

Ecosystem Collaboration Capability on Business Resilience: The Mediating Role of Knowledge Co-Creation

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ARTICLE INFO	ABSTRACT
Article history: Submitted: May 20, 2025 Final Revised: June 04, 2025 Accepted: June 15, 2025 Published: June 19, 2025	Purpose This study investigates how ecosystem collaboration capability contributes to business resilience among Indonesian small and medium-sized enterprises (SMEs) and examines the mediating role of knowledge co-creation in explaining this relationship. Although prior studies increasingly acknowledge the importance of business ecosystems in supporting organizational adaptability, existing literature remains fragmented in clarifying the mechanism through which collaborative capability is translated into resilient business outcomes. This study addresses this gap by positioning knowledge co-creation as the intermediate process connecting ecosystem collaboration capability and business resilience.
Keywords: Business Resilience; Ecosystem Collaboration Capability; Knowledge Co-Creation; SMEs; Structural Equation Modeling–Partial Least Squares (SEM-PLS).	Methods A quantitative explanatory research design was employed using a cross-sectional survey approach. Data were collected from 362 Indonesian SMEs selected through purposive sampling based on business experience and ecosystem participation criteria. The proposed model was analyzed using Structural Equation Modeling–Partial Least Squares (SEM-PLS) with SmartPLS 4. The analysis involved measurement model evaluation, structural model testing, and mediation analysis through bootstrapping procedures.
	Findings The results demonstrate that ecosystem collaboration capability has a positive and significant effect on business resilience ($\beta = 0.328$; $t = 5.412$; $p < 0.001$) and knowledge co-creation ($\beta = 0.694$; $t = 14.928$; $p < 0.001$). Knowledge co-creation also significantly influences business resilience ($\beta = 0.512$; $t = 8.361$; $p < 0.001$). Mediation analysis confirms that knowledge co-creation partially mediates the relationship between ecosystem collaboration capability and business resilience (indirect effect = 0.355; $t = 7.108$; $p < 0.001$). The structural model explains 48.2% of the variance in knowledge co-creation and 62.1% of the variance in business resilience, indicating substantial predictive capability.
	Research Implications This study extends business administration literature by integrating business ecosystem theory, the knowledge-based view, and dynamic capability perspectives into a unified framework explaining resilience formation. Practically, the findings suggest that SMEs and policymakers should prioritize collaborative infrastructures and shared knowledge mechanisms to strengthen adaptive capacity and long-term organizational sustainability.
	Originality This study offers a novel ecosystem-based explanation of business resilience by conceptualizing ecosystem collaboration capability as a strategic organizational capability and identifying knowledge co-creation as the underlying mechanism that transforms collaborative engagement into resilient outcomes. Unlike prior firm-centric approaches, this study advances resilience research through an ecosystem-oriented and mediation-based analytical model in the context of Indonesian SMEs.

INTRODUCTION

The contemporary business environment has entered an era characterized by systemic turbulence, accelerated digital transformation, and increasing interdependence among economic actors, prompting a substantial shift in administrative and strategic management scholarship from firm-centric competitiveness toward ecosystem-based resilience. In this evolving landscape, business resilience is no longer interpreted merely as an organization's capacity to absorb shocks, but increasingly as an emergent outcome generated through collaborative arrangements, relational resources, and distributed capabilities across interconnected actors. Recent studies indicate that firms embedded in entrepreneurial and innovation ecosystems exhibit superior adaptive capacity because access to external knowledge and collaborative infrastructures expands strategic flexibility under uncertainty (Zhang & Li, 2025). Parallel developments in digital and platform environments further demonstrate that resilience emerges from collective interactions that enable dynamic knowledge circulation and coordinated responses to disruption (Yu et al., 2022). The growing prominence of ecosystem logic has consequently transformed the conceptual foundations of business administration by repositioning resilience as a relational and co-created organizational capability rather than an internally accumulated asset.

