

Social ecology based innovation communication and MSME sustainability: Evidence from an exploratory sequential mixed-methods study

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ABSTRACT

This study develops and empirically tests an initial model of Social Ecology-based Innovation Communication regarding MSME sustainability perceptions in Indonesia, employing an exploratory sequential mixed-methods design. Interviews with 12 MSME owners and managers identified stakeholder engagement, networking, knowledge exchange, community and institutional support, feedback, innovation, and digital communication as interconnected practices; these informed the development of a 32-item survey administered to 160 MSMEs. PLS-SEM results reveal positive relationships between Social Ecology and Innovation Communication ($\beta = 0.704$, $p < 0.001$), Innovation Communication and MSME sustainability perceptions ($\beta = 0.708$, $p < 0.001$), and Social Ecology and sustainability perceptions ($\beta = 0.415$, $p = 0.008$). Innovation Communication also demonstrates a significant indirect relationship between Social Ecology and sustainability perceptions ($\beta = 0.291$, $p = 0.013$), consistent with partial statistical mediation. These findings provide preliminary empirical support for Innovation Communication as a potential linking capability that connects social and institutional resources with innovation-oriented practices. The framework integrates Social Ecology, Communication for Development (C4D), Strategic Communication, and Diffusion of Innovations. Given the study's cross-sectional and self-reported nature, the findings indicate associations rather than causal relationships. The proposed model remains exploratory and requires further validation.

Keywords: *Innovation Communication; Communication for Development; Social Ecology; MSME sustainability perceptions; Exploratory Sequential Mixed Methods; PLS-SEM*

INTRODUCTION

Micro, small, and medium-sized enterprises (MSMEs) have contributed significantly to Indonesia's economic growth (60,5%) in providing workspace for Indonesian people, absorbing a large share of the national workforce (96,9%) (Afriyadi, 2023). However, their aggregate economic contribution does not always reflect strong productivity, resilience, or long-term sustainability at the firm level (Salsabillah et al., 2023; Sarfiah et al., 2019). Many MSMEs in Indonesia continue to face constraints regarding skills, finance, digital capabilities, access to knowledge, and institutional support (Lukita et al., 2025).

The Asian Development Bank highlights the importance of a supportive MSME ecosystem encompassing skills, digitalization, finance, business networks, and support

institutions for fostering resilient business development (Asian Development Bank, 2023). Recent evidence from Indonesia also indicates that digital literacy, knowledge sharing, human capital, and digital transformation are linked to MSME sustainability (Noerchoidah et al., 2025). These conditions suggest that MSME sustainability should be viewed not merely as business continuity, but as the capacity to maintain future growth, stability, resilience, and survival while adapting to changing economic, technological, and institutional environments (Wawo et al., 2026).

One fundamental yet under-researched question is how the social and institutional environments surrounding MSMEs help them adapt, learn, and innovate in their day-to-day business activities. MSMEs rarely operate in isolation (Safitri et al., 2026). A business owner might identify shifting customer preferences through conversations, adjust products based on feedback, discover new suppliers via business networks, learn new production methods from peers, or gain access to training and financing through government agencies or community groups. These daily interactions shape how MSMEs acquire information, solve problems, respond to changes, and identify opportunities. Therefore, this study employs Social Ecology (SE) as its primary conceptual framework.

Drawing on ecological and socio-ecological perspectives (Bronfenbreneer, 1994; Bronfenbreneet. Urie, 1979; McLeroy et al., 1988). SE views MSMEs as entities embedded within interconnected environments operating at four levels: individual, relational, community, and societal. At the individual level, the owner's initiative, participation, and willingness to seek knowledge influence how the business responds to opportunities and challenges. At the relational level, daily interactions with customers, suppliers, employees, and business partners provide information, feedback, and practical knowledge. At the community level, peer networks, local business groups, collaborative learning, and mutual support can help MSMEs find solutions and access resources. At the societal level, government policies, regulations, economic conditions, cultural practices, and institutional programs create the macro-environment in which businesses operate (Moenawar et al., 2026). Collectively, these environments shape opportunities for MSMEs to learn, exchange information, mobilize resources, and adapt to changing market conditions (Hummel et al., 2017).

However, merely being connected to people, networks, or institutions does not automatically lead to innovation or sustainability. What matters most is how MSMEs utilize these connections. Information must be communicated, discussed, interpreted, and translated into decisions and actions. For instance, customer feedback might prompt an owner to modify a product, supplier conversations could improve production processes, or peer advice might encourage the adoption of digital sales channels. This is where Innovation Communication becomes crucial. This study views Innovation Communication as a capability oriented towards Communication for Development (C4D), enabling MSMEs to engage stakeholders, exchange knowledge, develop innovations, and mobilize resources (Moenawar et al., 2023; Winarko et al., 2024).

Innovation Communication encompasses both the content of the innovation being communicated and the manner in which it is conveyed. Innovation content may include new or enhanced products, product differentiation, process improvements, customer value, or responses to market needs (Rogers, 2003; Zerfass et al., 2018). Communication can take place through face-to-face conversations, business networks, social media, digital platforms, marketplaces, and other channels. Thus, innovation communication is not limited to mere advertising or digital promotion; it also encompasses the everyday conversations, feedback, relationships, and knowledge exchanges that allow an idea to

be developed, refined, shared, and put into practice (Corsi & Akhunov, 2000; Zerfass et al., 2018)

To strengthen the link between theory and practice, three complementary perspectives adopted. C4D emphasizes participation, dialogue, mutual learning, and collective action (Lennie & Tacchi, 2013; Servaes, 2008). In the context of MSMEs, this is evident when owners listen to customers, learn from peers, involve partners in problem-solving, or work collectively within the business community. Strategic communication highlights purposeful communication and stakeholder engagement (Hallahan et al., 2007; Zerfass et al., 2018). Diffusion of Innovation (DOI) theory explains how new ideas and practices spread through social relationships and communication channels (Rogers, 2003). For MSMEs, this can occur when owners adopt new technologies after seeing other businesses use them successfully or learn about new market opportunities through peer networks. This perspective helps interpret how communication operates in daily business life, rather than serving merely as an additional empirical construct.

