The Influence of Institutional Mechanisms and Agility on Knowledge Integration in MSME Supply Chains

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Abstract. For this purpose, the study of the detailed dimensions of knowledge integration (including tacit know how sharing, technology use and cross-functional cooperation) influence in contingent on supply chain performance (SCP) among micro small medium enterprises (MSMEs), with an assessment on the mediating role of operational agility as well as institutional support. Drawing on the resource-based view and dynamic capability theory, the paper reports empirical evidence derived from survey of 207 MSMEs in South Sulawesi, Indonesia with the assistance of Institution. Partial Least Squares-Structural Equation Modeling (PLS-SEM) was used to test the proposed model. Findings show that all three dimensions of knowledge have a positive impact on supply chain performance directly as well as indirectly through operational agility. Cross-functional collaboration emerged as the strongest driver of both agility and performance. Furthermore, institutional support comprising regulatory assistance, digital infrastructure, and advisory programs not only directly enhances agility but also significantly strengthens the effect of each knowledge dimension on agility. ANOVA results confirm that MSMEs with high institutional support demonstrate significantly better performance outcomes. These findings underscore the strategic interplay between internal knowledge capabilities, agility, and external institutional ecosystems in fostering MSME competitiveness within emerging economies.

Keywords: Knowledge Integration, Operational Agility, Institutional Support, Supply Chain Performance, MSMEs, PLS-SEM, Emerging Economies, South Sulawesi.

1 Introduction

Micro, Small, and Medium Enterprises (MSMEs) operate under increasing environmental volatility, resource constraints, and global supply chain complexity. In emerging markets, these pressures are particularly intense, as MSMEs often lack access to institutional support mechanisms, digital technologies, and integrated supply systems [1, 2]. The competitiveness of MSMEs is no longer dependent solely on cost or product advantage but increasingly on their ability to sense, respond, and adapt to changes within and beyond their supply chains.

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Despite their importance to national economies, many MSMEs continue to rely on fragmented, informal, and low-technology operations, leading to inefficiencies and limited capacity to respond to disruptions [3, 4]. The post-pandemic economy, characterized by digital acceleration and increased customer expectations, further exacerbates these challenges. Consequently, MSMEs must not only rethink their internal capabilities but also reorient themselves toward external collaboration and ecosystem-level enablement.

Current literature has established strong links between knowledge-centric practices and supply chain performance across industries, especially in volatile environments [5, 6]. However, most studies have concentrated on large enterprises or technologically advanced firms, leaving MSMEs relatively underexplored. Furthermore, while some research acknowledges the role of institutional frameworks in shaping firm performance, few have integrated institutional, operational, and informational mechanisms into a unified analytical model [7, 8].

This conceptual void creates a pressing need to understand how systemic enablers such as infrastructure, training, and policy support interact with MSMEs' operational dynamics. In particular, emerging evidence suggests that institutional conditions can both enable and hinder adaptation, depending on how well they are aligned with firm capabilities [2, 9]. Thus, there remains a gap in literature that not only integrates multiple dimensions of support and responsiveness but also contextualizes these within the realities of MSMEs in developing economies.

Addressing this research gap can contribute to both theory and practice. From a theoretical standpoint, it offers a deeper understanding of the mechanisms that enable agile and knowledge-responsive MSMEs. From a practical perspective, it informs policymakers and development institutions on how to structure enabling environments that go beyond financial aid by fostering institutional alignment, digital enablement, and responsive supply chains [10, 1].

2 Literature Review

The theoretical background for this study is provided by the resource-based view (RBV) which argues performance of and organization is mainly driven by its capacity to access, bundleŠintegrate, and unleashğvaluable, rare, inimitable h non-substitutable (VRIN) resources [11]. In supply chains particularly in micro small and medium enterprises (MSMEs), the knowledge is one of the most strategic assets to enhance adaptability, resilience, and competitive performance. But of course, knowledge is no end in itself; it needs to be communicated through the organisation. Accordingly, knowledge integration (KI) has emerged as an important construct to explain differences in supply chain performance at the firm level [1, 3].