Existing studies have increasingly explored collaborative mechanisms as antecedents of organizational resilience, yet the theoretical explanations remain fragmented across disciplinary traditions. Research in entrepreneurial ecosystems reveals that coopetition and dynamic exchange capability strengthen resilience by enabling organizations to mobilize external resources and maintain continuity under environmental volatility (Zhang & Li, 2025). Complementary findings emphasize that social media-enabled knowledge ecosystems facilitate collective intelligence and collaborative adaptation, generating stronger resilience outcomes among participating organizations (Yu et al., 2022). At the organizational level, co-creation practices have also been associated with improved work performance, employee well-being, and team resilience, suggesting that value emerges through interactive rather than unilateral processes (Partouche-Sebban et al., 2022). Similar evidence from service industries shows that resilience reinforces innovation capability and expands value co-creation mechanisms within SMEs operating under uncertain market conditions (Lopez et al., 2024). Collectively, these findings indicate that collaboration and knowledge interaction constitute increasingly central elements in explaining organizational survival and renewal.

Despite such advances, the literature exhibits unresolved conceptual ambiguity regarding the mechanisms through which collaborative capabilities are translated into resilient business outcomes. Most prior studies conceptualize collaboration as either a structural condition of ecosystem participation or as a contextual moderator of innovation processes, leaving insufficient explanation concerning the organizational capability that enables firms to extract adaptive value from ecosystem engagement. Investigations of digital service ecosystems suggest that ecosystem self-adjustment mediates value co-creation processes during periods of disruption, implying that resilience may depend on internalized collaborative capabilities rather than ecosystem membership alone (Sakaya, 2022). Studies on manufacturing innovation ecosystems similarly demonstrate that value co-creation affects innovation performance through multidirectional interactions among actors, yet stop short of clarifying whether collaborative capability itself constitutes a strategic antecedent of resilience (Pan et al., 2025). This conceptual inconsistency generates uncertainty regarding how firms transform ecosystem participation into durable organizational outcomes.

The fragmentation becomes more evident in studies focusing on knowledge-related processes, where knowledge creation is frequently treated as an auxiliary activity rather than a central explanatory mechanism. Interorganizational coworking research argues that collaborative environments reduce complexity while simultaneously stimulating resilience and open innovation through intensified knowledge co-creation processes (Hysa & Themeli, 2022). Empirical evidence from platform ecosystems further shows that knowledge sharing generates business value indirectly through governance mechanisms, indicating that knowledge processes may function as intermediate strategic pathways rather than direct performance drivers (Liu et al., 2025). Research grounded in open innovation theory likewise demonstrates that coupled knowledge flows significantly shape value co-creation dynamics within innovation ecosystems (Xin et al., 2026). These observations suggest that knowledge co-creation may represent the missing explanatory layer connecting ecosystem collaboration and resilient organizational performance, yet this proposition remains insufficiently tested in business administration research.

The empirical limitations of prior scholarship become increasingly problematic when viewed in the context of small and medium-sized enterprises (SMEs), particularly in emerging economies. Existing evidence concerning ecosystem-enabled resilience remains heavily concentrated in technologically advanced contexts and large organizations with abundant collaborative infrastructure. Studies investigating SME resilience frequently emphasize technological capability, digital adaptation, or innovation outcomes while giving limited attention to collaborative ecosystem capability as an organizational resource. Research demonstrates that co-innovation and analytical capabilities contribute to resilience under uncertainty, although the relational processes that convert external interactions into sustained adaptive capacity remain underdeveloped conceptually (Ciasullo et al., 2022). This

imbalance restricts theoretical generalizability and leaves unresolved questions regarding whether resilience in SMEs emerges from technological sophistication or from the capability to orchestrate ecosystem relationships and generate shared knowledge.

Such limitations establish both scientific and practical urgency for developing a more integrated explanatory model capable of connecting ecosystem collaboration, knowledge generation, and organizational resilience. From a scientific perspective, business administration literature requires stronger theoretical integration between ecosystem theory, knowledge-based perspectives, and resilience research to avoid treating collaboration as an isolated organizational practice. From a practical standpoint, SMEs increasingly operate in volatile environments shaped by market uncertainty, technological disruption, and shifting stakeholder expectations, conditions under which survival depends less on ownership of resources and more on capability to access and recombine external knowledge. The absence of robust empirical evidence explaining this process limits managerial understanding of how collaborative strategies can be transformed into sustainable resilience outcomes. Addressing this issue becomes particularly relevant for emerging economies where ecosystem participation may compensate for structural resource constraints.