Based on this perspective, the study proposes that social ecology is linked to Innovation Communication, Innovation Communication is linked to perceived MSME sustainability, and social ecology also has a direct relationship with perceived sustainability. The proposed mediation pathway reflects the idea that relationships, networks, community resources, and institutional support become more beneficial when communicated and translated into innovation-oriented actions. At the same time, the direct pathway suggests that social, community, and institutional conditions can support MSME sustainability even when their influence does not operate through innovation communication. Therefore, this study addresses four research questions: RQ1: How is social ecology related to innovation communication among MSMEs? RQ2: How is innovation communication related to MSMEs' perceptions of sustainability? RQ3: How is social ecology related to MSMEs' perceptions of sustainability? RQ4: Does innovation communication mediate the relationship between social ecology and MSMEs' perceptions of sustainability?

These research questions lead to four hypotheses. First, Spanning the individual, relational, community, and societal levels, the social ecology reflects the context (Bronfenbreneer, 1994; Bronfenbreneet. Urie, 1979; McLeroy et al., 1988) in which MSMEs access knowledge, collaboration, and resources. These networks are linked to opportunities for innovation and external knowledge (OECD, 2023; Olsson & Galaz, 2011) and—from a C4D perspective—support dialogue, participation, and knowledge exchange (FAO, 2007). Therefore: H1-Social Ecology is positively associated with Innovation Communication in MSMEs.

Second, Innovation communication can enhance the market responsiveness of MSMEs through stakeholder engagement, knowledge exchange, feedback, and appropriate communication channels. Effective strategic communication supports organizational adaptation (Moenawar et al., 2026; Zerfass et al., 2018), while digital knowledge sharing is linked to MSME sustainability (Noerchoidah et al., 2025). Therefore: H2-Innovation communication is positively associated with the perceived sustainability of MSMEs.

Third, Social Ecology (SE) encompasses the interconnected contexts of individuals, relationships, communities, and society (Bronfenbreneer, 1994; Bronfenbreneet. Urie, 1979; McLeroy et al., 1988), all of which relate to MSMEs' access to knowledge, social support, networks, and institutional resources. These resources are linked to adaptive capacity and business continuity, aligning with research connecting socio-ecological

resources and resource-based capabilities to MSME sustainability (Lejano, 2019; Noerchoidah et al., 2025). Therefore: H3-Social ecology is positively associated with perceived MSME sustainability.

Finally, At the levels of the individual, relationships, the community, and society, social ecology provides the context (Bronfenbrenner, 1994; Bronfenbrenner, Urie, 1979; McLeroy et al., 1988) shaping MSMEs' access to knowledge, collaboration, and resources. Innovation communication concerns how these resources are mobilized through stakeholder engagement, knowledge exchange, and innovation-oriented practices linked to business resilience and sustainability (Hummel et al., 2017; Noerchoidah et al., 2025). Therefore: H4-Innovation Communication mediates the positive relationship between Social Ecology and MSME sustainability perceptions.

METHOD

Research Paradigm and Mixed-Methods Design

Guided by a pragmatic paradigm, this study employs an exploratory sequential mixed-methods design (QUAL → instrument development → QUAN → integration). This approach enables the integration of qualitative and quantitative evidence to address complex MSME sustainability issues, combining contextual understanding with statistical assessment of relationships among constructs (Feilzer, 2009; Kaushik & Walsh, 2019). The exploratory sequential design was selected because constructs and indicators are first developed based on participant experiences and subsequently assessed quantitatively. This design is particularly suitable when qualitative evidence is needed to develop or refine constructs and measurement instruments prior to quantitative testing (Creswell & Plano Clark, 2018). Consequently, the study was conducted in four sequential stages: (1) qualitative exploration, (2) instrument development, (3) quantitative testing, and (4) mixed-methods integration.

Stage 1: Qualitative Exploration

The qualitative stage involved 12 MSME owners or managers purposively recruited from Jakarta, Bogor, Depok, Bekasi, Tangerang, and Surabaya as six significant areas of economic contributor development in Indonesia (Limanseto, 2025; Patoppoi, 2023). Participants comprised active MSME owners/managers with strategic decision-making roles and demonstrated experience in innovation, communication, marketing, stakeholder engagement, and business development. Drawn primarily from the culinary sector across multiple Indonesian regions, 12 owners or managers participated in semi-structured interviews conducted both in person and online. Interviews, averaging 90 minutes, were audio-recorded, transcribed verbatim, and analysed until thematic saturation was reached. Ethical standards were maintained through informed consent, confidentiality, and anonymization procedures.

Qualitative data were analysed manually using matrix-based comparison alongside iterative open, axial, and selective coding (Böhm, 1994; Mohajan & Mohajan, 2022) to find and organize the findings according to data into theoretical framework meticulously. Twelve empirical codes were subsequently consolidated into three high-level constructs: Social Ecology (SE), Innovation Communication (IC), and MSME Sustainability (MS). Selective coding identified socially embedded innovation communication for MSME sustainability as the primary interpretive theme. Qualitative

evidence supported the proposed SE → IC → MS framework as a relational pattern, while also acknowledging complementary influences such as customer loyalty, market demand, employee relations, social support, and managerial capabilities.

Phase 2: Instrument Development

In the second phase, qualitative findings were systematically translated into a quantitative instrument by mapping participant accounts to constructs, dimensions, and survey indicators, ensuring conceptual continuity. Social Ecology comprised four dimensions (individual, relationship, community, and society), while Innovation Communication encompassed product innovation and digital marketing. MSME Sustainability was operationalized through business growth, resilience, and future orientation. The final instrument included 32 indicators across the three constructs and was evaluated for relevance, clarity, and construct distinctiveness prior to survey implementation. Consistent with the study's pragmatic orientation, instrument development emphasized empirical relevance and methodological utility rather than causal inference.

Stage 3: Quantitative Testing

The quantitative phase surveyed 160 MSME respondents. The minimum sample requirement based on the Lemeshow approach is 97 respondents; this sample size also exceeds the minimum requirements generally recommended for PLS-SEM. Moreover, it according to minimum respondent of the PLS-SEM criteria (Hair Jr et al., 2023). Approximately 90% of respondents operated in the culinary sector. The survey measured respondent characteristics and the constructs of Social Ecology (SE), Innovation Communication (IC), and MSME Sustainability (MS). Quantitative data were analysed using PLS-SEM to assess both the measurement model and the structural relationships among the three constructs. This phase provided a statistical evaluation of the constructs and propositions derived from the qualitative findings.

