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Impact of Information Sharing and Supply Chain Collaboration on the Perfomance of Herbal SMEs in Batam: The Mediating Role of Innovation Capability

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Abstract: This study looks at how sharing information and working together in the supply chain affect the performance of small and medium herbal businesses in Batam. It also explores how innovation ability plays a middle role in this relationship. The research used a quantitative method by giving questionnaires to 198 herbal businesses in Batam and analyzing the results using Partial Least Squares Structural Equation Modeling.The results show that information sharing has a significant positive effect on both performance and innovation capability. In contrast, supply chain collaboration and innovation capability do not significantly influence performance, and innovation capability does not mediate the relationship between information sharing or supply chain collaboration and performance. These findings highlight the importance of information sharing in enhancing competitiveness, while collaboration and innovation still require further optimization. Practically, enterprises are encouraged to adopt digital platforms for information sharing and strengthen strategic cooperation with suppliers, while government support is needed through technology and innovation training. This study is limited to Batam with cross-sectional data, suggesting that future research should examine external factors such as digitalization and global market dynamics.

Keywords: Herbal enterprises, information sharing, innovation capability, performance, supply chain collaboration.

INTRODUCTION

Small and Medium Enterprises (SMEs) are the backbone of the Indonesian economy, contributing 61% to the national Gross Domestic Product (GDP) and employing 97% of the workforce, or approximately 119.6 million people, according to data from the Central Statistics Agency (BPS) in 2022 (Coordinating Ministry for Economic Affairs, 2022). In Indonesia's traditional herbal industry, SMEs hold an important role by making use of the country's rich biodiversity, which includes 32,013 types of medicinal plants and 2,848 plant species used as raw materials (Euromonitor International, 2024). However, this potential is not without challenges. Herbal SMEs frequently struggle with intense competition, restricted acces to

technology, and complex supply chain networks that can hinder performance (Purwati et al., 2020; Sidabutar et al., 2024). According to Yuliana et al., (2022) the sustainability of herbal SMEs is strongly influenced by their ability to manage resources efficiently and maintain continuous innovation amid digital transformation pressures. Strengthening competitiveness, therefore, requires not only effective supply chain management but also the development of robust innovation capabilities.

Batam, given its geographic position close to Singapore and Malaysia, has become a strategic hub for the growth of herbal SMEs. Industry reports valued the Indonesian herbal market at USD 13,732.1 million in 2024 and project it to nearly double to USD 25,459.1 million by 2033, representing a compound annual growth rate (CAGR) of 7.1% (Custom Market Insights, 2024). In Batam, herbal SMEs face opportunities to capitalize on the growing demand for natural health products, but also face challenges such as dependence on imported raw materials (approximately 25% are still imported) and a lack of supply chain collaboration (Sari & Al-Hasin, 2023; Sidabutar et al., 2024; Utami et al., 2021; Zan et al., 2024). Moreover, Batam's position as a free trade zone offers unique opportunities for SMEs to integrate into regional value chains, yet exposes them to international competition that demands higher operational efficiency and innovation. Thus, information sharing and supply chain collaboration are crucial to support the sustainability and growth of herbal SMEs in Batam.

Information sharing refers to the exchange of relevant data, knowledge, and insights among supply chain partners to enhance decision-making and operational efficiency (Yuliana et al., 2022). The flow of information between firms allows quicker responses to market changes and customer preferences, improving innovation and business performance (Rashima Nugraha & Hartono, 2022; Suriyanti, Alam, Palwa, & Fajril, 2025). Open technological knowledge sharing also strengthens firms' absorptive capacity, the ability to absorb and transform knowledge into innovation outcomes, which is essential for herbal SMEs to respond to market uncertainty (Sidabutar et al., 2024). Therefore, information sharing not only improves coordination but also serves as a foundation for innovation capability and long-term competitiveness.

Supply chain collaboration is defined as a strategic partnership among firms, suppliers, and distributors to achieve shared goals, reduce risk, and enhance performance (Kijkasiwat & Phuensane, 2020). It provides SMEs with access to external resources such as technology, knowledge, and market opportunities (Imtiaz, Hamid, Nadarajah, Mehmood, & Ahmad, 2023), while trust and mutual cooperation within the supply chain foster product innovation and logistics efficiency (Purwati et al., 2020; Suriyanti et al., 2025). Close collaboration between partners facilitates knowledge transfer and strengthens absorptive capacity (Sang, Md Noor, Ghazali, & Aghamohammadi, 2024a), which is crucial for innovation. In Batam, collaboration with local suppliers, distributors, and universities can help herbal SMEs secure consistent-quality materials and develop innovative herbal products.