Against this background, the present study positions itself within the intersection of ecosystem management, knowledge management, and business resilience literature by proposing ecosystem collaboration capability as a strategic organizational capability rather than merely an environmental condition. This study argues that firms derive resilience not solely from participation in ecosystems but from their capability to coordinate relationships, mobilize interactions, and convert collaborative engagement into knowledge co-creation processes. Knowledge co-creation is conceptualized as the mediating mechanism that transforms collaborative capability into adaptive organizational outcomes, thereby extending existing perspectives that predominantly examine direct effects between collaboration and performance. Through this positioning, the study responds simultaneously to conceptual fragmentation and empirical underrepresentation in prior business administration research.

This research therefore seeks to examine the effect of ecosystem collaboration capability on business resilience and to evaluate the mediating role of knowledge co-creation among Indonesian SMEs using a quantitative approach based on Structural Equation Modeling–Partial Least Squares (SEM-PLS). The study contributes theoretically by advancing an ecosystem-enabled explanation of resilience that integrates collaborative capability and knowledge generation into a unified causal framework. Methodologically, the study extends prior empirical work through mediation analysis in an emerging economy context and offers a predictive model for understanding resilience formation beyond firm-level resource accumulation. The expected findings are intended to enrich contemporary business administration scholarship while generating actionable insights for SMEs seeking to strengthen adaptive capacity through collaborative ecosystem strategies.

METHOD

Research Design

This study employed a quantitative research approach using an explanatory design to examine the causal relationships among ecosystem collaboration capability, knowledge co-creation, and business resilience. The research adopted a cross-sectional survey strategy because the objective was to evaluate structural relationships among latent variables and test mediation effects within a single period of observation. Structural Equation Modeling–Partial Least Squares (SEM-PLS) was selected as the analytical technique due to its predictive orientation, suitability for mediation analysis, and robustness in handling complex latent-variable models with non-normal data distributions.

Table 1. Research Design Specification

Component	Description
Research approach	Quantitative
Research type	Explanatory research
Time horizon	Cross-sectional
Unit of analysis	SME owners/managers
Analytical technique	SEM-PLS
Software	SmartPLS 4
Data collection method	Structured questionnaire
Scale	Likert Scale (1–7)

Table 1 demonstrates that the study was designed to test causal relationships rather than describe business phenomena. The explanatory approach allows the examination of direct and indirect effects among latent constructs. SEM-PLS was selected because the proposed model includes a mediation mechanism and predictive objectives.

Population, Sampling Technique, and Respondent Profile

The population consisted of Indonesian small and medium-sized enterprises (SMEs) actively operating across manufacturing, trade, services, and digital business sectors. The sampling process applied purposive sampling to ensure that respondents possessed relevant experience in ecosystem interaction and collaborative activities. Respondents were required to meet three criteria: (1) business operation for at least two years, (2) involvement in collaboration with external stakeholders such as suppliers, communities, government agencies, or digital platforms, and (3) active participation in business decision-making.

The minimum sample size was calculated using the ten-times rule and statistical recommendations for SEM-PLS. A total of 420 questionnaires were distributed and 362 valid responses were retained for analysis.

Table 2. Sampling Criteria and Data Collection Results

Item	Number
Distributed questionnaires	420
Returned questionnaires	381
Incomplete responses	19
Final valid sample	362
Response rate	86.0%

Table 2 shows that the study achieved a relatively high response rate, indicating acceptable participation among SME respondents. The exclusion process ensured that only complete and reliable responses entered the final dataset. The final sample exceeded the minimum requirement for SEM-PLS estimation.

Table 3. Respondent Characteristics (n = 362)

Variable	Category	Frequency	Percentage
Gender	Male	204	56.4%
	Female	158	43.6%
Business Age	2–5 years	104	28.7%
	6–10 years	147	40.6%
	>10 years	111	30.7%
Business Sector	Manufacturing	87	24.0%
	Trade	103	28.5%
	Services	122	33.7%
	Digital business	50	13.8%
Employees	<10	131	36.2%
	10–49	173	47.8%
	50–99	58	16.0%

Table 3 indicates that the sample represents heterogeneous SME characteristics across sectors and business maturity levels. Service and trade sectors constituted the largest proportion of respondents. Such variation improves the generalizability of the findings across different SME contexts.

Variable Measurement and Instrument Development

All constructs were measured using reflective indicators adapted and contextualized into SME settings. Responses were recorded using a seven-point Likert scale ranging from 1 (“strongly disagree”) to 7 (“strongly agree”).