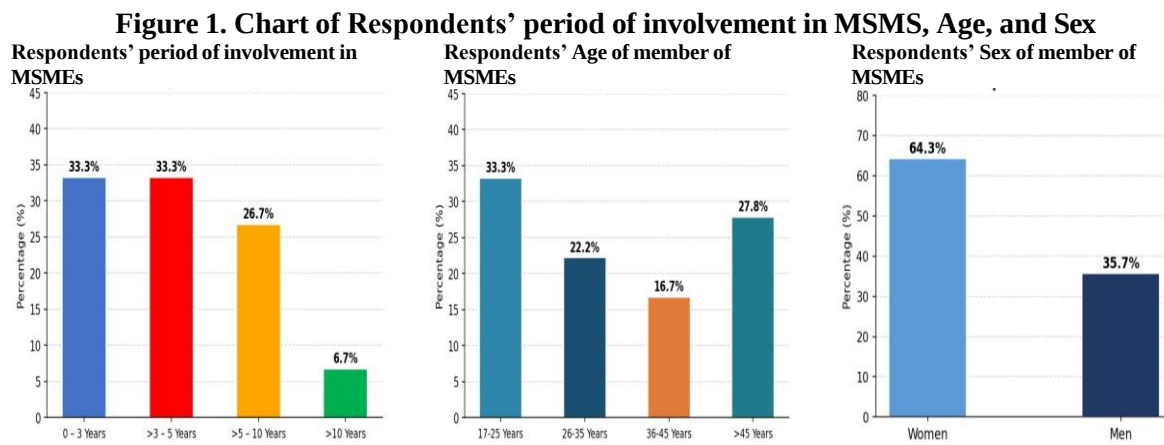
Stage 4: Mixed Methods Integration

The final stage integrated qualitative and quantitative evidence through a joint display (Table 2) that linked representative interview quotes, qualitative codes, dimensions, survey indicators, and their associated constructs. The joint display served to clarify the relationship between qualitative and quantitative evidence and facilitated integrated interpretation within the mixed methods study (Creswell & Plano Clark, 2018). Integration followed the progression from qualitative evidence to constructs, survey indicators, quantitative assessment, and integrated interpretation, providing a transparent audit trail from participant experiences to measurable constructs. The findings informed the proposed Social Ecology-Based Innovation Communication Model for MSME Sustainability while distinguishing statistical associations from causal claims.

RESULTS AND DISCUSSION

Participant and Enterprise Characteristics

The qualitative phase involved 12 MSME owners or managers from six regions, selected to capture diverse perspectives on innovation and sustainability. Their experiences in networking, institutional engagement, innovation communication, and business development provided contextual insights into the mobilization of social and communication resources within MSMEs.



The quantitative phase involved 160 MSME respondents representing businesses across various sectors. Approximately 90% of the businesses operated in the culinary sector, while the remainder were active in fashion, herbal and health products, and household goods. The majority of businesses had been operating for 3–5 years, followed by those with less than three years of operation, while only 7% had been in business for more than 10 years. Most respondents were young entrepreneurs aged 17–25, with 64.3% being female. The sample reflects an MSME population that is relatively young and female-dominated, with businesses concentrated in the culinary sector and generally characterized by a relatively short operational history.

Qualitative Finding

To systematically document the experiences of MSMEs, the twelve interview questions were grouped into three main domains to guide data collection, while specific codes and categories were developed iteratively based on participants' responses. These questions provided a general framework for data collection, while specific codes and categories were developed iteratively based on participant responses. Table 1 presents representative interview evidence alongside the resulting construct-domain mapping

Table 1. Qualitative data based on interview

No	Question	Answers from Interview Results	Construct Domains
1	How does the MSME community help promote members' product, both offline and online?	"When there is a village event or bazaar, the <u>MSME community usually helps each other promote it</u> through WhatsApp groups and social media" (Informant 1); "We often <u>create joint promotional packages</u> so that buyers are interested in buying more than one product" (Informant3); "Community friends often repost my product, so the market reach is wider". (Informant 6); "If there are new members, we help introduce their product so they become known quickly" (Informant 8)	Community Promotion/marketing Support - (IC)
2	Do you regularly attend business group meetings, and how does that support your business?	"I <u>regularly attend</u> business group meetings every month." (Informant 2); "Some time I <u>visit the sub-district office to attend information sessions</u> and share experiences <u>regarding my business...</u> " (Infomant 4)	Individual - Participation and Social Networking - (SE)
3	To what extent do social networks help you get market information or business opportunities?	"I <u>usually get information</u> about market opportunities from fellow MSMEs." (Informant 4); "If there is an exhibition from a government agency, <u>usually the first information comes</u> from community groups." (Informant 7); " <u>Relationships</u> are important, because sometimes there are <u>large orders that are shared.</u> " (Informant 9)	Individual - Participation and Social Networking (information exchange) – (SE)
4	How does formal institutional support (government, cooperatives, banks) help your business?	"The cooperative office <u>helped me process</u> halal certification." (Informant 11); "The government management training has made me understand <u>how to manage finances</u> better." (Informant 5); " <u>The relationship</u> with the bank is quite good, so the application process is easier" "Licensing procedures are simpler." (Informant 6); "Government regulations support MSMEs." (Informant 1) "Banks provide accessible microcredit." (Informant 3) "Local policies encourage MSMEs." (Informant 2) "Government assistance is provided regularly." (Informant 9) " <u>Information</u> about business permits can now be accessed via the government website." (Informant 10)	Relationship and Institutional Support in management and operational matters – (SE)
5	How much does social support (neighbours, friends, customers, community members) influence the enthusiasm and sustainability of your business?	"Neighbours and friends always <u>encourage us</u> when sales are down." (Informant 7); "Customers still buy even when prices go up a bit." (Informant 5); "We <u>borrow raw materials</u> from each other when we run out of stock." (Informant 11); " <u>Word of mouth promotion</u> really helps increase sales." (Informant 12)	Societal and Social Solidarity (psychological and material support) of community – (SE)
6	How often do you innovate products to attract customers?	"I try <u>new recipes every month</u> so that customers don't get bored." (Informant 4); "We <u>usually test new products</u> first on regular customers." (Informant 6) I pay attention to what customers like and request, then use their feedback to develop new flavors, designs, or variations (Informant 9)	Continuous Product Innovation – (IC)