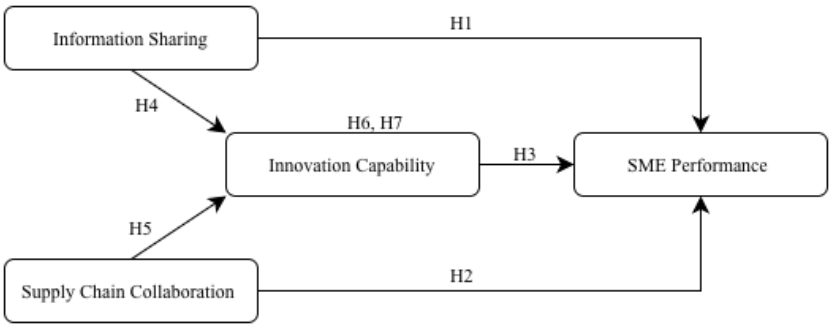
Innovation capability represents a firm's capacity to transform knowledge and resources into new products, processes, or business models. It serves as a key determinant of SME competitiveness and acts as the bridge linking supply chain strategies with business performance (Purwati et al., 2020; Sudhartio, Peranginangin, Hamsal, & Ganiarsa, 2023; Zan et al., 2024). Firms that develop strong innovation capability can adapt to dynamic market and technological conditions (Bagas Aji & Nursyamsiah, 2023), engage in digital transformation (Sentoso, Sibarani (, & Muchsinati, 2024), and create higher business value. In the context of herbal SMEs, innovation capability may involve developing eco-friendly packaging, introducing new formulations, or adopting online sales channels (Cuandra & Candy, 2024; Indarto, 2024). SMEs in Batam that engage in such innovative efforts tend to achieve superior performance and greater competitiveness.

However, although various previous studies have examined the influence of information sharing, supply chain collaboration, and innovation capability on the performance of MSMEs, there has been no research that specifically tests whether innovation capability mediates the influence of information sharing and supply chain collaboration on the performance of herbal MSMEs in Batam, especially in the context of cross-border supply chains. Most previous studies have focused more on the general manufacturing sector, food and beverage industry, or technology-based MSMEs, so they have not captured the unique characteristics of the herbal industry which is highly dependent on the quality of raw materials, connectivity with foreign suppliers, and the complexity of biodiversity-based product innovation (Annisa, Dwiantoro, & Wijayanti, 2024). In addition, Batam as a free trade zone has supply chain dynamics that are different from other parts of Indonesia, including faster information flows, demands for international standards, and the pressure of global competition. This condition creates an important research gap, namely the need for an empirical understanding of how innovation capability acts as a key mechanism that links supply chain collaboration and information sharing with improving the performance of herbal MSMEs in a cross-border business environment (Fauzzan, Putra Kusuma, Fitra, Nailussaadah, & Penelitian, 2025).

Performance, in this study, refers to the extent to which SMEs achieve their strategic and operational objectives, including profitability, efficiency, and customer satisfaction (Imtiaz et al., 2023). Previous studies have found that information sharing and supply chain collaboration positively influence innovation and business outcomes (Rashima Nugraha & Hartono, 2022; Suriyanti et al., 2025; Yuliana et al., 2022), while innovation capability mediates these relationships and enhances overall performance (Indarto, 2024; Purwati et al., 2020; Sudhartio et al., 2023). Thus, for herbal SMEs in Batam, integrating collaborative and innovative practices across the supply chain is essential to achieve sustainable growth and competitiveness.

Based on these considerations, this study aims to investigate the impact of information sharing and supply chain collaboration on the performance of herbal SMEs in Batam, with innovation capability serving as a mediating variable. Specifically, this research examines whether information sharing and supply chain collaboration significantly affect the performance and innovation capability of SMEs, and whether innovation capability mediates the relationship between these variables and performance.

This study is further motivated by observable empirical phenomena in Batam, where herbal SMEs often experience volatility in raw material availability due to dependency on inter-island and cross-border shipments, frequent regulatory adjustments within the Free Trade Zone, and fluctuating logistics costs driven by international market dynamics. These issues intensify unique supply chain challenges, such as inconsistent quality of herbal inputs, limited traceability systems, and weak integration between farmers, processors, and distributors. Moreover, many SMEs still rely on manual documentation and non-digital coordination, creating information delays that hinder responsiveness to market demands. These structural and contextual barriers suggest that the mechanisms linking information sharing, collaboration, innovation capability, and performance may function differently in Batam compared to other regions. Accordingly, the novelty of this research lies in its empirical examination within a cross-border herbal supply chain environment, an area rarely explored in existing Indonesian SME studies while simultaneously testing the mediating role of innovation capability in a setting characterized by high biodiversity dependence, international competition, and rapid information flows unique to Batam’s economic ecosystem.



Source: Research Result (2025)

Figure 1. Conceptual Framework

METHOD

This research applied a quantitative method approach with both descriptive and explanatory design (Waruwu, Natijatulpùat, Utami, Yanti, & Rusydiana, 2025). The research was conducted in Batam City, and data were collected between December 2024 and March 2025. The focus was on herbal SMEs operating in Batam, and a total of 198 owners or managers participated as respondents. The sampling technique used was purposive sampling (Memon, Thurasamy, Ting, & Cheah, 2024), with criteria that respondents were directly responsible for the enterprise, located in Batam, and engaged in activities such as raw material procurement, production, distribution, or marketing.