Table 4. Operationalization of Variables

Variable	Code	Indicators
Ecosystem Collaboration Capability	ECC	Coordination capability; stakeholder integration; joint problem solving; information sharing; collaborative responsiveness
Knowledge Co-Creation	KCC	Knowledge exchange; collective learning; knowledge integration; co-development; shared experimentation
Business Resilience	BR	Adaptability; recovery capability; operational continuity; strategic flexibility; transformation capability

Table 4 illustrates that each construct was operationalized through multidimensional indicators reflecting theoretical definitions. Ecosystem collaboration capability captures organizational capacity to interact effectively with ecosystem actors. Knowledge co-creation and business resilience represent process and outcome dimensions respectively.

Conceptual Model

The conceptual model proposes that ecosystem collaboration capability directly affects business resilience and indirectly affects resilience through knowledge co-creation.

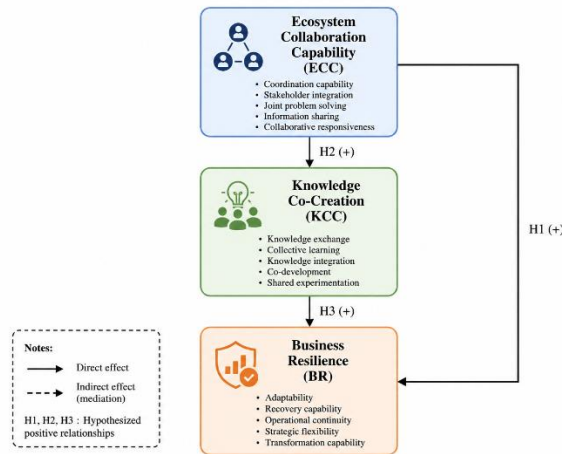
**Figure 1. Research Framework**

Figure 1 presents the mediation structure tested in this study. Knowledge co-creation is positioned as the mechanism through which collaborative capability translates into resilient outcomes. The direct relationship is maintained to evaluate partial mediation.

Data Analysis Technique

Data analysis was conducted using SmartPLS 4 through a two-stage procedure consisting of measurement model evaluation and structural model assessment. The measurement model assessed reliability and validity using indicator loading, Cronbach's alpha, composite reliability (CR), average variance extracted (AVE), and discriminant validity through HTMT. The structural model examined collinearity, path coefficients, coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2), and mediation effects through bootstrapping.

Table 5. Statistical Evaluation Criteria

Measurement	Threshold
Outer loading	> 0.70

Measurement	Threshold
Cronbach's Alpha	> 0.70
Composite Reliability	> 0.70
AVE	> 0.50
HTMT	< 0.90
VIF	< 5.00
p-value	< 0.05
R ²	≥ 0.25

Table 5 presents the statistical standards applied for model evaluation. These thresholds ensure reliability, convergent validity, discriminant validity, and predictive capability. The use of bootstrapping enables robust estimation of direct and indirect relationships among constructs.

Ethical Consideration

Participation in this study was voluntary and respondents provided informed consent before completing the questionnaire. All responses were anonymized and used exclusively for academic purposes. No personal identifiers were collected during data processing to maintain confidentiality and reduce response bias.

RESULTS

Respondent Descriptive Statistics

Descriptive analysis was conducted to identify the general distribution of responses across the study variables. The average values indicate respondents' perceptions regarding ecosystem collaboration capability, knowledge co-creation, and business resilience among Indonesian SMEs.

Table 6. Descriptive Statistics of Research Variables

Variable	Mean	Standard Deviation	Minimum	Maximum
Ecosystem Collaboration Capability (ECC)	5.64	0.83	2.40	7.00
Knowledge Co-Creation (KCC)	5.52	0.79	2.20	7.00
Business Resilience (BR)	5.70	0.76	2.60	7.00

Table 6 indicates that all latent variables achieved mean scores above 5.50, suggesting relatively positive perceptions among SME respondents. Business resilience recorded the highest average score, indicating that many respondents perceived their firms as capable of adapting and maintaining continuity under changing business conditions. The moderate standard deviation values also imply acceptable variability and sufficient dispersion for multivariate analysis.

Measurement Model Evaluation

The measurement model was evaluated to assess convergent validity and internal consistency reliability. Indicator loadings, Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE) were examined.