No	Question	Answers from Interview Results	Construct Domains
7	Do you regularly evaluate your production process and discuss new ideas before implementing them?	We <u>regularly evaluate production</u> to make it more efficient." (Informant 3); "Every new idea is <u>discussed before being implemented</u> ." (Informant 8) "we discuss them and look for a better way before making changes (Informant 2)	Process Evaluation and Improvement through dialogue – (IC)
8	How does the use of digital marketing strategies (Instagram, marketplace, social media) affect sales?	"I started <u>promoting through Instagram</u> and marketplaces." (Informant 2); "Digital <u>promotion methods</u> make sales more stable." (Informant 5) "Social media helps us promote new products quickly" (Informant 7) "We have seen an increase in sales since we started using digital platforms more actively" (Informant 12)	Marketing Strategy Innovation – technological usage (digital marketing) – (IC)
9	How do you differentiate your product from competitors (e.g., materials, packaging, or design)?	"My <u>product is different</u> because it uses premium local ingredients." (Informant 10); "We <u>create unique packaging</u> to differentiate ourselves from our competitors." (Informant 6) "We use attractive design to be recognized" Informant 5)	Product Differentiation – (MS)
10	What factors have contributed to the growth and resilience of your business?	"Revenue has increased since <u>using digital promotions</u> ." (Informant 12); "The number of <u>customers increases</u> every year." (Informant 4); "Despite the pandemic, the <u>business remains resilient</u> ." (Informant 7)	Business Growth and Resilience – (MS)
11	How does internal management (employees, finance, planning) support business stability?	"Employees are loyal because the work environment is comfortable." (Informant 8); "Cash flow is controlled because of routine recording." (Informant 3); "We already have a five-year business plan." (Informant 9)	Managerial and Financial Stability – (MS)
12	To what extent do future orientation and product diversification strategies help maintain business sustainability?	"There is an opportunity for expansion because demand is increasing." (Informant 1); "I am confident that this business will continue to run." (Informant 6); "We are preparing product diversification to maintain the business." (Informant 10)	Future Orientation and Sustainability Strategy – (MS)

Qualitative findings indicate that MSME sustainability is embedded in everyday social and institutional relationships rather than being driven by a single factor. Business communities provide more than just promotional support; they facilitate access to information and market opportunities, problem-solving, and mutual assistance reflecting the relational dimension of Social Ecology. Institutional relationships provide training, licensing, certification, financing, and policy support that reduce barriers and strengthen business capacity. Within these relationships, Innovation Communication emerges through the exchange of ideas, customer feedback, process evaluation, product experimentation, and digital communication practices.

These interactions contribute to three interconnected dimensions of sustainability: business growth and resilience, organizational and financial stability, and future-oriented strategic capacity. However, the qualitative evidence does not support a deterministic or entirely linear relationship between Social Ecology, Innovation Communication, and sustainability. Participants also identified customer loyalty, market demand, employee relations, managerial capabilities, self-confidence, and social support as important complementary factors. Variations in networking intensity,

institutional accessibility, digital technology adoption, and innovation practices further demonstrate that MSMEs achieve sustainability through diverse pathways. Rather than representing contradictory cases, these variations highlight the context-dependent nature of sustainability. Thus, Social Ecology and Innovation Communication are best understood as enabling and supporting mechanisms that strengthen the capacity of MSMEs to sustain and adapt their businesses, rather than as absolute prerequisites for sustainability

Matrix-Based Comparison and Iterative Coding

Interview data were analysed manually using matrix-based comparison alongside iterative open, axial, and selective coding (Böhm, 1994; Mohajan & Mohajan, 2022). This analysis yielded empirical codes that were progressively organized into higher-level themes representing Social Ecology (SE), Innovation Communication (IC), and MSME Sustainability (MS). These qualitative themes served as the foundation for developing and operationalizing the constructs and indicators that were subsequently tested during the quantitative phase.

Table 2. Qualitative Iterative Coding Data

Open codes	Axial categories	Higher-order construct
Networking and participation; market information exchange; institutional support; social solidarity	Social networking; information exchange; institutional relationships; social cohesion	Social Ecology (SE)
Community promotion; product innovation; process evaluation and dialogue; digital marketing; product differentiation	Community-oriented communication; content-product/process innovation; collaborative dialogue; delivery-digital market engagement	Innovation Communication (IC)
Business growth and resilience; managerial and financial stability; future orientation and diversification	Adaptive capacity; organizational stability; long-term orientation	MSME Sustainability (MS)

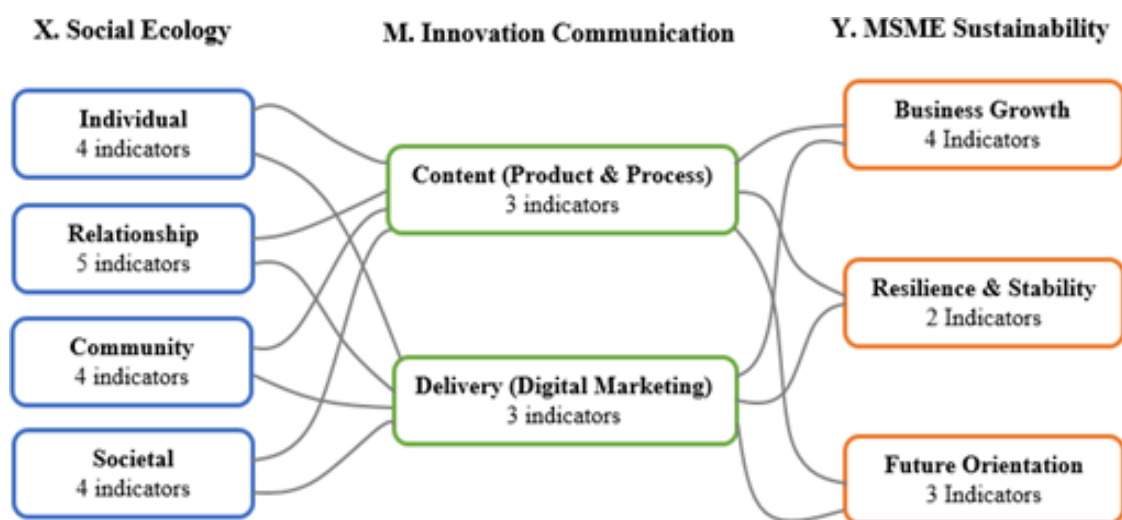
Selective coding integrates various categories around the central theme of Socially Embedded Innovation Communication (SE-IC) for MSME sustainability. The findings indicate that social and institutional relationships facilitate the exchange of information, resources, and opportunities, thereby supporting innovation communication and adaptive business practices. These qualitative insights form the foundation and provide context for the SE-IC-MS framework, which is subsequently tested in the quantitative phase without implying deterministic causality. Coding sequence: Interview evidence → Open coding → Axial coding → Selective coding → SE-IC-MS framework → Quantitative testing.