The adequacy of the sample size was determined using the guideline by Hair et al. (2022), which recommends five to ten respondents for each indicator. With 19 indicators, the minimum requirement ranged from 95 to 190. The final sample of 198 responses therefore met and exceeded this standard. Data were gathered through structured questionnaires distributed both online (Google Forms) and directly to SMEs. All items were assessed using a five-point Likert scale, ranging from “strongly disagree” to “strongly agree.” The main variables measured in this study were information sharing, supply chain collaboration, innovation capability, and SME performance.

Table 1. Research Indicators

No	Variable	Indicator
1	Information Sharing (Sugito & Kusrini, 2023)	The company routinely shares information about market demand with suppliers/distributors.
		The company openly shares information regarding raw material quality with supply chain partners.
		The company shares information about changes in market conditions with all supply chain partners.
		The company uses technology to facilitate information exchange with supply chain partners.
2	Supply Chain Collaboration (Firmansyah & Siagian Hotlan, 2022)	The company and suppliers make joint decisions in production planning.
		The company and supply chain partners collaborate when there are changes in demand.
		The company and supply chain partners collaborate in new product development.
		The company and its partners support each other in meeting quality standards and regulations.
3	Innovation Capability (Sang, Md Noor, Ghazali, & Aghamohammadi, 2024b)	The company actively develops new products.
		The company regularly conducts innovations in production processes.
		The company implements innovations in managerial aspects.
		The company adapts its innovations to changes in consumer preferences.

		The company utilizes knowledge from supply chain partners to support innovation.
4	SME Performance (Latifah, 2024)	The company has increased its revenue in the past 1–2 years. The company improves operational efficiency. The company maintains or improves product quality. The company fulfills customer demand on time. The company receives high customer satisfaction. The company sustains long-term business continuity.

Data analysis in this study used both descriptive and inferential statistical methods. Descriptive statistics were processed using Statistical Product and Service Solutions (SPSS) to describe respondents based on their business type, years of operation, role in the enterprise, educational background, main products, and position in the supply chain. For the inferential analysis, Partial Least Squares Structural Equation Modeling (PLS-SEM) was applied using SmartPLS software. The procedure included conducting descriptive tests, checking for multicollinearity, assessing the validity and reliability of the constructs, performing path analysis between variables, and evaluating the overall model fit to test the proposed relationships.

RESULTS AND DISCUSSION

Descriptive Statistics. This research data was obtained from 198 respondents who are owners or managers of herbal SMEs in Batam City to analyze demographic characteristics in the context of supply chain management, innovation, and business performance.

Table 2. Output SPSS

Business Status	**Frequency**	**Percent**
Self-Established Business	45	22.7
Business Inherited from the Family	96	48.5
Business Purchased or Taken Over	57	28.8
Total	198	100.0
Duration of Business	**Frequency**	**Percent**
< 1 Year	11	5.6
1-3 Years	64	32.3
3-5 Years	94	47.5
> 5 Years	29	14.6
Total	198	100.0
Job Position	**Frequency**	**Percent**
Owner	34	17.2
Manager	73	36.9
Owner and Manager	91	46.0
Total	198	100.0
Education	**Frequency**	**Percent**
Junior High School	5	2.5
Senior High School/ Vocational School	55	27.8
Diploma	51	25.8
Bachelor degree	67	33.8
Postgraduate Masters/Doctoral Degree	20	10.1
Total	198	100.0
Main Product	**Frequency**	**Percent**
Liquid Herbal Medicine	27	13.6
Herbal Powder	65	32.8
Herbal Tablets/Capsules	60	30.3
Liquid Herbal Medicine & Powder Herbal Medicine	24	12.1

Liquid Herbal Medicine, Powder Herbal Medicine, Tablet/Capsule Herbal Medicine	22	11.1
Total	198	100.0
Supply Chain Stage	**Frequency**	**Percent**
Procurement of Raw Materials	28	14.1
Production	67	33.8
Distribution	45	22.7
Marketing & Sales	14	7.1
Raw Material Procurement, Production, Distribution, Marketing & Sales	44	22.2
Total	198	100.0

Source: Processed Data (2025)

Based on the results of descriptive statistical analysis, the majority of respondents were successors to family businesses (48.5%), followed by those who took over or purchased businesses (28.8%), and the remainder established their own businesses (22.7%). In terms of operational duration, most businesses had been running for 3–5 years (47.5%), indicating that many SMEs were in the growth phase, followed by businesses aged 1–3 years (32.3%). Regarding the respondents' position in the business, 46% were both owners and managers, indicating direct involvement in strategic decision-making. Based on educational level, the majority of respondents had a secondary or higher educational background, namely bachelor's degree (33.8%) and diploma (25.8%), with a proportion of high school/vocational school graduates of 27.8%, reflecting the relatively competent capacity of human resources in managing and developing businesses. In terms of products produced, herbal powder (32.8%) and tablets/capsules (30.3%) were the most dominant product forms, followed by liquid herbal medicine and a combination of other forms, indicating the diversification of product forms to reach a wider market. In terms of supply chain management, most SMEs focus on the production (33.8%) and distribution (22.7%) stages, while 22.2% of respondents stated they managed all stages of the supply chain, from raw material procurement to marketing. These findings indicate that herbal medicine SMEs in Batam possess diverse entrepreneurial characteristics with potential for strengthening in the areas of innovation and supply chain efficiency.