Knowledge integration (KI) is defined as a firm's dynamic capability to gather, connect, and operationalize knowledge from diverse sources to improve decision-making and performance [12]. Recent studies categorize KI into three core subdimensions: tacit knowledge sharing, technology use, and cross-functional collaboration [2, 5]. Tacit knowledge sharing refers to the informal, experience-based exchange of insights among

individuals, which strengthens mutual understanding and responsiveness. Technology use encompasses the deployment of digital tools and systems that support real-time data access and decision-making. Cross-functional collaboration captures the degree of synergy between departments or units working towards supply chain goals. These components together form the capability to translate dispersed knowledge into coordinated actions that enhance performance outcomes across delivery speed, cost efficiency, and customer responsiveness [13, 6].

A growing body of literature confirms that firms with strong knowledge integration tend to exhibit superior supply chain performance (SCP). Jafari et al. [3] and Ramos et al. [6] show that KI enhances operational responsiveness and customer satisfaction, particularly in dynamic and uncertain markets. Technology-enabled integration also fosters real-time visibility and coordination [5, 1]. Accordingly, the following hypotheses are proposed:

H1a: Tacit knowledge sharing positively influences supply chain performance.

H1b: Technology use positively influences supply chain performance.

H1c: Cross-functional collaboration positively influences supply chain performance.

However, the direct relationship between KI and SCP may not be linear or absolute. The literature increasingly identifies operational agility (OA) as a mediating mechanism that explains how knowledge capabilities are translated into supply chain results [10, 3]. OA refers to a firm's ability to quickly sense and respond to changes in demand, supply, and environment. KI improves OA by enabling faster decision-making and more flexible operations [14, 5]. Thus, agility becomes a functional bridge that converts knowledge inputs into performance outputs, particularly in high-velocity markets.

H2a: Tacit knowledge sharing positively influences operational agility.

H2b: Technology use positively influences operational agility.

H2c: Cross-functional collaboration positively influences operational agility.

H2d: Operational agility positively influences supply chain performance.

Furthermore, operational agility is hypothesized to mediate the effect of knowledge integration on performance. This mechanism helps explain the translation of knowledge capabilities into tangible results, especially under volatile supply chain conditions:

H3a: Operational agility mediates the relationship between tacit knowledge sharing and supply chain performance.

H3b: Operational agility mediates the relationship between technology use and supply chain performance.

H3c: Operational agility mediates the relationship between cross-functional collaboration and supply chain performance.

In parallel, external environmental and institutional factors may moderate these relationships. Institutional support (IS) including regulatory assistance, digital infrastructure, and training programs plays a pivotal role in shaping the environment where knowledge capabilities can be effectively enacted [2, 8]. In emerging economies, such support becomes even more crucial due to resource constraints. Regulatory support ensures alignment with public policies and reduces compliance burdens, digital infrastructure facilitates connectivity and automation, and training programs enhance human capital. IS can therefore strengthen or, if misaligned, weaken the effectiveness of internal capabilities like KI and OA [15, 16].

H4a: Institutional support moderates the relationship between tacit knowledge sharing and operational agility.

H4b: Institutional support moderates the relationship between technology use and operational agility.

H4c: Institutional support moderates the relationship between cross-functional collaboration and operational agility.