Instrument Development

The qualitative phase generated empirically grounded constructs for quantitative testing (Creswell & Plano Clark, 2018). Social Ecology (SE) captured individual, relational, community, and societal influences; Innovation Communication (IC) reflected content-communication processes supporting product innovation and

delivery-digital marketing; and MSME Sustainability (MS) encompassed business growth, resilience, and future orientation. The transition from qualitative findings to quantitative measurement followed a systematic mapping process linking qualitative evidence, thematic codes, conceptual categories, constructs, dimensions, and survey indicators. This process was intended to preserve conceptual continuity between participants' experiences and the subsequent measurement model. Accordingly, the quantitative phase does not assume that the relationships identified qualitatively represent established causal effects. Rather, the proposed relationships are treated as empirically derived propositions that require statistical testing in the subsequent quantitative phase.

Figure 2. Qualitative Thematic Map of Research Concepts



The thematic map illustrates two principal functions of the qualitative phase in instrument development. First, it identified the substantive dimensions through which participants experienced and described Social Ecology, Innovation Communication, and MSME Sustainability. Second, it revealed the mechanisms and contextual boundaries through which these constructs were perceived to be interconnected. These findings provided the empirical foundation for translating qualitative themes into measurable dimensions and survey indicators for quantitative validation.

Table 3. Instrument Development and Operationalisation of Constructs

Construct	Dimension	Operational Definition	Survey Indicators
Social Ecology (X)	Individual	The extent to which MSME owners interact with relevant business communities, access institutional knowledge, maintain relationships with stakeholders, and acquire information relevant to business development.	1. Active participation in the business community 2. Access to training and institutional knowledge 3. Positive relationships with relevant stakeholders 4. Accessibility of relevant policy information
	Relationship	The extent to which MSMEs establish supportive relationships with the government and financial	5. Regulations support business development 6. Licensing procedures are easy to understand 7. Access to

	Community	institutions, and experience institutional conditions that facilitate business development. The extent to which local communities, institutions, and social networks provide support, information, and opportunities for collaboration in business activities.	financing is available 8. Local policies support MSMEs 9. Government support is consistent 10. Community support for business development 11. Institutional support for MSME activities 12. Social networks providing useful business information 13. Social environment fostering collaboration 14. The social environment provides motivation for business development 15. Customers demonstrate loyalty to the business 16. Entrepreneurs provide mutual assistance 17. Social relationships facilitate marketing activities
	Societal	To what extent do broader social relationships and community interactions foster motivation, customer loyalty, mutual assistance, and opportunities for market development	
Innovation Communication (IC)	Content: Product Innovation and Improvement	The extent to which MSMEs communicate and implement new product ideas and utilize communication processes to support continuous improvement in products and production activities.	18. The business regularly communicates and implements product innovations. 19. Communication supports continuous process improvement. 20. Innovative ideas are communicated and implemented in business activities.
	Delivery: Digital Marketing	The extent to which MSMEs implement innovative marketing strategies and digital communication channels to communicate product value, differentiation, and market relevance.	21. The business implements innovative marketing strategies 22. Digital communication channels are actively utilized for marketing 23. Digital communication is used to convey product differentiation
MSME Sustainability (Y)	Business Growth	The extent to which MSMEs achieve continuous improvement in business performance, market development, organizational resilience, and workforce sustainability	24. Business revenue increased 25. Customer base grew 26. Business is resilient against operational disruptions 27. Business is able to retain employees
	Resilience and Stability	The ability of MSMEs to maintain financial and operational stability while preparing for sustainable business growth.	28. The business maintains stable cash flow 29. The business engages in long-term planning
	Future Orientation	The extent to which MSMEs recognize future growth opportunities, maintain confidence in business continuity, and implement strategies to sustain the business in the long term.	30. The business identifies future growth opportunities 31. The business is confident about its future viability 32. The business implements strategies to ensure long-term sustainability

Measurement Model Assessment

The measurement model was assessed based on indicator reliability, internal consistency reliability, convergent validity, discriminant validity, and indicator collinearity using PLS-SEM with 5,000 bootstrap resamples (Hair Jr et al., 2023). The results indicate that the measurement model meets the recommended reliability and validity criteria. Indicator reliability and convergent validity. Indicator loading values ranged from 0.801 to 0.872, exceeding the recommended threshold of 0.70. The lowest

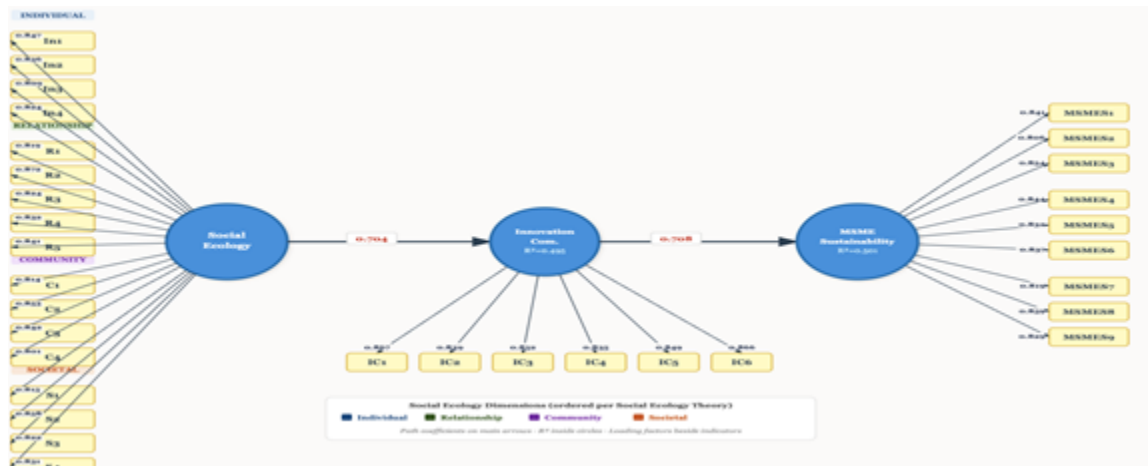
loading value was observed for C4 (0.801), while R2 showed the highest loading value (0.872). All loading values were statistically significant ($t = 22.977\text{--}41.148$; $p < 0.001$), confirming satisfactory indicator reliability and convergent validity. Mean indicator scores ranged from 2.97 to 3.15 on a four-point Likert scale, with median values consistently at 3.00, indicating a generally positive evaluation without substantial floor effects. Internal consistency reliability. The constructs demonstrated strong internal consistency. Cronbach's alpha values ranged from 0.926 for Innovation Communication (IC) to 0.972 for Social Ecology (SE), while composite reliability (ρ_c) ranged from 0.942 to 0.974 and ρ_A ranged from 0.926 to 0.973. All coefficients exceeded the 0.70 criterion, confirming adequate reliability. Although these coefficients are relatively high, they do not strongly indicate excessive indicator redundancy—particularly for IC, where the value remains below 0.95.