Multicollinearity Test. The Variance Inflation Factor (VIF) is used to detect multicollinearity between latent variables. If the VIF is > 5, it means there is a multicollinearity problem that can cause bias in the estimation of the path coefficients (Harel Chairunnisa et al., 2025).

Table 3. Variance Inflation Factor

	VIF
IC1	3.682
IC2	4.228
IC3	3.763
IC4	4.528
IS1	4.568
IS2	4.046
IS3	2.993
IS4	4.186
IS5	1.725
SCC1	2.117
SCC2	4.024
SCC3	3.809
SCC4	3.539
SCC5	3.257

	VIF
SMEP1	2.744
SMEP2	4.503
SMEP3	3.289
SMEP4	4.099
SMEP5	4.470

Source: Processed Data (2025)

Based on the results shown in Table 2, all indicators in the model have VIF values below 5. This means there is no strong or significant multicollinearity among the indicators that could influence the relationships between the latent variables. In other words, each indicator accurately measures its construct as expected according to the guidelines. (Hair et al., 2022).

Convergent Validity, measures the extent to which indicators within a construct are highly correlated and truly measure the same concept. This test is conducted through two components: Outer Loading and Average Variance Extracted.

Outer Loadings, indicate that an indicator has valid reliability in measuring a latent variable, with a value > 0.70 considered valid. Meanwhile, AVE measures the average variance of the indicator explained by the construct, with a value > 0.50 (Savitri et al., 2022).

Table 4. Outer Loadings

	Information Sharing	Supply Chain Collaboration	SMEs Performance	Innovation Capability
IS1	0.929			
IS2	0.905			
IS3	0.853			
IS4	0.908			
IS5	0.766			
SCC1		0.901		
SCC2		0.872		
SCC3		0.887		
SCC4		0.861		
SCC5		0.851		
SMEP1			0.859	
SMEP2			0.916	
SMEP3			0.891	
SMEP4			0.914	
SMEP5			0.924	
IC1				0.916
IC2				0.913
IC3				0.919
IC4				0.927

Source: Processed Data (2025)

Table 5. AVE (Average Variance Extracted)

	AVE
Information Sharing	0.844
Supply Chain Collaboration	0.765
SMEs Performance	0.812
Innovation Capability	0.764

Source: Processed Data (2025)

Based on Table 3, all indicator values have outer loadings greater than 0.70, which means the indicators are valid. In Table 4, the AVE values are higher than 0.50, showing that more than half of the variation in the indicators is explained by the latent variables (Hair et al., 2022). Therefore, it can be concluded that the requirements for convergent validity have been fulfilled.

Discriminant Validity, measures whether a latent variable is truly different from other variables in the model. This is tested through Cross Loadings, Fornell-Larcker Criterion, and HTMT Ratio. Cross Loadings are used to ensure that the indicators of a latent variable have a correlation > its own variable compared to other variables, Fornell-Larcker is used to test the discriminant validity between constructs by comparing the root value of AVE for each construct > of the correlation between other constructs in the model, and HTMT ratio is used to compare the correlation between different latent variables with the correlation within the same latent variable with the interpretation rule HTMT < 0.85 (Budhiasa Sudjana, 2016).

Table 6. Cross Loadings

	Innovation Capability	Supply Chain Collaboration	SMEs Performance	Information Sharing
IC1	**0.916**	0.109	0.271	0.338
IC2	**0.913**	0.176	0.203	0.272
IC3	**0.919**	0.139	0.257	0.332
IC4	**0.927**	0.142	0.238	0.333
IS1	0.329	-0.089	0.717	**0.929**
IS2	0.317	-0.003	0.648	**0.905**
IS3	0.198	-0.117	0.554	**0.853**
IS4	0.289	-0.005	0.659	**0.908**
IS5	0.363	0.060	0.681	**0.766**
SCC1	0.256	**0.901**	-0.094	-0.057
SCC2	0.060	**0.872**	-0.057	0.016
SCC3	0.082	**0.887**	-0.071	0.005
SCC4	0.036	**0.861**	-0.120	-0.038
SCC5	0.037	**0.851**	-0.134	-0.012
SMEP1	0.197	-0.095	**0.859**	0.661
SMEP2	0.204	-0.137	**0.916**	0.678
SMEP3	0.305	-0.078	**0.891**	0.660
SMEP4	0.244	-0.079	**0.914**	0.693
SMEP5	0.246	-0.101	**0.924**	0.701