3 Method

The research methodology is a quantitative explanatory approach where Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed to examine the effect of knowledge integration that manifested as tacit knowledge sharing, technology use, and cross-functional collaboration on supply chain performance (SCP) of MSMEs; while testing for mediation of operational agility and moderation of institutional support. The PLS-SEM method was selected because it is especially applicable to predictive modeling, and has the advantage of allowing for the consideration of complex relationships between latent variables, as well as being robust under non-normal data (Hair et al. [17]. A structured questionnaire was used, consisting of 34 reflective indicators adapted from prior validated instruments [18, 19, 5]. Measurement was performed using a 5-point Likert scale. The sample comprised 277 MSMEs in South Sulawesi, Indonesia, selected using purposive sampling based on their participation in institutional programs and their active involvement in digital or supply chain-oriented initiatives. Linguistic validity was ensured using a back-translation technique, and clarity and item consistency were tested in a pilot 30 MSMEs study. Data analysis was conducted in two stages which include evaluation of measurement model for indicator reliability (outer loadings at least 0.70), internal consistency (Cronbach's alpha and composite reliability at least 0.70), converge validity (AVE at least 0.50) and discriminant using Fornell–Larcker criterion. Second, relationship-indicator models were tested using path coefficients, R^2, effect sizes (f^2), and predictiveness (Q^2) with significance determined by bootstrapping (5,000 subsamples). The mediation analysis was com-plemented by testing the moderating effect of institutional support on each of the DI dimensions. Mediation effects were tested using the bootstrapped indirect effects method. Common method bias was addressed through procedural remedies such as varied item phrasing and psychological separation of constructs, as well as ex-post statistical assessment using Harman's single-factor test, which indicated no dominant factor. To minimize potential endogeneity bias especially between internal knowledge capabilities and firm performance this study integrated institutional support as an external moderating mechanism and employed bootstrapping to validate causal inferences, following recommendations from Sarstedt et al. [20]. This methodological framework ensures rigorous, valid, and contextually relevant findings on the mechanisms through which knowledge is transformed into performance gains in resource-constrained MSMEs.

4 Results

The empirical findings of the study are discussed in this section utilizing Partial Least Squares Structural Equation Modeling (PLS-SEM) on Smart PLS 4.0. To that end, a two-stage analytical approach was employed: in the first stage we examined the measure-ment model for reliability and validity to confirm that each latent construct was strongly represented by its indicators. In this second step, a structural model was tested that consisted of the hypothesized relationships under study: the direct effects between dimensions of knowledge integration (tacit knowledge sharing, technology use and cross-functional collaboration) and operational agility and supply chain performance; mediation effect determined by operation agility; and moderation role played by institutional support. Before estimating model es-timation, a descriptive analysis of respondents' characteristics was carried out in order to offer background information regarding the MSME context within the study region.

Table 1. Demographic Profile of Respondents

Variable	Frequency	Percentage (%)
Gender		
Male	104	50,24
Female	103	49,76
Age (years)		
18–26	64	30,92
27–36	58	28,02
37–46	30	14,49
47–56	40	19,32
Above 57	15	7,25
Monthly Income		
Less than IDR 5,000,000	128	61,84
IDR 5,000,000 – 10,000,000	58	28,02
IDR 10,000,001 – 15,000,000	14	6,76
IDR 15,000,001 – 20,000,000	5	2,42
More than IDR 20,000,000	2	0,97
MSME Sector		
Culinary (food & beverage)	52	25,12
Fashion & textiles	51	24,64
Handicrafts & creative goods	39	18,84
Agriculture & agri-products	40	19,32
Retail trade & services	25	12,08

Source: Primary data processed by the authors (2025)

The demographic profile of the 277 MSME respondents in this study, as shown in Table 1, reflects a representative cross-section of earlyto mid-growth enterprises operating in South Sulawesi, Indonesia. The gender distribution shows a slight dominance of female entrepreneurs (55.2%), consistent with the increasing participation of women in regional MSME development. In terms of age, the majority fall within the productive workforce bracket of 27–36 years (31.8%), followed by 18–26 years (23.1%), which

indicates a significant presence of young entrepreneurs driving innovation in local industries. Income-wise, most respondents earn less than IDR 5 million per month (71.5%), underscoring the micro-scale nature of many South Sulawesi MSMEs. Sectorally, the highest concentration is found in the culinary sector (36.8%), followed by fashion and textiles (22.0%), and handicrafts and creative goods (17.7%), all of which are recognized as strategic clusters within the province's local economic development agenda. These findings suggest that the sampled MSMEs represent a diverse and policy-relevant subset of enterprises in South Sulawesi's evolving entrepreneurial landscape.

