmed when each indicator's cross-loading on its respective construct exceeded its loadings on other constructs. Multicollinearity was examined using the Variance Inflation Factor (VIF), with acceptable values of less than 10 [19].

Reliability was verified using Cronbach's alpha, with a threshold of 0.70 or higher denoting adequate internal consistency. Outer loadings greater than 0.70 indicated strong correlations between indicators and their latent constructs. The structural model was evaluated through several statistical criteria: (1) the coefficient of determination (R^2) to assess the explanatory power of endogenous variables; (2) predictive relevance (Q^2) to determine model accuracy; (3) t-statistics and corresponding p-values ($p < 0.05$) obtained via bootstrapping to assess the significance of hypothesized paths; and (4) the Goodness of Fit (GoF) index, where values approaching 1 represent a robust overall model fit [19].

3- Theoretical Framework and Hypothesis Development

The conceptual framework was developed by integrating the dynamic capabilities of SMEs and the TOE framework. Dynamic capabilities describe how SMEs develop, integrate, and reconfigure internal competencies to cope with a rapidly changing environment, by emphasizing ambidexterity and organizational resilience as key mechanisms. The TOE framework provides a contextual perspective on how technological readiness, organizational, and environmental variables, shape SMEs' ability to create innovation. By integrating these two perspectives, this study conceptualizes dynamic capabilities (AO and OR) and TR as transformed into IP that impacts CA. This combined theoretical approach allows for a more comprehensive explanation of SME competitiveness beyond single-factor models. In addition, this research model was developed from previous research by the author involving the triple helix role, AO, OR to achieve IP, which was conducted on 145 craft SME respondents in Indonesia.

In the first stage of this research method, the problem definition and literature review related to this research were conducted. At this stage, a conceptual model was designed based on several previous studies and preliminary hypotheses were formulated to address the research problems. Each construct was modeled as a latent variable and measured using a scale of several items taken from the existing literature.

Hypothesis design is useful for explaining the relationship between dependent and independent variables. Figure 2 presents the conceptual model of the research, showing the relationship between the variables of TR, OR, and AO on the IP of SMEs that follow the conceptual model design. The variables in the conceptual model in Figure 1 attempt to explain the following relationships: (i) the correlation between SME TR and the achievement of CA with IP as a mediator; (ii) the correlation between SME AO and the achievement of CA with IP as a mediator; (iii) the correlation between OR and the achievement of CA, with IP as a mediator; (iv) the correlation between OA and the relationship with the achievement of CA; (v) the correlation between OR and the relationship with the achievement of CA.

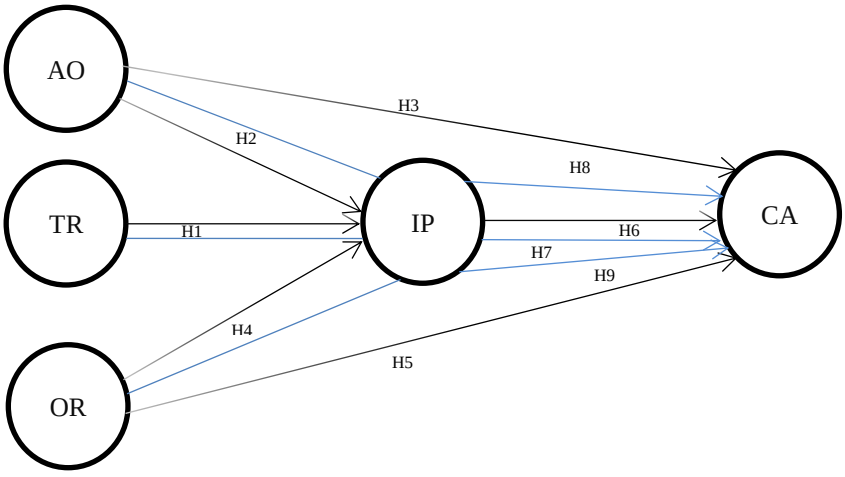

Figure 2. Initial SEM model for predicting competitive advantage

3-1- TOE Readiness (TR)

The TOE framework explains how companies adopt innovations in technology, organization, and environment [9, 10]. The implementation of technology not only changed the organization's work patterns to be more modern, but has also increased productivity, transparency, data security, and more optimal budget allocation [20]. The TOE framework is effective in value creation and innovation. Other studies also state that TOE elements have a positive significance on company performance and influence both CA and e-business with government regulations.

From a technological perspective, this refers to an organization's ability to adopt new technologies that have comparative advantages and innovation complexity [21]. TR elements include the availability of infrastructure, compatibility, and relative benefits perceived by users, and from an organizational perspective, it emphasizes human resources, corporate culture, and managerial support to drive change. Organizational factors refer to the resources available within the Organization and how the characteristics and internal support of the Organization contribute to improving organizational performance and customer satisfaction [22]. In terms of the environment, it highlights competitive pressures, government support, and regulatory conditions that shape the external dynamics of an organization. Several studies explain that the environmental aspect in the TOE framework is defined as activities between buyers and suppliers [23] as well as competitive competition in the market [24], thus making organizations need to conduct R&D [25] in the field of technology to increase product innovation. The three components of technology acceptance, which include perceived usefulness, perceived enjoyment, and confirmation, significantly increase user satisfaction and impact organizational performance improvement [26]. Therefore, we have identified the following:

H1: *TR has a significant effect on IP.*

3-2- Ambidextrous Organization (AO)

AO refers to an organization's capability to balance the exploration of new opportunities and the exploitation of existing resources, and it is widely recognized as a key driver of SME performance. Empirical studies consistently support this view. For example, Jaidi et al. [12] found that ambidextrous behavior among creative SMEs in Indonesia and Taiwan significantly enhanced IP under disruptive conditions. Similarly, Adibah & Abdul Ghofar [17] identified ambidexterity as a mediating mechanism linking strategic leadership to organizational performance in batik SMEs in Yogyakarta, while Mariza & Baskoro [27] demonstrated that strategic ambidexterity directly improves business performance and supports sustainable CA in manufacturing firms in Jakarta.