Discriminant validity. Discriminant validity was assessed using the Fornell–Larcker criterion and the Heterotrait - Monotrait (HTMT) ratio. The square roots of the AVEs, ranging from 0.832 to 0.854, exceeded the corresponding inter-construct correlations; this indicates that each construct shares more variance with its own indicators than with other constructs. HTMT values ranged from 0.733 to 0.750, remaining below the conservative threshold of 0.90. These findings confirm that SE, IC, and MS (SME Sustainability) are empirically distinct constructs. Indicator collinearity. Outer VIF values ranged from 2.412 to 4.108, remaining below the 5.00 threshold. The highest VIF values were observed for R2 (4.108), followed by S2 (3.788) and In1 (3.551). Thus, multicollinearity at the indicator level does not appear to be a critical issue. Overall, the results demonstrate adequate reliability, convergent validity, and discriminant validity, as well as acceptable levels of collinearity, thereby supporting the use of these constructs in the subsequent structural model assessment.

Structural Model and Mediation Results

The structural model provides empirical support for all four hypotheses. H1 demonstrates a positive and significant relationship between Social Ecology and Innovation Communication ($\beta = 0.704$; $t = 7.908$; $p < 0.001$; $f^2 = 0.981$). H2 indicates a positive and significant relationship between Innovation Communication and MSME Sustainability perceptions ($\beta = 0.708$; $t = 8.532$; $p < 0.001$; $f^2 = 1.003$). H3 confirms a positive relationship between Social Ecology and the perception of MSME Sustainability ($\beta = 0.415$; $t = 2.636$; $p = 0.008$). H4 reveals a significant indirect relationship between Social Ecology and MSME Sustainability perceptions mediated by Innovation Communication ($\beta = 0.291$; $t = 2.496$; $p = 0.013$), supporting the existence of partial mediation. Overall, these findings support the proposed SE–IC–MS framework while indicating relationships between variables rather than causal effects.

Figure 3. PLS-SEM path coefficients between Social Ecology, Innovation Communication, and MSME Sustainability



Mixed-Methods Integration

This integrated display links qualitative evidence on Social Ecology (SE), Innovation Communication (IC), and MSME Sustainability (MS) to their quantitative operationalization. By connecting participant experiences, derived dimensions, and SEM indicators (outer loadings), it provides a transparent and empirically grounded basis for construct measurement and quantitative evaluation.

Table 4. Joint Display of Qualitative and Quantitative Evidence: Interview Quotes, Survey Indicators, and SEM Factor Loadings (LF)

Construct	Dimension	Representative Interview Quote	Survey Indicator	LF
Social Ecology	Individual	1. "I participate in business group activities."	1. Active participation in business community	0.847
		2. "Training improved my business confidence."	2. Access to institutional training	0.836
		3. "Relationships with stakeholders are well maintained."	3. Good stakeholder relations	0.809
		4. "Policy information is easy to access."	4. Policy information is easily accessible	0.824
	Relationship	5. "Government regulations support MSMEs."	5. Regulations support business development	0.819
		6. "Licensing procedures are simpler."	6. Easy-to-understand licensing procedures	0.872
		7. "Banks provide accessible microcredit."	7. Easy access to financing	0.824
		8. "Local policies encourage MSMEs."	8. Local policies favour MSMEs	0.832
		9. "Government assistance is provided regularly."	9. Consistent government support	0.841
	Community	10. "The community helps promote my products."		0.814
		11. "The cooperative helped us obtain certification."	10. Community support for business development	0.853
		12. "Friends share market information."	11. Institutional support	
		13. "We organize joint promotional events."	12. Social networks provide business information	0.842
			13. Social environment encourages collaboration	0.801

Construct	Dimension	Representative Interview Quote	Survey Indicator	LF
	Societal	14. "Neighbours always encourage us."	14. Social environment provides motivation	0.815
		15. "Customers remain loyal."	15. Customer loyalty	0.858
		16. "We share raw materials during shortages."	16. Mutual assistance among entrepreneurs	0.822
		17. "Word-of-mouth promotion is very effective."	17. Social relationships facilitate marketing	0.831
Innovation Communication	Content: • Product Innovation • Product Improvement	18. "We introduce new products every month."	18. Regular product innovation	0.862
		19. "We routinely evaluate production."	19. Continuous process improvement	0.839
		20. "New ideas are discussed before implementation."	20. Implementation of innovative ideas	0.852
	Content Delivery: Digital Marketing	21. "We continuously improve promotional methods."	21. Marketing strategy innovation	0.855
		22. "Instagram and marketplaces increase sales."	22. Digital marketing utilization	0.849
		23. "Our products have unique characteristics."	23. Product differentiation	0.866
MSME Sustainability	Business Growth	24. "Revenue increased after digital promotion."	24. Increased revenue	0.841
		25. "Our customer base continues to grow."	25. Customer growth	0.806
		26. "The business survived difficult periods."	26. Business resilience	0.854
		27. "Employees remain committed."	27. Employee retention	0.844
	Resilience & Stability	28. "Routine bookkeeping keeps finances stable."	28. Stable cash flow	0.832
		29. "We have a five-year business plan."	29. Long-term planning	0.837
	Future Orientation	30. "Demand creates expansion opportunities."	30. Future growth opportunities	0.819
		31. "I am confident about business continuity."	31. Confidence in business continuity	0.859
		32. "We are preparing product diversification."	32. Sustainability maintenance strategies	0.829

The Interpretation of Qualitative Data and SEM

The interpretation of all indicators related to the latent constructs: Social Ecology, Innovation Communication, and MSME Sustainability showed standardized factor loadings ranging from 0.801 to 0.872, exceeding the recommended threshold of 0.70 for reflective measurement models in Structural Equation Modeling. These results confirm adequate convergent validity and strong indicator reliability, indicating that the observed variables substantially explain the variance of their respective constructs (Hair Jr et al., 2023). In Partial Least Squares SEM, loadings above 0.70 indicate that more than 50% of the indicator's variance is explained by the latent variables. Several indicators exceeded this benchmark, such as licensing procedures (R2) with a loading of 0.872 and product uniqueness with a loading of 0.866, demonstrating strong measurement robustness.