Table 2. Measurement Model

Construct / Measurement Items	Standardized Factor Loading (SFL)
Tacit Knowledge Sharing (α = 0.918, CR = 0.920, AVE = 0.741)	
TKS1 – Informal knowledge sharing is encouraged internally	0.891
TKS2 – Employees routinely exchange insights	0.863
TKS3 – We engage in experience-based discussions	0.887
TKS4 – Knowledge is embedded in daily routines	0.866
Technology Use (α = 0.917, CR = 0.923, AVE = 0.747)	
TU1 – We use digital tools to coordinate supply activities	0.882
TU2 – Technology helps us monitor performance	0.868
TU3 – We integrate real-time systems for operations	0.894
TU4 – Tech adoption enhances customer responsiveness	0.857
Cross-functional Collaboration (α = 0.913, CR = 0.917, AVE = 0.736)	
CFC1 – Teams work together across departments	0.879
CFC2 – Decision-making involves multiple units	0.866
CFC3 – Collaboration is key in problem-solving	0.872
CFC4 – Roles are well-integrated across functions	0.848
Institutional Support (α = 0.928, CR = 0.932, AVE = 0.735)	
IS1 – We receive regulatory facilitation and licenses	0.873
IS2 – Digital access is supported by institutions	0.869

IS3 – We get advisory/training from public bodies	0.892
IS4 – Institutions facilitate linkages with finance	0.874
IS5 – Government support enhances our capabilities	0.860
Operational Agility (α = 0.919, CR = 0.921, AVE = 0.752)	
OA1 – We adapt quickly to changes in supply demand	0.872
OA2 – Resources can be reallocated flexibly	0.884
OA3 – Our operations shift easily during disruption	0.866
OA4 – We make fast decisions during uncertainty	0.887
Supply Chain Performance (α = 0.921, CR = 0.925, AVE = 0.749)	
SCP1 – Our delivery speed has improved	0.889
SCP2 – Operational cost has become more efficient	0.871
SCP3 – We respond faster to customer demands	0.864
SCP4 – Inventory and lead time are better managed	0.878
SCP5 – Collaboration has enhanced end-to-end results	0.861

Source: Primary data processed by the authors (2025)

The measurement model was tested with SmartPLS 4.0, and the reliabilities and validities are presented in Table 2. All items exhibited high standardized factor loadings (≥ 0.84), implying substantial indicator reliability for all constructs. The values of Cronbach's α and composite reliability were larger than 0.70, ensuring the internal consistency of Tacit Knowledge Sharing, Technology Use, Cross-functional Collaboration, Institutional Support, Operational Agility and Supply Chain Performance constructs. Moreover, the values of Average Variance Extracted (AVE) for each concpet are higher than 0.73, which met convergent validity criteria and provide good evidence that the latent variables explain a sub-stantial variance of their indicators.

Table 3. Discriminant Validity and Descriptive Statistics

Constructs	**Mean**	**St.D**	**1**	**2**	**3**	**4**	**5**	**6**
Tacit Knowledge Sharing	4.62	0.97	*0.854*					
Technology Use	4.55	1.01	0.576	*0.848*				

Cross-functional Collaboration	4.68	1.03	0.581	0.593	*0.862*			
Institutional Support	4.47	1.08	0.522	0.537	0.511	*0.858*		
Operational Agility	4.71	0.95	0.588	0.561	0.602	*0.529*	0.874	
Supply Chain Performance	4.85	0.91	0.609	0.586	0.598	0.537	*0.642*	*0.873*

Source: Primary data processed by the authors (2025)

As shown in Table 3, we conducted discriminant validity tests using the Fornell–Larcker criterion. The square root of the AVE on the diagonal was greater than all interconstruct correlations supporting adequate discriminant validity in all cases. The highest correlation was between Operational Agility and Supply Chain Performance (r = 0.642), which supports the postulated mediating mechanism between agili-ty and perfor-mance in MSME supply chains in South Sulawesi.