From an innovation perspective, ambidexterity is operationalized through the complementary integration of exploitative and exploratory activities. Exploitation emphasizes leveraging existing knowledge, technologies, and resources to improve efficiency and product quality, whereas exploration focuses on developing new knowledge, innovative capabilities, and market opportunities through investments in product development and promotion [6, 27]. Rather than representing opposing strategies, the interaction of exploration and exploitation enables firms to pursue incremental improvements while simultaneously preparing for future growth.

Firms exhibiting high levels of AO tend to be more adaptive and innovation-oriented. They continuously refine internal processes and introduce new products by adopting advanced technologies such as supply chain management systems [28], information technology and IoT solutions [29], and forecasting tools [30]. In addition, supportive organizational cultures characterized by internal support, discipline, and trust, together with contextual factors such as resource availability and service innovation quality from the TOE perspective, further strengthen ambidextrous capabilities. At the firm level, ambidexterity has been shown to consistently improve performance, particularly when supported by appropriate organizational strategies and favorable business environments [5]. Accordingly, AO can be regarded as a crucial strategic mechanism that enables SMEs to sustain continuous innovation and competitiveness in dynamic markets. Based on the reviewed literature, the following hypotheses are proposed:

H2: *AO has a significant effect on IP.*

H3: *AO has a significant effect on CA.*

3-3- Organizational Resilience (OR)

OR is defined as an organization's ability to maximize its internal capacity in a changing market environment [14], sustain organizational activities [31], and quickly recover from unexpected threats [32] towards continuous adaptation [33]. A flexible, externally oriented, and balanced cultural strategy is most effective in helping SMEs cope with the pressures of economic crisis [34]. Research on the implementation of technology in business innovation development indicates the strong influence of technological adoption on an organization's ability to withstand market challenges [35]. In practice, AO also supports resilience by enabling the development of optimal production [36] and sales models to cope with market complexity [37].

For SMEs, resilience facilitates adaptation to change, ensures business continuity, and enhances the effectiveness of crisis response. It functions not only as the capacity to recover but also as an ability to thrive under pressure, ultimately contributing to improved long-term performance. Within the SME context, OR has been shown to significantly enhance innovation and business performance, especially in conditions of market uncertainty [38]. Recent studies also suggest that digital and adaptive resilience play an important role in fostering sustainable CA [39]. Accordingly, the following hypotheses are proposed:

H4: *OR has a significant effect on IP.*

H5: *OR has a significant effect on CA.*

3-4- Innovation Performance (IP)

The study highlights that the adoption and effective utilization of e-commerce technologies significantly contribute to improving the operational and strategic performance of SMEs [40]. OA contributes to higher performance when a balance between exploration and exploitation is achieved, and when organizations effectively integrate both dimensions [41]. Likewise, organizations that can withstand threats and overcome obstacles are considered to have stronger performance outcomes [18].

OR can be assessed through key performance indicators in both the financial and non-financial domains, enabling firms to remain competitive and sustainable [42]. Resilience positively influences organizational performance [15]. Firms, in turn, require effective innovation not only to generate products and services but also to respond swiftly and appropriately to market changes while improving operational efficiency. Product and process innovation directly contribute to a CA through differentiation and cost reduction, thereby reinforcing sustainable competitiveness [43]. Thus, we proposed the following hypothesis:

H6: *IP has a significant effect on the CA of SMEs.*

3-5- Competitive Advantage (CA)

A firm achieves a CA when it is able to offer products or services that are superior, differentiated, or more efficient compared to its competitors. CA is significantly influenced by an OR to adopt and integrate TOE factors, its ambidextrous capabilities, OR, and IP. Organizations that are ambidextrous balancing resource exploitation with opportunity exploration tend [44] to be more flexible in responding to market uncertainty, thereby strengthening their competitive position [45].

Moreover, IP serves as a strategic bridge that links internal capabilities with CA [46]. Evidence demonstrates that product, process, and business model innovation enhance organizational competitiveness by creating differentiation and cost advantages [47]. Perceived process innovation has proven to be the most powerful factor influencing companies' decisions to pursue continuous innovation, thereby impacting CA [48].

From a dynamic capability perspective, organizational capabilities do not directly translate into CA unless they are effectively deployed through innovation-related outcomes. IP represents the tangible manifestation of firms' ability to transform contextual readiness and internal capabilities into market-relevant value. Accordingly, TR, AO, and OR are expected to influence CA primarily through their impact on IP, which functions as a strategic transmission mechanism. Accordingly, this study proposes the following hypotheses:

H7: *IP mediates the relationship between TR and CA.*

H8: *IP mediates the relationship between AO and CA.*

H9: *IP mediates the relationship between OR and CA.*

A comprehensive understanding of TR is a crucial prerequisite for SMEs to achieve CA through digital innovation. In this study, the TR framework is developed through six main dimensions: compatibility (TR1) [49] and complexity (TR2), which emphasize how technologies available within the firm are adopted [50]; top management support (TR3), which refers to the extent to which organizations provide facilities for strengthening infrastructure [51]; digital culture (TR4), highlighting the role of digitalization culture within the organization [52]; competitive pressure (TR5), which relates to innovation pressures from competitors; and government support in terms of regulations (TR6) [50].