Table 7. Convergent Validity and Reliability Assessment

Construct	Indicators	Outer Loading	Cronbach's Alpha	CR	AVE
ECC	ECC1	0.842	0.911	0.934	0.740
	ECC2	0.873			
	ECC3	0.851			
	ECC4	0.867			
	ECC5	0.879			
KCC	KCC1	0.832	0.903	0.928	0.721

Construct	Indicators	Outer Loading	Cronbach's Alpha	CR	AVE
BR	KCC2	0.858	0.918	0.938	0.752
	KCC3	0.875			
	KCC4	0.841			
	KCC5	0.857			
	BR1	0.846			
	BR2	0.871			
	BR3	0.892			
	BR4	0.860			
	BR5	0.873			

Table 7 demonstrates that all indicator loadings exceeded the recommended threshold of 0.70. Cronbach's alpha and composite reliability values were above 0.90, confirming strong internal consistency. The AVE values exceeded 0.50 across all constructs, indicating adequate convergent validity.

Table 8. Discriminant Validity (HTMT)

Constructs	ECC	KCC	BR
ECC	—		
KCC	0.768	—	
BR	0.741	0.802	—

Table 8 shows that all HTMT values remained below the threshold of 0.90. These findings indicate sufficient discriminant validity among constructs. Each construct captured conceptually distinct dimensions and minimized overlap within the measurement model.

Structural Model Evaluation

The structural model was assessed through collinearity diagnostics, explanatory power, and predictive relevance.

Table 9. Structural Model Assessment

Construct	R ²	Adjusted R ²	Q ²	VIF
Knowledge Co-Creation	0.482	0.480	0.337	2.114
Business Resilience	0.621	0.617	0.442	2.304

Table 9 indicates that ecosystem collaboration capability explained 48.2% of variance in knowledge co-creation. The combined effect of ecosystem collaboration capability and knowledge co-creation explained 62.1% of business resilience variation. Positive Q² values confirm that the model possesses predictive relevance and satisfactory explanatory performance.

Hypothesis Testing

Hypothesis testing was conducted using bootstrapping with 5,000 subsamples to evaluate path significance.

Table 10. Direct Effect Testing

Hypothesis	Relationship	Path Coefficient (β)	t-value	p-value	Decision
H1	ECC $\rightarrow$ BR	0.328	5.412	0.000	Supported
H2	ECC $\rightarrow$ KCC	0.694	14.928	0.000	Supported
H3	KCC $\rightarrow$ BR	0.512	8.361	0.000	Supported

Table 10 demonstrates that all direct relationships were statistically significant. Ecosystem collaboration capability exerted a strong positive influence on knowledge co-creation and a moderate direct effect on business resilience. Knowledge co-creation also significantly contributed to business resilience, indicating that collaborative knowledge processes enhance organizational adaptability and continuity.

Mediation Analysis

The mediation effect of knowledge co-creation was examined to determine whether ecosystem collaboration capability influences business resilience indirectly.

Table 11. Indirect Effect and Mediation Analysis

Relationship	Indirect Effect	t-value	p-value	Mediation Type
ECC → KCC → BR	0.355	7.108	0.000	Partial mediation

Table 11 reveals that the indirect effect of ecosystem collaboration capability on business resilience through knowledge co-creation was statistically significant. Since both direct and indirect effects remained significant simultaneously, the mediation pattern was classified as partial mediation. This finding suggests that ecosystem collaboration capability strengthens resilience both directly and through the creation and integration of shared knowledge.

Effect Size Analysis

Effect size analysis was conducted to identify the substantive contribution of each exogenous construct.

Table 12. Effect Size (f^2)

Relationship	f^2	Interpretation
ECC → KCC	0.931	Large
ECC → BR	0.186	Medium
KCC → BR	0.352	Large

Table 12 indicates that ecosystem collaboration capability produced a substantial effect on knowledge co-creation. Knowledge co-creation generated a large contribution to business resilience, suggesting its strategic role within the model. The direct effect of ecosystem collaboration capability on resilience remained meaningful but weaker than the mediated pathway.