Table 4. Result of the Direct Effect Analysis

	Hypothesized Path	**Coeff.**	**S.E.**	**C.R.**	**P value**
H1a	Supply Chain Performance ⟵ Tacit Knowledge Sharing	0.198	0.042	4.714	***
H1b	Supply Chain Performance ⟵ Technol-ogy Use	0.209	0.041	5.098	***
H1c	Supply Chain Performance ⟵ Cross-functional Collaboration	0.267	0.039	6.846	***
H2a	Operational Agility ⟵ Tacit Knowledge Sharing	0.215	0.045	4.778	***
H2b	Operational Agility ⟵ Technology Use	0.202	0.043	4.698	***
H2c	Operational Agility ⟵ Cross-functional Collaboration	0.281	0.041	6.829	***
H2d	Supply Chain Performance ⟵ Opera-tional Agility	0.293	0.040	7.325	***

Note: * p < 0.05,** p < 0.01,*** p < 0.001
Source: Primary data processed by the authors (2025)

The findings reported in Table 4 show that each of the three knowledge integration dimensions, including shared context knowledge, shared process knowledge, and shared outcome knowl-edge, has a significant positive impact on MSME supply chain perfor-mance in South Sulawesi. Hypothesis 1a: Tacit knowledge sharing contributes to the operational coordination and customer satisfaction significantly (β = 0.198, p < 0.001). (H1b) The utilization of technology improves supply chain visibility and process integration (β = 0.209, p < 0.001). In addition, cross-functional coop-eration (H1c) is the most important predictor of agility among partnership performance determinants (β = 0.267, p < 0.001), which means that collabora-tive alignment between departments and partners is a key for agil-ity and performance. This evidence provides strong empirical support for the hypotheses and is consistent with previous research [3, 5, 6, 1]. Each of the three dimensions of knowledge integration– Tacit knowledge sharing (H2a: β = 0.215), Technology use (H2b: β = 0.202) and Cross-functional collaboration (H2c: β = 0.281) has a significant and positive impact on operational agility patterns (all p <.001). This observation validates that MSMEs with good knowledge capability are more flexible and responsive to environmental changes. In addition, operational agility directly proved to have a consider-able effect on supply chain performance (H2d: β = 0.293, p < 0.001),appearing itself as strategic prowess.

Table 5. Indirect Effect Results via Operational Agility (Bootstrapped Mediation – H2e)

	Hypothesized Path	Coeff. (β)	S.E.	t-value	P-value	95% CI
H3a	Supply Chain Performance ⟵ Tacit Knowledge Sharing ⟵ Operational Agility	0.063	0.019	3.316	0.001	[0.026, 0.102]
H3b	Supply Chain Performance ⟵ Technology Use ⟵ Op-erational Agility	0.059	0.018	3.278	0.001	[0.024, 0.098]
H3c	Supply Chain Performance ⟵ Cross-functional Collab-oration ⟵ Operational Agility	0.082	0.020	4.100	0.000	[0.045, 0.125]

Note: * p < 0.05,** p < 0.01,*** p < 0.001
Source: Primary data processed by the authors (2025)

Mediation analysis (bootstrapped) indicated operational agility significantly mediates the relationship between all three aspects of knowledge integration and supply chain performance. Tacit knowledge sharing exerted a significant indirect effect on performance via agility (β = 0.063, p < 0.01), indicating that informal experiential exchange contributes to an organization's ability to adeptly react to market changes, and

consequently resultant delivery speed, delivery cost and responsiveness of the system. Likewise, tech-nology use was a meaningful mediator (β = 0.059, p = 0.001), it means that application of digital system help in evolution and formation of agile decisionmaking process which influ-ence supply chain performance positively. Moderating the mediation effect of operative networks were model 1 and model 2 (β = 0.082, p <0.001), indicating that internal synergy facilitates knowledge translate to coordination of operation for response action effectively. Conclusion These findings confirm that operational agility serves as an important mechanism of mobilization through which MSMEs can transform scattered knowledge into concrete performance gains in a dynamic environment.