AO is measured using the scale of exploration (AO1) and exploitation (AO2) indicators [53]. OR is operationalized using three indicators: resilience behavior (OR1) [41], resilience resources (OR2) [54], and resilience capability (OR3) [55]. The IP of SMEs is assessed using five indicators: product diversification (IP1) [56], customer orientation (IP2) [57], entrepreneurial orientation (IP3) [58], process innovation (IP4) [59], and competence innovation (IP5) [60]. The

endogenous variable in this study is CA, which, according to the literature, can be measured using indicators such as firm-specific competencies (CA1) [61] and market position (CA2) [62].

4- Results and Discussion

4-1- Result

The data obtained from the respondents were processed and analyzed using SMART PLS 3.0. The correlation between variables was tested using factor loading values and Average Variance Extracted (AVE). As presented in Table 2, the variables TR, OA, OR, IP, and CA were found to be valid and reliable.

The empirical analysis using SEM-PLS demonstrates that the proposed model exhibits satisfactory explanatory and predictive power. All constructs meet the recommended thresholds for reliability and validity, confirming the robustness of the measurement model. The structural model results indicate that TR, OA, and OR significantly influence IP, which in turn exerts a strong positive effect on CA. Moreover, IP acts as a complementary partial mediator linking TR, AO, and OR to CA. As shown in Figure 3, these findings support all nine hypotheses (H1–H9), suggesting that SME competitiveness is not driven by a single capability but rather by the interaction of contextual readiness and internal dynamic capabilities.

Table 2. Factor loading values and average variance extracted

Construct	Measurable Items	Loading Factor	p-value	CA	CR	AVE	R^2	Q^2	SRMR
TR	TR1	0.838	0.000	0.878	0.908	0.622			0.058
	TR2	0.824	0.000						
	TR3	0.754	0.000						
	TR4	0.757	0.000						
	TR5	0.81	0.000						
	TR6	0.745	0.000						
OR	OR1	0.737	0.000	0.707	0.837	0.631			
	OR2	0.822	0.000						
	OR3	0.821	0.000						
AO	AO1	0.895	0.000	0.746	0.887	0.797			
	AO2	0.891	0.000						
IP	IP1	0.829	0.000	0.896	0.923	0.706	0.443	0.306	
	IP2	0.865	0.000						
	IP3	0.809	0.000						
	IP4	0.858	0.000						
	IP5	0.84	0.000						
CA	CA1	0.922	0.000	0.82	0.917	0.847	0.381	0.311	
	CA2	0.919	0.000						

*CA: Cronbach's Alpha; CR: Composite Reliability; AVE: Average Variance Extracted; SRMR: Standardized Root Mean Square.

Furthermore, the Q-squared values indicate that the proposed model demonstrates good predictive relevance. The model explains 30.6% of the variance in IP and 31.1% of the variance in CA, confirming that the research framework has acceptable explanatory power. The next step was to conduct bootstrapping with 200 samples to obtain p-values, which were subsequently used to analyze the proposed hypotheses. Based on Table 2, the Standardized Root Mean Square Residual (SRMR) value was found to be less than 0.10, indicating that the model has a good overall fit in representing the underlying structure.

To examine the direct relationships among variables, the analysis relied on the size of the path coefficients, with significance determined by p-values < 0.05 and t-statistics > 1.96. Based on these criteria, the hypotheses were accepted (Table 3). Figure 2 and Table 3 illustrate the corresponding path coefficients and p-values, respectively. The results revealed that TR has a significant effect on IP (H1), AO has a significant effect on IP (H2), AO significantly affects CA (H3), OR significantly influences IP (H4), OR significantly influences CA (H5), IP significantly affects CA (H6), TR significantly affects CA through IP as a mediator (H7), AO significantly affects CA through IP as a mediator (H8), and OR significantly affects CA through IP as a mediator (H9).

Table 3. Direct effect, indirect effect, and total effect

No.	Variables	Direct Effect	P-Values	Indirect Effect	P-Values	Total Effect	P-Values	Result
1	TR → IP **(H1)**	0.314	0			0.314	0	Supported
2	AO → IP **(H2)**	0.365	0			0.365	0	Supported
3	AO → CA **(H3)**			0.215	0	0.215	0	Supported
4	OR → IP **(H4)**	0.144	0.023			0.144	0.023	Supported
5	OR → CA **(H5)**	0.109	0.078	0.085	0.026	0.194	0.006	Supported
6	IP → CA **(H6)**	0.59	0			0.59	0	Supported
7	AO → IP → CA **(H7)**			0.215	0	0.215	0	Supported
8	TR → IP → CA **(H8)**			0.185	0	0.185	0	Supported
9	OR → IP → CA **(H9)**			0.085	0.026	0.085	0.026	Supported