The integrated results also demonstrated strong explanatory capacity for all three constructs. The Social Ecology construct highlights the importance of the socio-institutional environment, particularly regulatory clarity in supporting the adaptability and stability of MSMEs, consistent with insights from the Organization for Economic Cooperation and Development (OECD) on entrepreneurial ecosystems (OECD, 2020).

Innovation Communication (IC) is reflected in product innovation and sustainable development, while MSME Sustainability (MS) is characterized by competitiveness, growth, and resilience. The convergence of qualitative and quantitative findings supports construct validity and suggests that MSME sustainability emerges from the interaction of socio-institutional support, innovation communication, and organizational adaptability.

The Association Between Social Ecology and Innovation Communication

Qualitative findings indicate that Social Ecology (SE) (Bronfenbreener, 1994; Bronfenbreener. Urie, 1979; McLeroy et al., 1988) has a positive relationship with Innovation Communication (IC) at the individual, relational, community, and societal levels. At the individual level, participation, knowledge seeking, and engagement are linked to access to innovation-related information. At the relational level, interactions with customers, suppliers, business partners, universities, and government agencies are associated with opportunities for feedback, dialogue, and knowledge exchange. At the community level, business associations and peer networks facilitate collective learning, collaboration, and mutual support. At the societal level, institutional policies, government programs, and digital platforms provide broader opportunities to access innovation-related resources and information.

This interpretation aligns with evidence showing that SME networks are linked to access to external knowledge, resources, and innovation opportunities (OECD, 2023; Olsson & Galaz, 2011). From a C4D perspective, these networks can be understood as spaces for participation, dialogue, and mutual learning, as well as channels for resource exchange (FAO, 2007). Further quantitative results reveal a strong positive relationship between SE and IC ($\beta = 0.704$, $t = 7.908$, $p < 0.001$; $f^2 = 0.981$). These findings indicate that Social Ecology is relevant to IC not merely due to the existence of social and institutional connections, but through communication practices related to the access and use of innovation-related knowledge. Therefore, IC can be conceptualized as a linking capability that connects individual participation, interpersonal relationships, community networks, and societal contexts with innovation-oriented practices through stakeholder engagement, dialogue, knowledge sharing, and collaborative problem-solving.

The Association Between Innovation Communication on MSME Sustainability

Qualitative findings identify two complementary dimensions of Innovation Communication (IC): product innovation and enhancement as the communication content, and digital marketing as the delivery strategy. Participants explained how product innovation and enhancement are communicated through appropriate channels to convey value, differentiation, and market relevance. These practices enhance the market responsiveness of MSMEs through stakeholder engagement, knowledge exchange, feedback, and adaptation to changing market needs. Quantitative results confirm a strong positive influence of IC on the perceived sustainability of MSMEs ($\beta = 0.708$, $t = 8.532$, $p < 0.001$; $f^2 = 1.003$), supporting hypothesis H2.

Integrated findings indicate that IC contributes to sustainability by linking innovation, stakeholder interaction, market learning, and organizational adaptation. Effective strategic communication supports organizational adaptation (Moenawar et al., 2026; Zerfass et al., 2018), while digital knowledge sharing strengthens sustainable

MSME practices (Noerchoidah et al., 2025) . Thus, IC goes beyond mere information dissemination; it enables MSMEs to gather feedback, refine innovations, respond to market changes, and bolster growth, resilience, and long-term business continuity. Aligned with the C4D approach, this process emphasizes dialogue, participation, and knowledge exchange as mechanisms that allow communication to support sustainable business development.

Social Ecology and Perceived MSME Sustainability

Qualitative findings identified four interconnected Social Ecology (SE) dimensions (Bronfenbreener, 1994; Bronfenbreeneet. Urie, 1979; McLeroy et al., 1988) linked to MSME sustainability. At the individual level, participants described active participation, knowledge-seeking efforts, and engagement in business activities as crucial contexts for accessing information and support. At the relational level, interactions with customers, suppliers, business partners, and other stakeholders were associated with information exchange, feedback, and mutual assistance. At the community level, business groups and peer networks provided opportunities for collaboration, collective learning, and social solidarity. At the societal level, government programs, institutional support, regulations, licensing, and access to finance constituted the broader conditions encompassing MSME activities.

These qualitative patterns were subsequently translated into survey indicators representing the four SE dimensions, serving as the basis for a quantitative assessment of their relationship with MSME sustainability perceptions. Quantitative results revealed a positive relationship between SE and sustainability ($\beta = 0.415$, $p = 0.008$). However, participants also identified customer loyalty, market demand, employee relations, managerial capabilities, and other forms of social support as complementary conditions for business continuity. Consequently, these integrated findings indicate an associative rather than causal relationship, wherein SE functions as a contextual resource linked to the adaptive capacity and perceived sustainability of MSMEs.

Innovation Communication as a Mediating Mechanism between Social Ecology and MSME Sustainability

Integrated findings indicate that Innovation Communication provides a potential pathway linking socio-ecological resources to MSME sustainability. Social Ecology is positively associated with Innovation Communication ($\beta = 0.704$, $p < 0.001$), while Innovation Communication is positively associated with MSME sustainability perceptions ($\beta = 0.708$, $p < 0.001$). The presence of a significant indirect effect ($\beta = 0.291$, $p = 0.013$), alongside a significant direct relationship between Social Ecology and perceived sustainability ($\beta = 0.415$, $p = 0.008$), indicates partial statistical mediation. Qualitative findings help explain these statistical patterns. Relationships with the business community, institutions, customers, suppliers, and other stakeholders provide MSMEs with information, knowledge, feedback, and opportunities. These resources become actionable when entrepreneurs communicate, discuss, interpret, and apply them to product development, process improvements, marketing, and business planning. In this context, Innovation Communication serves as a linking capability between the social environment and daily innovation-oriented practices.