Source: Processed Data (2025)

Table 7. Fornell-Larcker Criterion

	Innovation Capability	Supply Chain Collaboration	SMEs Performance	Information Sharing
Innovation Capability	**0.919**			
Supply Chain Collaboration	0.152	**0.875**		
SMEs Performance	0.265	-0.109	**0.901**	
Information Sharing	0.349	-0.031	0.753	**0.874**

Source: Processed Data (2025)

Table 8. HTMT Rasio

	Innovation Capability	Supply Chain Collaboration	SMEs Performance	Information Sharing
Innovation Capability				
Supply Chain Collaboration	0.116			
SMEs Performance	0.281	0.114		
Information Sharing	0.367	0.083	0.802	

Source: Processed Data (2025)

Table 5 shows that the correlation values for all indicators meet the requirements, with the loading values for each construct being higher than for the other constructs. Table 6 shows that the values for each variable are greater than the correlations between the other constructs.

Table 7 shows that all construct values are < 0.85, indicating no issues in the model, consistent with the guidelines of Henseler et al. (2016).

Reliability measures the internal consistency of indicators within the latent construct. This is tested using Cronbach's Alpha and Composite Reliability, with Cronbach's Alpha and Composite Reliability values > 0.70 (Hamid et al., 2019).

Table 9. Cronbach's Alpha dan Composite Reliability

	Cronbach's Alpha	Composite Reliability (Rho_C)
Innovation Capability	0.938	**0.956**
Supply Chain Collaboration	0.932	**0.942**
SMEs Performance	0.942	**0.956**
Information Sharing	0.922	**0.942**

Source: Processed Data (2025)

Based on the results in Table 8, all Cronbach's alphas were > 0.70, indicating high reliability. Composite reliability was also high, > 0.70, but did not exceed 0.95, indicating no indicator redundancy. Therefore, it can be concluded that reliability was met.

R-Square, or the coefficient of determination, indicates the proportion of variance in the dependent variable that can be explained by the independent variable. The values are 0.70 (Strong), 0.50 (Moderate), 0.25 (Weak), and <0.25 (Very Weak) (Savitri et al., 2022).

Table 10. R-Square

	R-Square	R-Square Adjusted
Innovation Capability	0.148	0.140
SMEs Performance	0.575	0.568

Source: Processed Data (2025)

In Table 9, the r-square value for the innovation capability variable is 0.148, and the adjusted r-square value is 0.140. This means that information sharing and supply chain collaboration together explain 14% of the changes in innovation capability. Although this influence is relatively weak, it suggests that other factors outside the model may also affect innovation capability. Meanwhile, the r-square value for SME performance is 0.575, with an adjusted r-square value of 0.568. This indicates that the information sharing, supply chain collaboration, and innovation capability variable explains 57% of the SMEs performance variable. This indicates stable and moderate predictive power.

Hypothesis Testing: A significant relationship between variables must meet the minimum standard requirements of a T-Statistic > 1.96 (significance level = 5%), and P-Values (Hamid et al., 2019; Savitri et al., 2022)

Table 11. Path Coefficient Bootstrapping

Track	Path Coefficient	T Statistics	P Values
Information Sharing -> SMEs Performance	0.744	14.542	0.000
Supply Chain Collaboration -> SMEs Performance	-0.088	1.916	0.055
Innovation Capability -> SMEs Performance	0.019	0.358	0.720
Information Sharing -> Innovation Capability	0.354	4.836	0.000
Supply Chain Collaboration -> Innovation Capability	0.164	1.791	0.073
Information Sharing -> Innovation Capability -> SMEs Performance	0.007	0.343	0.732
Supply Chain Collaboration -> Innovation Capability -> SMEs Performance	0.003	0.302	0.762

Source: Processed Data (2025)

Discussion

H1: The Influence of Information Sharing on SMEs Performance

The test results show a path coefficient of 0.744 with a p-value of 0.000 (<0.05), thus H1 is accepted. This indicates that information sharing has a significant and positive effect on the performance of herbal medicine SMEs in Batam. Fast and accurate access to information, such as consumer preference data or traditional health market trends, enables SMEs to improve coordination with suppliers, operational efficiency, and business strategy adjustments. This finding aligns with Rashima Nugraha & Hartono (2022), who stated that information sharing in the supply chain strengthens organizational performance, and Yuliana et al. (2022) who highlighted the role of information technology in accelerating innovation processes. In the Batam context, information on herbal raw materials or local market regulations appears to be a key driver of success.