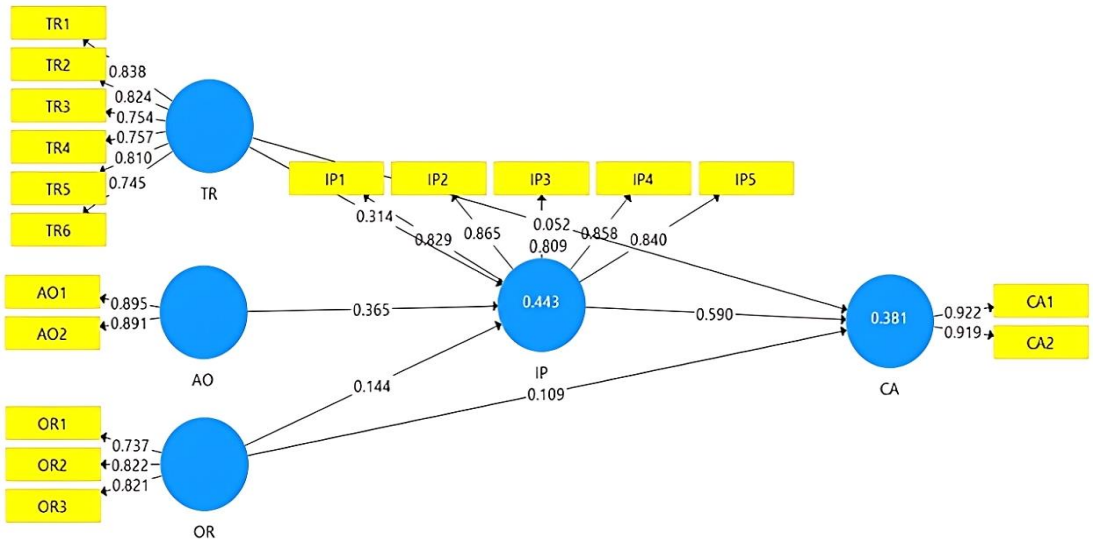

Figure 3. Path analysis model for predicting innovation performance

4-1-1- Effects of TOE Readiness (TR) on Innovation Performance (IP) and Competitive Advantage (CA)

The findings provide robust empirical evidence that TR plays a pivotal role in improving the IP of craft-based SMEs. The positive and significant path coefficient ($\beta = 0.314$, $p < 0.001$) indicates that when technological adequacy, organizational support, and environmental alignment are jointly strengthened, SMEs are better able to mobilize and coordinate resources for innovation-related activities. From a TOE perspective, technological readiness reduces operational constraints and information asymmetries, organizational readiness enhances managerial coordination and decision-making effectiveness, and environmental readiness improves firms' access to external knowledge, networks, and institutional support. Together, these conditions create a fertile organizational context in which innovation initiatives can be systematically developed and implemented. For craft-based SMEs in particular, TR not only facilitates the adoption of digital technologies but also enables the reconfiguration of production routines, knowledge flows, and decision-making structures, thereby increasing responsiveness to evolving market preferences and competitive pressures.

Furthermore, the results reveal that the influence of TR on CA is predominantly indirect and mediated by IP ($\beta = 0.185$, $p < 0.001$). This finding provides a process-based explanation that contextual readiness alone does not automatically generate superior competitive outcomes. Instead, TR functions as an enabling condition that must be actively transformed into tangible innovation outputs, such as new products, improved processes, and enhanced organizational competencies. In this sense, IP represents the operationalization of readiness in value-creating activities. SMEs that fail to convert contextual readiness into sustained innovation are therefore unlikely to realize competitive benefits, even when favorable technological and environmental conditions are present.

By emphasizing this mediating mechanism, the study advances TOE-based research that goes beyond the direct-effect logic and offers a more nuanced, process-oriented explanation of how contextual factors shape firm competitiveness. While prior studies have largely treated TR as an immediate determinant of firm performance in Sudari [9] research and in Song et al. [11], the present findings demonstrate that IP serves as a critical transmission mechanism linking readiness conditions to competitive outcomes. This refined understanding highlights the strategic importance of aligning digital readiness initiatives with innovation-oriented organizational capabilities, particularly for craft-based SMEs operating under resource constraints in developing economy contexts.

4-1-2- Effects of Ambidextrous Organization (AO) on Innovation Performance (IP) and Competitive Advantage (CA)

AO exhibits the strongest effect on IP among the antecedent variables ($\beta = 0.365$, $p < 0.001$), thereby supporting H2 and highlighting its central role in shaping innovation outcomes in craft-based SMEs. This strong effect indicates that SMEs capable of simultaneously engaging in exploratory activities (such as experimenting with new designs, materials, and market segments) and exploitative activities (such as refining existing products, improving production efficiency, and leveraging accumulated craftsmanship) are better able to generate sustained IP. From a dynamic capability perspective, ambidexterity enables firms to integrate learning-oriented exploration with efficiency-driven exploitation, allowing limited resources to be allocated more effectively across short-term operational needs and long-term innovation objectives. In craft-based SMEs, where innovation is predominantly incremental and deeply embedded in tacit knowledge and artisanal skills, ambidexterity facilitates the recombination of traditional competencies with new ideas and market insights. This recombination process enhances IP without requiring radical technological change or capital-intensive investments, which are often beyond the reach of small firms.

Moreover, the pronounced magnitude of the ambidexterity coefficient suggests that this capability plays a critical role in mitigating the inherent trade-offs between stability and change that characterize resource-constrained SMEs. Rather than prioritizing exploration at the expense of operational efficiency, or focusing excessively on exploitation to the detriment of novelty, ambidextrous SMEs are able to synchronize experimentation and refinement processes. This synchronization results in more consistent, scalable, and market-relevant innovation outcomes. In this respect, the findings extend prior ambidexterity research [12, 13] by demonstrating that balance between exploration and exploitation, rather than the intensity of either activity alone, is particularly crucial in the context of craft-based enterprises.