DISCUSSION

Ecosystem Collaboration Capability as a Strategic Foundation of Business Resilience

The empirical results demonstrate that ecosystem collaboration capability exerts a positive and significant influence on business resilience ($\beta = 0.328$; $p < 0.001$), indicating that SMEs capable of coordinating relationships and integrating external actors possess stronger adaptive and recovery capacities. This finding supports the proposition that resilience should not be conceptualized solely as an internally generated organizational attribute but as an ecosystem-enabled capability emerging from relational interactions. From the perspective of business administration theory, ecosystem collaboration capability expands the resource-based and dynamic capability traditions by emphasizing access, orchestration, and recombination of distributed resources. Firms increasingly compete through network embeddedness rather than isolated operational excellence. The explanatory power observed in this study suggests that collaboration functions as a mechanism through which uncertainty is transformed into collective strategic flexibility.

This finding aligns with ecosystem complementarity theory, which argues that organizational outcomes are increasingly shaped by co-evolutionary processes occurring across interconnected actors rather than within firm boundaries (Shou et al., 2022). Similar observations were reported by Toufaily and Zalan (2023), who found that resilience in service organizations emerges through ecosystem well-being and collaborative crisis responses. Evidence from stakeholder collaboration research also shows that coordinated ecosystem strategies improve risk prevention performance and organizational continuity (Li et al., 2022). The significance of the direct path further indicates that collaboration capability itself possesses intrinsic strategic value even before knowledge transformation occurs. This pattern reflects arguments developed in platform complementarity research showing that resource integration

capability enables organizations to sustain performance under complex environmental conditions (Pikkarainen et al., 2022). Comparable outcomes were identified in collaborative network studies demonstrating that partnership structures generate organizational competitiveness through collective action mechanisms (Permadi et al., 2025).

For SMEs, this finding suggests that resilience should be managed as a collaborative capability rather than a reactive recovery mechanism. Firms capable of continuously engaging suppliers, customers, institutions, and digital communities appear more capable of maintaining operational continuity during disruption. The result consequently extends business resilience literature by relocating resilience from an internal organizational outcome to a collaborative ecosystem phenomenon.

Ecosystem Collaboration Capability as an Antecedent of Knowledge Co-Creation

The strongest direct relationship in the model was observed between ecosystem collaboration capability and knowledge co-creation ($\beta = 0.694$; $p < 0.001$), indicating that collaborative capability substantially determines the extent to which organizations exchange, integrate, and generate knowledge collectively. This result suggests that knowledge does not emerge automatically from ecosystem participation but from the organizational capability to activate interaction processes. Theoretically, this finding reinforces the knowledge-based view by demonstrating that knowledge production increasingly depends on interorganizational engagement rather than internal accumulation. Knowledge co-creation becomes possible when firms establish routines for coordination, information circulation, and collective experimentation. The high effect size ($f^2 = 0.931$) confirms that collaborative capability acts as a dominant explanatory factor.

This result supports studies showing that innovation ecosystem stability enhances performance through knowledge acquisition mechanisms (Jiang et al., 2022). Research on socially embedded SME networks similarly argues that sustainable knowledge generation depends on trust, social interaction, and network participation (Capó-Vicedo et al., 2026). Findings from digital collaboration environments also indicate that crisis conditions often accelerate collaborative learning and shared value creation processes (Mursalzade, 2025). The empirical relationship observed here also resonates with recent developments in knowledge ecosystem literature emphasizing hybrid intelligence and collaborative cognition. Human–AI collaboration frameworks demonstrate that ecosystem intelligence emerges from collective interaction and knowledge exchange among heterogeneous actors (Ali et al., 2025). Similar conclusions appear in digital collaboration capability studies showing that organizational agility mediates the transformation of collaborative resources into innovation outcomes (Zhang & Hao, 2024). This finding implies that SMEs cannot rely solely on ecosystem membership as a strategic asset. The capability to coordinate interactions and translate relationships into collective knowledge becomes the decisive factor that differentiates resilient firms from merely connected firms.

The Role of Knowledge Co-Creation in Strengthening Business Resilience

The results indicate that knowledge co-creation significantly improves business resilience ($\beta = 0.512$; $p < 0.001$), suggesting that resilience emerges through organizational learning and collective knowledge integration processes. The magnitude of this effect demonstrates that knowledge capability functions as a central adaptive mechanism. From a theoretical standpoint, this finding supports the proposition that resilience is not simply a recovery response but an ongoing process of organizational renewal. Knowledge co-creation allows firms to interpret environmental change, redesign business processes, and identify strategic opportunities. Such mechanisms become increasingly important under dynamic market conditions.