However, these results show a different pattern compared to several previous studies, which found that information sharing does not always have a significant impact on MSME performance, particularly in regions with low technology adoption rates or unintegrated supply chains. This difference can be understood through Batam's characteristics as a free trade zone with faster information flows, superior logistics infrastructure, and international competitive pressures that encourage businesses to optimize information exchange as a basis for decision-making (Fikri et al., 2024). The herbal industry in Batam also has its own dynamics, such as dependence on specific raw materials, demands for export quality standards, and relationships with cross-border suppliers that require a higher level of information transparency (Alhamda & Wahyuningsih, 2023). These conditions make information sharing a strategic factor that directly impacts product quality, supply certainty, and innovation capabilities. Furthermore, there are potential moderating factors such as MSME size, market orientation, and level of digital readiness that can strengthen or weaken the effect of information sharing on performance. Larger MSMEs typically have more formal information systems, enabling them to utilize data optimally, while MSMEs with a strong market orientation are more responsive to changes in consumer preferences (Thalia, Aliya, Gunarto, & Helmi, 2024). Digital readiness also influences the speed of information processing and utilization. Thus, the effectiveness of information sharing is largely determined by the structural conditions, internal capabilities, and geographical context of herbal MSMEs in Batam.

H2: The Influence of Supply Chain Collaboration on SMEs Performance

The test results show a path coefficient of –0.088 with a p-value of 0.055, which is greater than 0.05, so H2 is rejected. This means that supply chain collaboration does not have a significant effect on the performance of herbal medicine SMEs in Batam. This finding differs from the studies of Suriyanti et al. (2025) and Sentoso et al. (2024), who highlighted the importance of strategic collaboration in improving market expansion and operational efficiency, this finding suggests that existing collaboration may be transactional or formal in nature, without generating real added value. Kijkasiwat & Phuensane (2020) argue some scholars point out that in developing countries, weak trust or limited intensity of collaboration often becomes a barrier. In Batam, this situation may be reinforced by inadequate logistics infrastructure and the absence of strong resource-sharing arrangements with local suppliers.

These differences in results can be explained by several contextual factors in Batam, such as its fragmented supply chain structure, dependence on off-island suppliers, and the dynamics of the free trade zone, which encourage competition rather than collaboration. Many herbal MSMEs in Batam lack robust resource-sharing, joint planning, or information integration mechanisms, preventing collaboration from developing into strategic partnerships that improve performance (Krykavskyy & Hayvanovych, 2021). Furthermore, moderating factors such as MSME size, market orientation, and digital readiness have the potential to undermine the

impact of collaboration. Small MSMEs often have limited managerial capacity, preventing them from optimally leveraging collaboration, while low market orientation leads to businesses underutilizing partner networks to capture new market opportunities (Kusmantini, Satmoko, Pratiwi, & Kurniawati, 2020). Minimal digital readiness also hinders the coordination, data integration, and communication processes necessary for effective collaboration. Therefore, the results of this study reflect that collaboration in the supply chain does not automatically improve performance unless accompanied by high levels of trust, process integration, technological readiness, and aligned long-term strategies among partners.

H3: The Influence of Innovation Capability on SMEs Performance

The test results show a path coefficient of 0.019 with a p-value of 0.720 (>0.05), thus H3 is rejected. This indicates that innovation capability does not exert a direct and significant influence on the performance of herbal SMEs in Batam. This result differs from the conclusions of Purwati et al. (2020) and Bagas Aji & Nursyamsiah (2023), who showed that both product and business model innovation can improve SME outcomes. One possible explanation is that many herbal SMEs in Batam are still in the early stages of adopting innovation. For instance, efforts such as adding new product variants or introducing modern packaging have not yet gained strong acceptance in the market. Another contributing factor may be the limited financial and technical resources available, which restrict the extent to which innovation can translate into better performance.

This difference can be explained by the fact that many herbal MSMEs in Batam are still in the early stages of innovation, so efforts such as adding product variants, using modern packaging, or adopting digital platforms have not yet generated strong commercial impact. Batam's context as an industrial and free trade zone also plays a role, as the local market is highly competitive and influenced by foreign products with higher standards (Romero & Mammadov, 2025). Therefore, simple innovations by local MSMEs are not sufficient to significantly improve performance. Furthermore, limited capital, R&D capabilities, and access to technology tend to make innovations imitative or incremental, rather than innovations that generate competitive advantage. Moderating factors such as MSME size also potentially influence this relationship, as small MSMEs typically lack sufficient operational capacity to monetize innovation. Low market orientation prevents innovation from being properly targeted to consumer needs, while varying levels of digital readiness hinder MSMEs from utilizing technology to support innovation. Thus, innovation capability is not yet a direct driver of performance because it is not accompanied by adequate internal capacity, technological readiness, and market strategy.

H4: The Influence of Information Sharing on Innovation Capability

The test results show a path coefficient of 0.354 with a p-value of 0.000 (<0.05), thus H4 is accepted. Access to information plays an important role in strengthening the innovation capability of SMEs in Batam. Insights drawn from global health trends or shifts in consumer preferences, such as the growing demand for ready-to-drink herbal products can inspire enterprises to design new products and improve existing processes.