Furthermore, an ambidextrous organization also exerts a direct positive effect on CA ($\beta = 0.215$, $p < 0.001$), supporting H3, which indirectly indicates that ambidextrous SMEs benefit not only from improved innovation outcomes but also from enhanced strategic flexibility and market responsiveness. The presence of partial mediation by IP ($\beta = 0.215$, $p < 0.001$), confirming H8, suggests that ambidexterity strengthens competitiveness through dual pathways: value creation via innovation outputs and value appropriation through improved organizational learning, adaptability, and responsiveness to environmental change. Collectively, these findings reinforce AO as a core dynamic capability that enables craft-based SMEs to sustain CA in dynamic and resource-constrained environments.

4-1-3- Effects of Organizational Resilience (OR) on Innovation Performance (IP) and Competitive Advantage (CA)

The results indicate that OR has a positive but relatively modest effect on IP ($\beta = 0.144$, $p = 0.023$), supporting H4. Although smaller than the effects of TR and AO, this coefficient suggests that resilience plays a stabilizing and enabling role rather than acting as a primary driver of innovation. Specifically, resilience equips SMEs with the capacity to absorb shocks, reconfigure routines, and sustain learning processes, thereby ensuring continuity of innovation activities during periods of uncertainty and disruption. In the context of craft-based SMEs, where operational slack and financial buffers are often limited, resilience functions as a protective mechanism that prevents innovation efforts from being disrupted when firms face market volatility or external crises.

This finding is consistent with recent studies emphasizing resilience as a key enabler of sustained innovation and performance in turbulent environments [15, 18]. However, the relatively lower effect size indicates that resilience alone does not directly intensify innovation outcomes; rather, it creates the organizational conditions necessary for innovation to persist over time. Unlike firms that rely solely on efficiency-driven strategies, resilient SMEs are better positioned to adapt their processes, restructure resource allocation, and adjust business models in response to external shocks, thereby safeguarding their innovative capacity.

OR also demonstrates a significant total effect on CA ($\beta = 0.194$, $p = 0.006$), with IP acting as a partial mediator ($\beta = 0.085$, $p = 0.026$), supporting H5 and H9. This pattern of results suggests that resilience enhances competitiveness through both defensive and proactive mechanisms. Beyond enabling recovery and operational continuity, resilience supports the sustained deployment of innovation as a strategic asset, allowing SMEs to maintain market relevance and competitive positioning in dynamic and uncertain environments. Collectively, these findings extend prior research by empirically confirming that OR is not merely a survival-oriented capability but a strategic contributor to long-term competitiveness through its indirect reinforcement of IP.

4-1-4- Role of Innovation Performance (IP) as a Central Mediating Mechanism

IP emerges as the most influential predictor of CA in the model ($\beta = 0.590$, $p < 0.001$), strongly supporting H6. This substantial effect size underscores that SMEs capable of consistently delivering product, process, and competence innovations are better positioned to achieve differentiation and strengthen their market positioning. In the context of craft-based SMEs, IP represents the primary mechanism through which firms transform internal capabilities into externally visible competitive outcomes.

This result corroborates earlier studies linking innovation outcomes to CA [5, 46], while extending the literature by empirically demonstrating the integrative role of IP within a capability-driven framework. Rather than acting as a standalone outcome, IP functions as a central strategic conduit that channels the effects of TR, OA, and OR towards CA. The complementary partial mediation across all three antecedents highlights the fact that IP simultaneously reinforces and amplifies the direct effects of these capabilities, thereby strengthening their overall impact on competitiveness.

From a theoretical perspective, the presence of complementary partial mediation indicates that IP operates at the intersection of value creation and value appropriation. While TR, AO, and OR contribute directly to CA, their influence is significantly enhanced when translated into tangible innovation outcomes. Consistent with mediation theory [63], the alignment of direct and indirect effects in the same direction confirms that IP serves not merely as an intermediate variable but as a strategic bridge that converts organizational capabilities into sustained CA. These findings position IP as a core mechanism through which SMEs in dynamic and resource-constrained environments can achieve and sustain superior competitive positioning.

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4-1-5- Importance-Performance Map Analysis (IPMA) Insights and Managerial Interpretation

The Importance-Performance Map Analysis (IPMA) was applied as an additional element of SEM-PLS to assess the performance of each construct included in the model. IPMA highlights the importance (total effects) of each dimension and its indicators, as well as their corresponding performance levels. The results are represented in a four-quadrant diagram, where the vertical axis indicates performance and the horizontal axis represents perceived importance. The quadrants were delineated using the mean performance scores and mean importance scores, which were reported in the IPMA results (Table 4).

Table 4. Indicator and variable performance and importance (total effects)

Variable	Performances	Total Effects	Indicator	MV Performances	Total Effects
AO	50	0.215	AO1	50	0.121
			AO2	50	0.12
IP	50	0.59	IP1	50	0.14
			IP2	50	0.147
			IP3	50	0.136
			IP4	50	0.144
			IP5	50	0.134
OR	50	0.194	OR1	50	0.073
			OR2	50	0.086
			OR3	50	0.085
TR	50	0.133	TR1	50	0.032
			TR2	50	0.029
			TR3	50	0.028
			TR4	50	0.028
			TR5	50	0.026
			TR6	50	0.026
Average	**50**	**0.4025**		**50**	**0.132**

The IPMA results (Figures 4 and 5) reveal that each construct demonstrates varying levels of importance and performance in shaping the CA. The IPMA results further reinforce the SEM findings by highlighting IP as the most important construct in explaining CA, despite its moderate performance level. This mismatch suggests substantial room for improvement and indicates that SMEs should prioritize innovation-related initiatives to maximize competitive gains. Ambidexterity, while highly important, exhibits lower performance, suggesting that many SMEs struggle to effectively balance exploration and exploitation. This finding aligns with prior research indicating that ambidexterity is difficult to implement in resource-constrained SMEs (Clauss et al., 2021). TR and OR, although performing relatively well, serve primarily as supporting capabilities that enhance the effectiveness of innovation activities rather than directly driving CA.