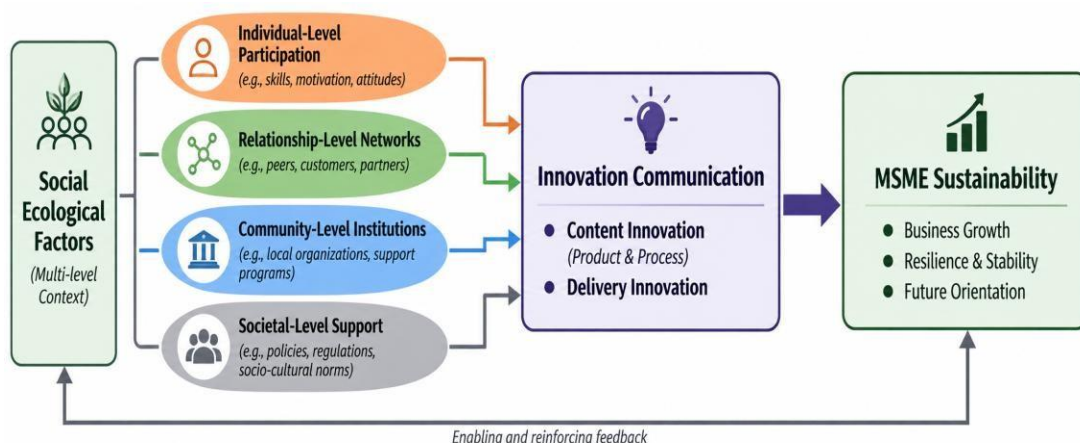
This interpretation aligns with the concept of C4D, which emphasizes dialogue, participation, mutual learning, and collective action (Otto & Fourie, 2016; Servaes,

2008). It also complements the concept of Strategic Communication by highlighting purposeful stakeholder engagement, as well as Diffusion of Innovations theory by explaining how ideas and practices spread through social relationships and communication channels (Rogers, 2003; Zerfass et al., 2018). However, crucially, these mediation results should be interpreted as statistical associations rather than evidence of a causal mechanism, given that the data used were cross-sectional and self-reported. Therefore, the contribution of this model lies not in positioning communication as the sole determinant of MSME sustainability, but rather in its ability to demonstrate how communication can help link social and institutional resources with innovation-oriented business practices. Sustainability continues to depend on various contextual conditions, including market demand, customer loyalty, managerial capacity, employee relations, and resource availability.

Social Ecology Based Innovation Communication Model for MSME Sustainability

The primary theoretical contribution of this study is initial empirical assessment of a context-specific Social Ecology Based Innovation Communication Model aimed at MSME sustainability, as perceived by the actors involved. Rather than viewing communication merely as a promotional activity, this model conceptualizes Innovation Communication as a bridging capability that enables MSMEs to engage stakeholders, exchange knowledge, communicate innovations, gather feedback, and coordinate adaptive activities within their socio-ecological environments. The model (Figure 4) notably extends the application of the socio-ecological perspective to MSME communication by highlighting the role of communication processes within social and institutional environments. Strategic Communication and C4D provide complementary perspectives for understanding purposeful stakeholder engagement and participatory interaction, while Diffusion of Innovation serves as a supporting lens for interpreting the spread and adaptation of innovation-related knowledge. Thus, this contribution is integrative in nature and does not claim to establish a new general theory. The proposed model should be viewed as an initial, context-specific framework requiring further validation across sectors and regions, as well as within longitudinal studies.

Figure 4. Social-Ecology Based Innovation Communication Model



Contributions, Implications, and Limitations

This study makes a theoretical contribution by integrating Social Ecology, Communication for Development (C4D), Strategic Communication, and the Diffusion of Innovations, while positioning Innovation Communication (IC) as a link between the socio-ecological context and MSME sustainability. From a practical standpoint, the findings highlight communication capabilities, stakeholder networks, innovation practices, and digital engagement. However, the exploratory sequential design employed may limit the translation of context-specific qualitative insights into standardized measures, potentially leading to conceptual overlap within IC and ambiguity regarding social-ecological (SE) dimensions. Future study needs to focus on strengthening construct definitions, iteratively refining instruments, and validating dimensions. Furthermore, the cross-sectional design relying on self-reports and a sample concentrated in a specific sector limits the ability to draw causal inferences or generalize results, underscoring the need for longitudinal and comparative studies that encompass digital capabilities, institutional quality, market demand, and resource constraints.

CONCLUSION

This study develops and empirically tests a preliminary model of Social Ecology-based Innovation Communication to understand MSME sustainability perceptions, employing an exploratory sequential mixed-methods design. Qualitative findings identify stakeholder engagement, networking, knowledge exchange, community and institutional support, participation, feedback, innovation, and digital communication as interconnected practices that form the basis for the quantitative model. Quantitative results reveal positive relationships among Social Ecology, Innovation Communication, and MSME sustainability perceptions; meanwhile, the indirect relationship between Social Ecology and sustainability perceptions—mediated by Innovation Communication—provides evidence of a partial statistical mediation pathway. Given the cross-sectional nature of the research design, these findings should be interpreted as associations rather than causal relationships.

The findings also indicate that Innovation Communication encompasses a broader scope than mere promotional and digital marketing activities. It includes communication regarding product and process innovation, differentiation, market responsiveness, stakeholder engagement, knowledge exchange, feedback, digital interaction, and collaborative learning. Consequently, this study proposes Innovation Communication as a potential linking capability through which social, relational, and institutional resources can be connected to innovation-oriented practices. Conceptually, this provides a preliminary foundation for integrating Social Ecology with Communication for Development, Strategic Communication, and the Diffusion of Innovations. However, the proposed model should be viewed as a theory-based and empirically supported starting point requiring further validation, rather than a definitive or universally generalizable model for MSMEs in Indonesia.

In practical terms, these findings underscore the need for greater attention to participatory communication, stakeholder networking, knowledge exchange, innovation practices, and digital engagement in the development of MSMEs. These recommendations should be viewed as areas for capacity building rather than as evidence that specific interventions will inevitably enhance sustainability. The study

has limitations, including its cross-sectional design, reliance on self-reported measures, sampling constraints, sectoral and geographic concentration, and potential conceptual overlap between constructs. Future research should employ longitudinal and comparative approaches, probability-based or clearly defined sampling, multi-source data, and objective sustainability indicators to test the robustness, distinctiveness, and generalizability of the proposed framework across various MSME sectors and regional contexts.

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