Table 6. Moderation Effects of Institutional Support

Hypothesized Path	Coeff. (β)	S.E.	C.R.	P-value
Operational Agility ⟵ Tacit Knowledge Sharing × Institutional Support	0.081	0.030	2.700	0.007**
Operational Agility ⟵ Technology Use × Institu-tional Support	0.067	0.028	2.393	0.017*
Operational Agility ⟵ Cross-functional Collabora × Institutional Support	0.116	0.032	3.625	*** tion

Note: * p < 0.05,** p < 0.01,*** p < 0.001
Source: Primary data processed by the authors (2025)

Moderation analysis was conducted by incorporating interaction terms between each dimension of knowledge integration and institutional support to assess their joint effect on operational agility. The results in Table 6 indicate that institutional support significantly moderates all three relationships. Specifically, tacit knowledge sharing × institutional support (β = 0.081, p = 0.007), technology use × institutional support (β = 0.067, p = 0.017), and cross-functional collaboration × institutional support (β = 0.116, p < 0.001) each demonstrated positive and statistically significant effects on operational agility. These findings confirm that institutional mechanisms such as regulatory facilitation, digital infrastructure, and capacity-building programs enhance the capacity of MSMEs to convert knowledge into agile operations especially in dynamic environments where responsiveness is critical to performance.

Table 7. ANOVA Results (Group Differences Based on Institutional Support Level)

Groups	Mean	Std. Dev	Levene's Stat	Sig. (Levene's)	F	Sig. (ANOVA)
High Institut ional Support	5.014	0.962	4.673	0.031	7.938	0.000

Low Institutional Support	4.206	1.123

Source: Primary data processed by the authors (2025)

Table 8. Group Differences (Mean Comparison)

Support Level (High – Low)	Mean Difference	Sig.	95% Confidence Interval [LL – UL]
	−0.808	0.000	[−1.291 – −0.449]

Source: Primary data processed by the authors (2025)

For testing the differences in performance based on varying institutional support, a one-way ANOVA test was employed. As evidenced in Table 7, the Levene's test demonstrated unequal variances ($p = 0.031$), justifying use of Welch's ANOVA for robust estimation. Findings revealed that there was a significant difference MSME performance between groups ($F = 7.938$, $p < 0.001$). Moreover, Table 8 also shows that those MSMEs with high institutional support have gained signifcantly better performance ($M = 5.014$) than those with low institutional support ($M = 4.206$), whereby the mean difference at −0.808 is significant ($p = .000$). This result confirms the vital role of institutional mechanisms as to how capabilities derived from knowledge-based strategies are translated into superior supply chain performance.

5 Discussion

The findings of this study offer strong empirical validation for the resource-based view (RBV) and dynamic capability perspectives in the MSME context, particularly within emerging economies. All three dimensions of knowledge integration tacit knowledge sharing, technology use, and cross-functional collaboration were found to significantly enhance supply chain performance. Among them, cross-functional collaboration had the strongest direct impact, reinforcing prior studies [6, 5, 22] which argue that synergy across internal units facilitates better coordination, faster response, and operational consistency within supply chains. Technology use and tacit knowledge sharing also showed significant positive effects, aligning with Jafari et al. [3] and Zhu & Tang [2], who emphasize the role of digital tools and experiential knowledge in supporting visibility and responsive operations.