This finding is consistent with Rashima Nugraha & Hartono (2022), who demonstrated that external information strengthens absorptive capacity, and Yuliana et al. (2022), who emphasized the role of information technology in supply chain innovation. In the Batam context, digital platforms or communication with distributors appear to be critical channels for supporting innovation activities.

However, these results may have unique characteristics compared to previous research due to Batam's more competitive market structure and openness to imported products, making herbal MSMEs highly dependent on external information to assess competitive dynamics.

Furthermore, the digital literacy levels of MSMEs in Batam vary; some have utilized marketplaces, social media, and WhatsApp Business, while others are still limited to traditional promotional methods (Restrepo-Morales, Ararat-Herrera, López-Cadavid, & Camacho-Vargas, 2024). This situation results in a stronger effect of information access, especially for MSMEs with a strong market orientation and actively monitoring changes in consumer preferences. Moderating factors such as MSME size, digital readiness, and supplier relationships may also explain the variation in influence (Mahdikhani & Meena, 2024). Smaller MSMEs with limited resources may rely more heavily on external information to make innovative decisions, while larger MSMEs typically have more established internal systems. Thus, Batam's local context including its business ecosystem that prioritizes speed of information and its proximity to regional markets makes information access a key driver of increased innovation capabilities (Restrepo-Morales et al., 2024).

H5: The Influence of Supply Chain Collaboration on Innovation Capability

The test results show a path coefficient of 0.164 with a p-value of 0.073 (>0.05), thus H5 is rejected. This indicates that supply chain collaboration does not significantly affect innovation capability. Unlike Sudhartio et al. (2023) and Suriyanti et al. (2025), who asserted that external collaboration fosters open innovation, this finding suggests that collaboration among SMEs in Batam may remain limited to routine operations, without active mechanisms for knowledge or technology transfer. Locally, the lack of intensive collaboration with institutions such as universities or herbal farming communities may act as an inhibiting factor Sang et al. (2024).

This difference in results can be explained by the Batam context, which has an industrial structure more oriented toward trade and distribution than toward a supply chain based on herbal raw material production. Many herbal MSMEs in Batam lack strong relationships with primary suppliers, as most raw materials are sourced from outside the region, severely limiting opportunities for sharing information on process innovation or product development (Supriadi, 2023). Furthermore, the predominantly micro-scale nature of MSMEs also tends to focus on the continuity of daily operations rather than establishing long-term strategic collaborations. Moderating factors such as low digital readiness, inconsistent market orientation, and limited managerial capabilities of MSME owners also weaken the potential for collaboration to generate innovation (Andrawina, 2025). Even when collaboration does occur, it is more transactional, such as material procurement or product distribution, rather than knowledge-based collaboration that can enhance innovation capabilities. Thus, the results of this study indicate that existing collaboration patterns are not yet intense or focused enough to encourage meaningful innovation among herbal MSMEs in Batam.

H6: The Role of Innovation Capability as a Link between Information Sharing and the Performance of Small and Medium Enterprises (SMEs)

The test results show a path coefficient of 0.007 with a p-value of 0.732 (>0.05), thus H6 is rejected. This indicates that innovation capability does not mediate the relationship between information sharing and SME performance. Instead, information sharing appears to have a more direct impact, for example through operational efficiency or responsiveness to market dynamics, without requiring innovation as an intermediary process. In contrast to Rashima Nugraha & Hartono (2022), who emphasized the mediating role of absorptive capacity, this finding may reflect the limited ability of SMEs in Batam to convert information into innovation-driven outcomes, largely due to their small scale or restricted resources.

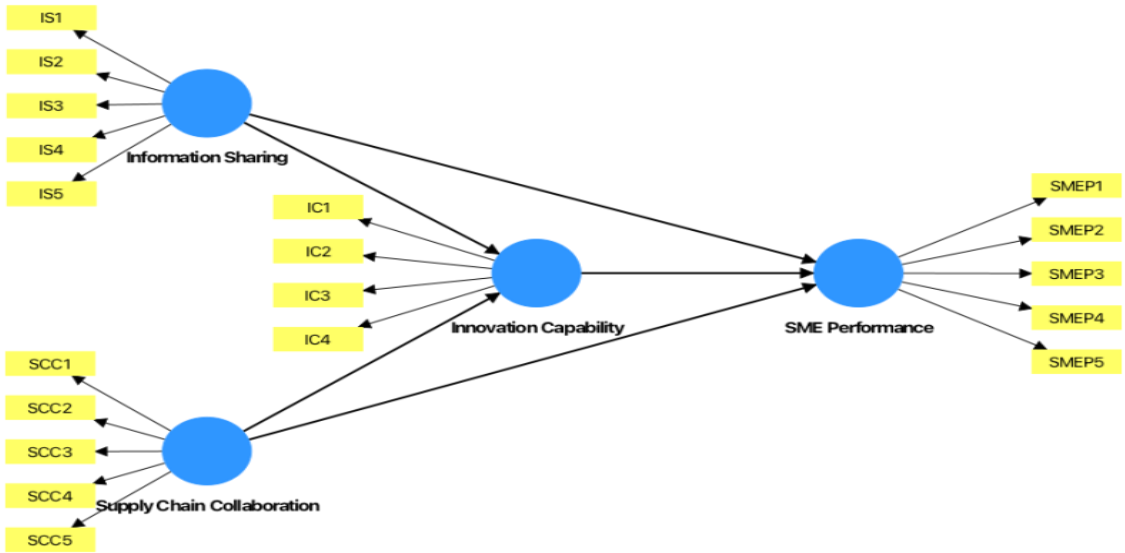
This difference can also be explained by the structural conditions of herbal MSMEs in Batam, which are still in the early stages of business development. Therefore, the information received is more often used for practical needs such as price adjustments, raw material