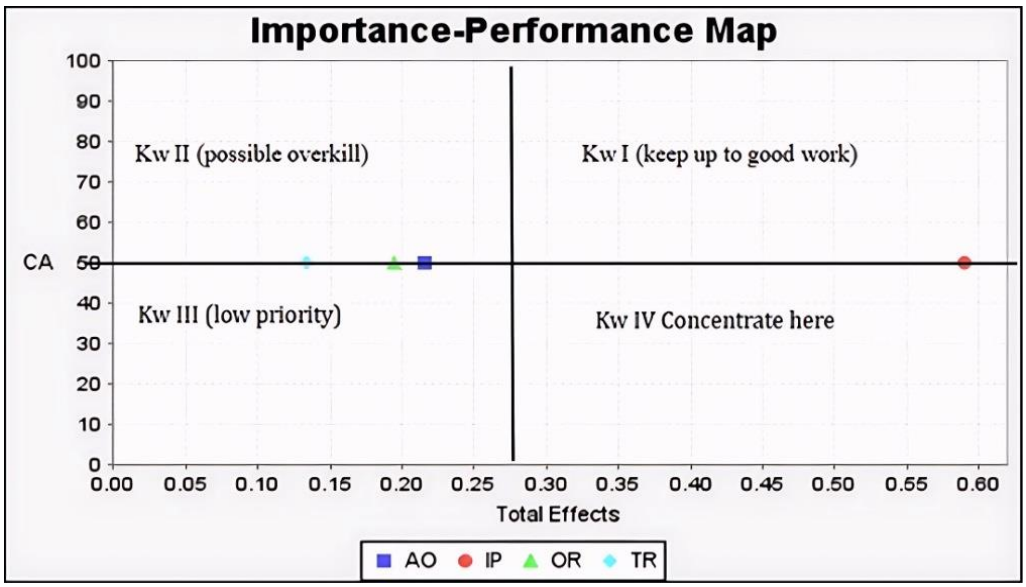

Figure 4. IPMA Variable Graph

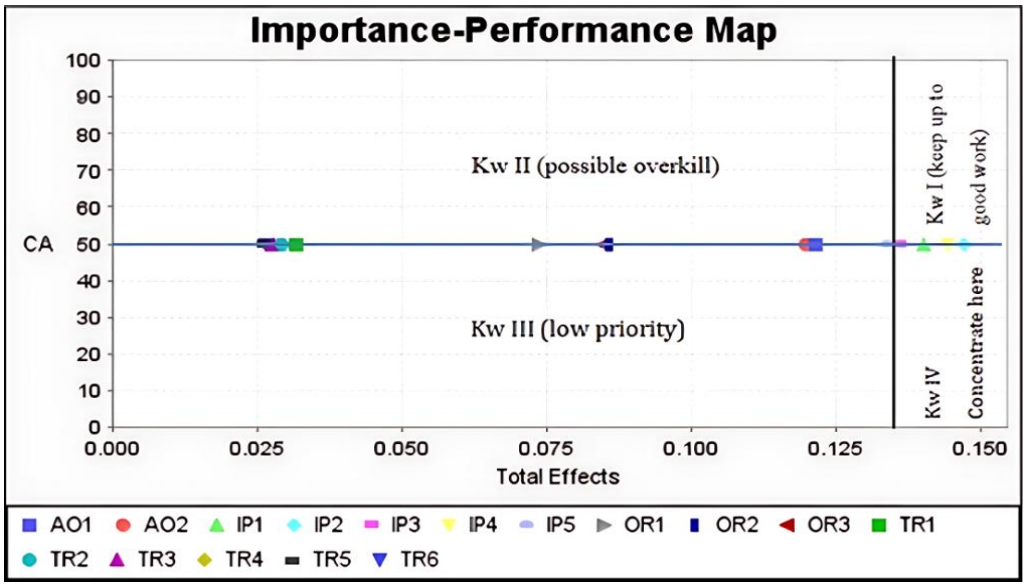

Figure 5. IPMA Indicator Graph

4-2- Discussion

The demographic profile of respondents provides additional insights into SMEs' innovation readiness. The dominance of owner-managers aged between 20 and 45 years suggests a balance between experiential knowledge and openness to innovation. However, the prevalence of micro-sized firms with limited employee numbers may constrain resource availability, reinforcing the importance of ambidextrous strategies and resilience in sustaining innovation activities under such limitations.

This study was motivated by the limited empirical evidence on how contextual readiness and internal dynamic capabilities jointly shape innovation-driven CA in SMEs, particularly in emerging economies. Addressing this gap, the findings demonstrate that the TR, AO, and OR interact synergistically to enhance IP, which in turn drives CA among Indonesian craft-based SMEs. The results provide empirical support for the integrative framework proposed in this study and confirm the central role of IP as a mediating mechanism linking organizational capabilities and contextual readiness to competitive outcomes.