The result is consistent with studies showing that organizational resilience is strengthened through open innovation and strategic knowledge orientation (Yu et al., 2026). Related findings indicate that knowledge brokerage stimulates dynamic capability development and sustainable ecosystem performance (Fait et al., 2024). Research on innovation capability also demonstrates that resilience-building among SMEs depends on the organization's capacity to continuously generate and absorb new knowledge (Shahzad et al., 2026). Additional support emerges from value co-creation literature showing that collective participation increases strategic flexibility and organizational transformation capability. Manufacturing ecosystem studies report that collaborative value creation improves adaptive outcomes through iterative knowledge exchange (Zhou et al., 2024). Evidence from customer and stakeholder co-creation research similarly highlights the importance of participatory interaction in generating superior organizational outcomes (Agag et al., 2025; Yang, 2025). At the managerial level, these findings imply that SMEs should invest not only in collaboration infrastructure but also in routines that convert interaction into actionable knowledge. Resilience appears to be built through learning capability rather than through resource accumulation alone.

Knowledge Co-Creation as the Mediating Mechanism

The mediation analysis confirmed that knowledge co-creation partially mediates the relationship between ecosystem collaboration capability and business resilience (indirect effect = 0.355; $p < 0.001$). This result indicates

that collaboration capability strengthens resilience both directly and indirectly through knowledge generation processes. Conceptually, this mediation structure explains an important mechanism previously underdeveloped in ecosystem literature. Ecosystem participation alone does not automatically produce resilience; organizational actors must transform interaction into shared understanding and coordinated strategic responses.

This finding supports recent studies suggesting that relationship quality and absorptive mechanisms determine whether collaborative ecosystems create business value (Al-Omoush, 2025). Research on digital transformation likewise demonstrates that knowledge management capability explains why some ecosystems outperform others despite similar technological infrastructure (Li et al., 2025). Evidence from platform empowerment research also indicates that trust and interaction quality enhance value co-creation outcomes (Sun & Qu, 2025). The result additionally aligns with arguments suggesting that knowledge destruction and information asymmetry can weaken ecosystem performance despite strong innovation capability (Arias-Pérez et al., 2026). Similar observations appear in studies examining how digital strategy influences stakeholder value creation through collaborative processes (Qiao & Liu, 2024). The mediation finding therefore contributes theoretically by clarifying that resilience emerges through an intermediate knowledge process rather than a purely structural collaborative effect. This provides a more nuanced explanation of ecosystem-enabled organizational adaptation.

Dynamic Capability Perspective on Ecosystem Resilience

The explanatory power of the model ($R^2 = 0.621$ for business resilience) indicates that collaboration and knowledge jointly explain a substantial proportion of resilience formation. Such evidence positions dynamic capability as a useful theoretical lens for interpreting ecosystem-enabled adaptation. Dynamic capability theory argues that organizations survive environmental turbulence through sensing, seizing, and transforming activities. Ecosystem collaboration capability appears to function as the sensing mechanism, while knowledge co-creation enables resource transformation into resilient outcomes. This interpretation corresponds with findings showing that digital capability and absorptive capacity support business model innovation under uncertainty (Durman et al., 2025). Similar arguments appear in research demonstrating that AI ambidexterity and ecosystem orchestration strengthen competitive advantage through capability renewal (De Fano et al., 2026). Studies on innovation ecosystem adoption also indicate that capability conversion determines whether ecosystem participation improves firm performance (Sun & Abdullahi Usman, 2025).

Further support comes from research showing that resilience emerges through interactions among digital transformation, human capability, and innovation readiness (Bahyan et al., 2025). Evidence from AI-enabled innovation also demonstrates that organizational capability serves as the conversion mechanism translating technological resources into strategic outcomes (Li et al., 2025). This perspective suggests that SMEs should not interpret ecosystem engagement as a static partnership model but as an evolving capability requiring continuous learning, orchestration, and adaptation.