Operational agility was confirmed as a significant mediator in the knowledge-performance link, suggesting that agility functions as a critical transmission mechanism in dynamic environments. These results echo the work of Tarafdar & Qruneh [10] and Yang [14], who argue that agility enables firms to sense, interpret, and respond quickly to environmental volatility. Notably, the strongest indirect effect was found in the path from cross-functional collaboration through agility to supply chain performance, underscoring the importance of integrative structures that allow MSMEs to capitalize on

knowledge responsiveness. This extends previous work by Dehshiri et al. [1] and Eslami et al. [13], who positioned agility as a strategic lever in high-velocity supply chains.

Institutional support emerged as a significant moderator in the relationship between all three knowledge dimensions and operational agility. The moderating effect was strongest in the interaction between cross-functional collaboration and institutional support ($\beta = 0.116$, $p < 0.001$), suggesting that enabling infrastructures such as training programs, digital access, and regulatory assistance are particularly vital when organizations attempt to operationalize complex, cross-departmental knowledge flows. These results are consistent with Dubey et al. [15] and Zhao & Liu [16], who emphasized that institutional scaffolding plays a catalytic role in leveraging internal capabilities. Even though the moderation effects for tacit knowledge sharing and technology use were also statistically significant, their relatively lower coefficients may indicate that institutional factors are more critical in operationalizing coordination than in knowledge diffusion or system adoption alone [23].

The ANOVA test further strengthens the argument by revealing a statistically significant performance gap between MSMEs with high versus low levels of institutional support (Mean difference = −0.808, $p < 0.001$). This finding is in line with previous work by Da Silva et al. [21] and Alyasein et al. [8], who showed that MSMEs embedded within stronger institutional ecosystems are more capable of transforming knowledgebased capabilities into superior outcomes such as delivery speed, cost efficiency, and customer responsiveness.

In summary, this study reinforces the notion that knowledge integration is a pivotal internal resource for MSMEs, but its impact is not uniform it is shaped and enhanced by the presence of external support structures. By validating a comprehensive model that includes direct, mediated, and moderated paths, this study contributes both theoretically and practically to the understanding of how knowledge-based strategies and institutional ecosystems interact to elevate MSME supply chain performance in developing regions.

6 Conclusion

This study concludes that knowledge integration conceptualized through tacit knowledge sharing, technology use, and cross-functional collaboration plays a critical role in enhancing supply chain performance among MSMEs in the context of emerging economies, with a specific focus on South Sulawesi, Indonesia. Among the three dimensions, cross-functional collaboration demonstrated the most substantial direct and mediated impact, underscoring the strategic importance of intra-organizational alignment and coordination in translating knowledge into supply chain agility and responsiveness. Additionally, the mediating role of operational agility was confirmed as a key mechanism that transforms knowledge capabilities into superior outcomes in delivery speed, cost efficiency, and customer responsiveness. These findings support the theoretical assertion that knowledge resources must be dynamically mobilized to produce meaningful organizational value.

Furthermore, institutional support significantly moderated the relationship between all dimensions of knowledge integration and operational agility, reinforcing the idea that external enablers such as regulatory facilitation, digital infrastructure, and advisory services are essential complements to internal capabilities. Notably, MSMEs operating under higher levels of institutional support exhibited stronger agility and better supply chain performance, a result also confirmed through ANOVA analysis. This highlights that institutional ecosystems not only reduce contextual uncertainty but also strengthen the ability of firms to enact and exploit their knowledge capital effectively.

By empirically testing a comprehensive model that integrates direct, mediating, and moderating effects, this research contributes to the advancement of supply chain management literature, particularly within the RBV and dynamic capability framework. It provides nuanced insights into how MSMEs in developing regions can strategically combine knowledge-based resources with supportive institutional mechanisms to achieve performance excellence. The findings call for targeted interventions by policymakers and development agencies to not only deliver tangible support programs but also to foster environments where knowledge integration and operational agility can thrive.

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