The first objective of this study was to examine the relationship between TR and IP. The results of the data analysis indicate that TR, particularly technology readiness, organizational management, and government support, has a direct effect on IP. This finding is consistent with prior research, which demonstrates that green IP is not determined by a single factor but rather by a configuration of TOE elements, namely technological readiness combined with organizational support and environmental stimuli (e.g., government subsidies and market pressures) [39]. Similarly, in Chinese firms (2017–2020), an effective configuration was identified in the combination of technological and organizational factors to enhance digital IP [11].

The second objective was to analyze the effect of AO on IP. Although SMEs may not be able to simultaneously and fully pursue both exploratory (e.g., experimenting with new business models) and exploitative activities (e.g., product diversification), their gradual efforts nevertheless demonstrate improvements in product IP. This result is consistent with evidence suggesting that knowledge sharing fosters ambidextrous organizations, which in turn enhances firm performance, including innovation-related outcomes [16]. Moreover, ambidexterity has been shown to help SMEs respond effectively to disruptive innovation streams [12].

The third objective was to examine the role of OR, which was found to exert a positive effect on IP. This implies that SMEs are likely to reorganize their structures, adopt new technologies, or even implement business model innovations in response to market shifts or crises. This result corroborates previous research showing that resilience enables organizations to transform external pressures into catalysts for product and process innovation [64]. Resilient firms also demonstrate greater adaptability in developing new ideas and aligning them with market demand, thereby directly contributing to improved IP.

The fourth objective is to confirm that IP has a positive effect on CA. SMEs are more likely to compete successfully in the marketplace when they can deliver unique characteristics and novel innovations through their products. This finding is consistent with prior studies that demonstrate a positive relationship between innovation strategies/capabilities (and their resulting performance) and CA [5].

Finally, the sixth and seventh objectives, which also represent the novelty of this study, demonstrate that ambidextrous organizations and OR positively influence CA. Combining organizational exploration and exploitation with strategic agility will significantly enhance CA. CA [65] argues that combining organizational exploration and exploitation with strategic agility substantially enhances CA. In conclusion, based on the findings and their alignment with the literature, this study confirms the critical role of TR, AO, and OR in fostering IP, which ultimately drives SMEs' CA.

5- Conclusion

Building on the empirical results discussed in the preceding section, this study demonstrates that the relationships between contextual readiness, internal organizational capabilities, and competitive outcomes in craft-based SMEs are best explained through an integrated theoretical lens combining the TOE framework and dynamic capability theory. The findings empirically support three hypotheses, namely H1, H2, and H3, indicating that TOE readiness, organizational ambidexterity, and organizational resilience each have a significant positive effect on innovation performance. As elaborated in the discussion, these results suggest that innovation performance reflects SMEs' ability to align technological readiness and environmental conditions with internal capabilities for balancing exploration and exploitation while maintaining adaptive capacity under uncertainty. Consistent with H4, innovation performance is shown to exert a significant positive effect on competitive advantage, confirming its role as a proximal outcome through which innovation-oriented capabilities enhance market positioning.

Furthermore, the mediation results support five other hypotheses, namely H5 through H9, demonstrating that innovation performance acts as a complementary mediating mechanism linking TOE readiness, organizational ambidexterity, and organizational resilience to competitive advantage. This finding substantiates the causal explanations advanced in the discussion by clarifying how external readiness and dynamic organizational capabilities are translated into competitive outcomes rather than exerting purely direct effects. From a theoretical standpoint, the study contributes to the literature by empirically validating an integrated structural model in which TOE readiness operates in conjunction with ambidexterity and resilience, rather than as an isolated antecedent of innovation. The results further indicate that contextual readiness alone is insufficient to generate sustained competitive advantage without being internalized through organizational processes that support ambidextrous innovation and resilience. These results are consistent with the expected objectives. Overall, this study reinforces the argument that innovation performance constitutes a central strategic mechanism through which craft-based SMEs in emerging economies transform contextual conditions and internal capabilities into sustainable competitive advantage in dynamic and uncertain environments.

5-1- Theoretical Implications

Theoretically, this study extends the SME innovation literature by integrating the TOE framework with dynamic capability theory, particularly AO and OR, within a single empirical model. By moving beyond single-factor explanations, the findings demonstrate that CA emerges from the synergistic interaction of contextual and internal capabilities, with IP acting as a complementary mediating mechanism. This integrative perspective provides a more comprehensive explanation of SME competitiveness, especially within emerging economy contexts that remain underrepresented in prior research.

5-2- Practical Implications

From a practical standpoint, the results suggest that SME managers should not focus solely on technological adoption to the point of neglecting the development of ambidextrous strategies that balance exploration and exploitation while strengthening OR. Policymakers and support institutions are encouraged to design SME development programs that simultaneously enhance digital readiness, innovation capability, and adaptive capacity to foster long-term competitiveness.

5-3- Limitations and Future Research

This study is limited by its cross-sectional design and regional scope, which may restrict generalizability. Future research could adopt longitudinal or mixed-method approaches, extend the model to other sectors or countries, and incorporate additional organizational factors such as leadership or culture to further advance understanding of innovation-driven CA.

6- Declarations

6-1- Author Contributions

Conceptualization, E.F.S., S.G.P., and R.W.; methodology, E.F.S., S.G.P., and R.W.; software, E.F.S.; validation, S.G.P. and R.W.; formal analysis, E.F.S., S.G.P., and R.W.; investigation, E.F.S.; writing—original draft preparation, E.F.S.; writing—review and editing, E.F.S. and R.W.; visualization, E.F.S., S.G.P., and R.W.; supervision, S.G.P. and R.W.; project administration, E.F.S. All authors have read and agreed to the published version of the manuscript.