Implications for Ecosystem Governance and SME Administration

The present findings generate several implications for administrative and strategic practice among SMEs. First, collaborative governance mechanisms should be treated as strategic investments rather than coordination costs. Ecosystem participation becomes valuable only when firms intentionally manage interaction quality and knowledge circulation. Second, resilience-oriented administration requires moving beyond transactional collaboration toward co-created strategic development. Research in digital innovation ecosystems demonstrates that value emerges when multiple stakeholders jointly shape organizational processes and outcomes (Li et al., 2022). Comparable conclusions were reported in studies of public governance reform and synergistic partnership systems (Khaerah et al., 2025).

Third, ecosystem management should remain attentive to the possible limitations of co-creation. Studies reveal that excessive co-creation without coordination may generate role overload and organizational tension (Terblanche & Babin, 2024). Similar concerns appear in studies emphasizing balanced stakeholder engagement and capability alignment (Bhattacharya & Damij, 2023). Evidence from sustainability and social entrepreneurship research further suggests that collaborative value creation contributes to broader social outcomes beyond financial performance (Amoozad Mahdiraji et al., 2025; Ashraf et al., 2026). Findings from educational and public-good ecosystems similarly show that co-creation expands transformative capability and long-term societal value (Davey et al., 2023; Nørgård & Holflod, 2025).

The ecosystem perspective appears increasingly applicable across multiple sectors, including tourism, service systems, and digital industries. Collaborative ecosystem governance has been shown to strengthen collective resilience through integration of heterogeneous actors and continuous value generation (Almunawar et al., 2026; Zhu & Wang, 2023; Liu, 2026; Tariq et al., 2026; Plouffe et al., 2024). These insights reinforce the proposition that ecosystem collaboration capability and knowledge co-creation represent strategic foundations for resilient SMEs in contemporary business environments.

CONCLUSION

This study contributes to business administration literature by proposing that business resilience is more appropriately understood as an ecosystem-enabled capability shaped through collaborative interaction and collective knowledge development rather than as an outcome generated solely from internal organizational resources. The findings collectively suggest that ecosystem collaboration capability becomes strategically meaningful when firms are able to transform interorganizational relationships into knowledge co-creation processes that strengthen adaptation, continuity, and long-term responsiveness. In doing so, this research extends the integration between business ecosystem theory, the knowledge-based view, and dynamic capability perspectives by introducing a more process-oriented explanation of resilience formation. Methodologically, the study demonstrates the relevance of a quantitative SEM-PLS approach for capturing complex relational mechanisms among SMEs in an emerging economy context. From a practical perspective, the study implies that SME resilience policies and managerial strategies should place greater emphasis on building collaborative infrastructures, strengthening stakeholder integration, and institutionalizing mechanisms that facilitate shared learning and collective problem solving, thereby contributing not only to organizational sustainability but also to broader economic stability and public welfare.

Despite these contributions, several research boundaries should be acknowledged. The cross-sectional design limits the ability to observe how collaboration capability and resilience evolve over time, while the focus on Indonesian SMEs and a limited set of constructs may not fully represent the complexity of ecosystem dynamics across industries and institutional environments. The quantitative orientation of this study also prioritizes generalizable relationships over deeper process-based explanations of how collaborative interactions are enacted in practice. Future research is encouraged to employ longitudinal, comparative, or mixed-method approaches and to incorporate additional variables such as absorptive capacity, digital capability, organizational agility, ecosystem governance, or innovation orientation to develop a more comprehensive resilience framework. Expanding empirical settings across sectors and countries would further strengthen theoretical generalization and provide richer evidence regarding how collaborative ecosystems can generate sustainable business systems and broader societal value.

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AI DISCLOSURE STATEMENT

Artificial Intelligence (AI) tools, specifically ChatGPT developed by OpenAI, were utilized solely to assist in language refinement, grammar improvement, idea organization, and editorial support during the preparation of this manuscript. The AI tool was not used to generate research data, conduct literature selection, perform data extraction, undertake coding procedures, synthesize findings, interpret results, or formulate the study's conclusions.

All stages of the research process, including research design, study selection, quality appraisal, thematic analysis, meta-synthesis procedures, conceptual framework development, interpretation of findings, and final manuscript preparation, were conducted, reviewed, and validated by the author. The author assumes full responsibility for the accuracy, originality, integrity, and scholarly quality of the work presented in this article.

The use of AI complied with the ethical guidelines and publication standards applicable to academic research. No AI system was credited as an author, and all intellectual contributions, analytical judgments, and research decisions remain the sole responsibility of the author.

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