selection, or simple marketing strategies, rather than as a basis for product or process innovation (Ramdan, Siwiyanti, Komariah, Nurmillah, & Ramdhany, 2025). Furthermore, Batam's highly competitive consumer market, dominated by herbal products from outside the region, tends to focus on efficiency and speed of distribution rather than engaging in risky innovative experiments. Moderating factors such as small business size, weak market orientation, and low digital readiness further weaken the ability of MSMEs to strategically utilize information flows. Consequently, the information obtained does not develop into significant innovations, thus failing to play a mediating role, as found in previous research (Asmawati, Ahmad, Suwarni, Alita, & Hasrina, 2024).

H7: The Mediating Role of Innovation Capability in the Relationship between Supply Chain Collaboration and SMEs Performance

The test results show a path coefficient of 0.003 with a p-value of 0.762, which is greater than 0.05, meaning that H7 is rejected. This result indicates that innovation capability does not serve as a mediator between supply chain collaboration and the performance of SMEs.This finding contrasts with Purwati et al. (2020) and Indarto (2024), who found that innovation mediates the effect of collaboration on business performance. The weak mediation effect in this study may be due to the lack of strategic collaboration that drives innovation, such as insufficient technology transfer from suppliers or distributors. In the Batam context, SMEs appear to focus more on operational collaboration than on partnership-based innovation.

In Batam, the relatively small and dispersed structure of the herbal industry also makes supplier relationships short-term and not based on long-term commitments, making it difficult to foster innovation through collaborative processes. Furthermore, Batam's geographic location as an import-dominated free trade zone makes MSMEs more focused on maintaining raw material continuity than developing collaboration-based innovation (Mahmud, Paul, Azeem, & Chowdhury, 2021). Moderating factors such as the small size of MSMEs, limited human resources, and uneven levels of digital readiness further weaken their ability to translate collaboration into innovative activities. A weak market orientation, with some MSMEs producing only for the local market, where competition does not demand significant differentiation, also contributes to the lack of motivation to develop innovation through supply chain collaboration. Thus, collaboration does not develop into innovation, and therefore cannot act as a mediating variable in improving MSME performance (Kusmantini et al., 2020).



Source: Processed Data (2025)

Figure 2. Model SmartPLS

CONCLUSION

This study shows that sharing information positively and significantly improves the performance of herbal medicine SMEs in Batam, both directly and by increasing their innovation ability. However, collaboration within the supply chain does not have a significant impact on SME performance or innovation capability, and innovation capability also does not function as a mediator between information sharing or supply chain collaboration and performance. Only hypotheses H1 and H4 were supported, reinforcing the central role of information sharing in enhancing operational efficiency and competitiveness. These findings diverge from several previous studies, likely due to the limited depth of strategic collaboration and the relatively low innovation adoption among SMEs in Batam. Practically, SMEs are encouraged to intensify their use of digital technologies such as data-sharing systems, e-commerce tools, and especially digital logistics platforms to improve coordination, traceability, and responsiveness across the supply chain.

In addition, MSMEs need to build and implement a supplier relationship management (SRM) system to strengthen long-term relationships with suppliers, improve supply quality, and reduce the risk of dependence on imported raw materials.. Strengthening long-term partnerships with local suppliers and integrating real-time data systems can also help address existing inefficiencies. In line with this, the Batam City Government needs to develop a structured innovation capability building program through technology training, product innovation assistance, and facilitation of research access to accelerate the innovative capabilities of herbal MSMEs. From a policy perspective, local governments are advised to develop targeted technology training, improve supply chain infrastructure, and establish an open innovation hub for the herbal industry to facilitate collaboration among SMEs, universities, and research institutions. In addition, digital platform integration is needed that connects MSMEs, distributors, and suppliers in a single integrated data ecosystem to improve transparency, demand-supply alignment, and overall supply chain responsiveness. This study is limited by its focus on Batam and its cross-sectional design; therefore, future research should explore the roles of digitalization, market orientation, and external environmental factors in shaping innovation and performance dynamics within the herbal medicine SME sector.

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