6-2- Data Availability Statement

The data presented in this study are available on request from the corresponding author.

6-3- Funding

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6-4- Acknowledgments

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6-5- Institutional Review Board Statement

The involvement of human participants was registered with the Ethics Commission of Mulawarman University, Samarinda, Indonesia, on July 2, 2025, and subsequently approved by the ethics committee on July 14, 2025, when the ethical clearance statement was officially issued. Clearance was granted after the data collection period, which took place from January 1 to December 31, 2024. Ethical approval for this study was granted by the Health Research Ethics Commission, Faculty of Medicine, Mulawarman University (No. 142/KEPK-FK/VII/2025), confirming compliance with the standards for the protection of human subjects. Participants were asked to complete a questionnaire, which initially included a written consent form to ensure the confidentiality of their data. They were informed that their responses would be used exclusively for academic purposes, with all data anonymized to guarantee privacy. Participants were also assured of their right to withdraw from the study at any time without penalty.

6-6- Informed Consent Statement

The respondents were randomly chosen from craft SMEs in East Kalimantan, Indonesia, based on the relevant characteristics. Consent was sought from each individual, and out of 245 invitations, 45 declined while 200 agreed to participate and completed the survey voluntarily. The study protocol provided written information regarding the objectives, potential risks, benefits, and participants' rights. All respondents were informed that they could withdraw at any stage. Confidentiality and anonymity of the data were strictly ensured in compliance with established ethical standards.

6-7- Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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Appendix I: Research Questionnaire

Survey Introduction

You are invited to participate in this academic research survey on innovation and competitiveness among small and medium-sized enterprises (SMEs). This study is conducted by Etwin Fibrianie, a doctoral candidate at the Institut Teknologi Surabaya**,** Faculty of Industrial Engineering**,** Department of Systems and Industrial Engineering**.** Your participation is voluntary, and all responses will be kept strictly confidential and used solely for academic research purposes. The questionnaire will take approximately 10–15 minutes to complete. As a token of appreciation, respondents who complete the survey will receive an incentive of IDR 20,000, provided in the form of a GoPay or DANA voucher.

Thank you for your time and valuable contribution.

(Etwin F & Team)

Informed Consent Statement

- I understand that this study is conducted by Etwin Fibrianie, a doctoral candidate at the Institut Teknologi Surabaya, Faculty of Industrial Engineering, Department of Systems and Industrial Engineering**.**
- I understand that my participation in this study is voluntary, and I may withdraw at any time without any consequences.
- I understand that all information I provide will be kept confidential and used solely for academic research purposes.
- I understand that the data will be analyzed in aggregate form, and no personal or business identity will be disclosed.
- I understand that, as a token of appreciation, I will receive an incentive of IDR 20,000 in the form of a GoPay or DANA voucher upon completion of the questionnaire.
- I agree to participate in this study.

Respondent Profile (Optional)

1. Age of owner/manager: …… years
2. Gender: □ Male □ Female
3. Number of employees: □ < 5 □ 5–9 □ 10–19 □ ≥ 20
4. Years in operation: □ < 5 □ 5–10 □ >10
5. Type of business: …

Instructions: Please indicate your level of agreement with the following statements based on your experience in managing your business.

Scale: 1 = Strongly Disagree | 2 = Disagree | 3 = Neutral | 4 = Agree | 5 = Strongly Agree

No	Indicators	1	2	3	4	5
Technology–Organization–Environment (TOE) Readiness, is TOE readiness refers to a firm's preparedness to adopt innovation based on its technological capabilities, organizational support, and external environmental conditions.						
1	TR1. Our business uses appropriate digital technologies to support daily operations.					
2	TR2. Information technology systems in our business are reliable and up to date.					
3	TR3. Digital tools help improve efficiency and accuracy in our business processes.					
Organizational Ambidexterity (OA), is a firm's ability to balance improving existing activities while exploring new opportunities to remain competitive.						
1	OA1. Our business simultaneously improves existing products while developing new ones.					
2	OA2. We balance refining current processes with experimenting with new ideas.					
3	OA3. Our business allocates resources to both short-term efficiency and long-term innovation.					
4	OA4. Employees are encouraged to explore new opportunities while maintaining operational efficiency.					
Organizational Readiness (ORg), is a firm's ability to adapt to disruptions, maintain operations, and recover quickly from unexpected challenges.						
1	OR1. Top management supports the adoption of new technologies and innovations.					
2	OR2. Employees are encouraged to learn and use new technologies.					
3	OR3. Our business has adequate internal resources to support innovation activities.					

Innovation Performance (IP), is innovation performance reflects how effectively a firm develops and implements new or improved products, services, or processes.	
1	IP1. Our business frequently introduces new or improved products.
2	IP2. We continuously improve production or service processes.
3	IP3. Our business adopts new ideas faster than competitors.
4	IP4. Innovation has improved the quality of our products or services.
E. Competitive Advantage (CA), is competitive advantage refers to a firm's ability to outperform competitors through differentiation, responsiveness, and superior customer value.	
1	CA1. Our products or services are differentiated from competitors.
2	CA2. Our business responds faster to market changes than competitors.
3	CA3. We achieve better customer satisfaction compared to competitors.
4	CA4. Our business has a stronger market position than similar firms.

Thank you for your participation. All responses will be kept confidential and used solely for academic research purposes.