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Research paper

Exploring The Role of External Integration in Shaping Supply Chain Capabilities

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Abstract

Purpose: This study investigates how external integration, supplier and customer integration, shape supply chain capabilities in Indonesian manufacturing firms, using the Dynamic Capability View as the theoretical foundation.
Methodology: A quantitative approach was applied using survey data collected from 115 supply chain professionals. The proposed model was analyzed through Partial Least Squares Structural Equation Modeling (PLS-SEM).
Findings: Supplier integration significantly enhances sensing and seizing capabilities, while customer integration shows no significant effect. Neither integration type influences reconfiguration capability, highlighting the role of internal organizational mechanisms in capability development.
Originality: This study clarifies how upstream and downstream integration contribute differently to the formation of dynamic capability. It extends theoretical understanding of supply chain capability development in emerging economies and offers practical guidance for strengthening cross-boundary collaboration.

Keywords: *Supplier Integration; Customer Integration; Dynamic Capability View; Supply Chain Capabilities; Manufacturing Industry*.

1. Introduction

In today's highly unstable global environment marked by frequent disruptions such as pandemics, geopolitical tensions, natural disasters, and rapid technological shifts, supply chains must not only withstand shocks but also adapt dynamically. This reality elevates the importance of the Dynamic Capability View (DCV), which posits that organizations must continuously sense, seize, and reconfigure their resources to remain competitive in rapidly changing markets. (Teece et al., 1997). For manufacturing firms, maintaining strong supply chain performance is essential for sustaining competitiveness, especially in emerging economies such as Indonesia, where supply chain vulnerabilities and structural inefficiencies remain significant challenges. As noted by Isfianadewi & Anindityoachieving competitive advantage requires supply chains that are capable of maintaining, if not improving, performance despite external pressures.

While DCV provides a strong theoretical foundation for understanding how firms adapt, the operational pathways through which external integration contributes to adaptive capacity remain poorly articulated. External integration, encompassing supplier and customer collaboration, is widely recognized as a mechanism that facilitates information exchange, knowledge sharing, and joint problem-solving. Prior studies have shown that such integration can enhance resilience and flexibility. (Brusset & Teller, 2016; Tarigan et al., 2021), enabling firms to address disruptions more effectively (Ramlawati et al., 2022). These benefits also resonate with the Knowledge-Based View (KBV), which highlights knowledge as the most strategically valuable resource and emphasizes its acquisition, assimilation, and application (Grant, 2009). In this sense, external integration does not merely coordinate operational activities but also functions as a knowledge-enabling process that supports capability development.

However, despite these insights, existing research has not fully clarified how external integration empowers the development of Supply Chain Capabilities (SCC), the collective abilities of a supply chain to respond, adapt, coordinate, and perform under uncertainty. Empirical findings remain inconsistent, particularly regarding the direct effect of integration on performance. These gaps underscore the need for a theoretical framework that connects external integration to capability-building processes through the combined lenses of DCV and KBV.

To address this gap, this study proposes a theoretical model that examines how supplier-customer integration shapes SCC. By synthesizing the DCV and the KBV, this study argues that external integration enables firms to acquire strategic knowledge, enhance learning mechanisms, and reconfigure operational routines, thereby strengthening their SCC and ultimately influencing supply chain performance. This approach contributes to a deeper understanding of capability formation within supply chains. It offers a more nuanced explanation of why external integration is crucial to competitive, resilient supply chains in volatile environments.

This paper is organized as follows: the literature review will explain external integration and the model construction of SCC. Next, the theoretical framework and research hypotheses are presented, followed by the results. The main conclusions are presented at the end, along with the managerial implications, limitations, and suggestions for future research.

2. Literature Review

2.1. Supplier integration

External integration in supply chain refers to the level of collaboration, coordination, and information flow between a company and its external partners, particularly suppliers (supplier integration, SI) and customers (customer integration, CI) (Flynn et al., 2010). This concept is rooted in the view that companies can no longer compete individually, but rather as part of a tightly connected supply chain network (Mentzer et al., 2001).

According to Zhang et al (2024), Supply chain integration aligns strategies, processes, information, and resources across supply chain actors to improve the effectiveness and efficiency of the flow of goods, information, and finances. Externally, integration with suppliers and customers helps ensure that market needs are met quickly and accurately while minimizing the risk of disruption.

SI involves activities such as intensive communication regarding quality and design changes, supplier development, strategic management of long-term relationships, and coordination of supply planning (Flynn et al., 2010; Vanpoucke et al., 2014). SI enables companies to improve supply reliability, accelerate product innovation, and reduce operational costs through shared efficiencies. According to Zhao et al (2013), SI reflects the level of closeness and coordination between a company and its supplier partners to achieve operational efficiency, reduce uncertainty, and increase adaptability to changing market demand. In this context, the primary goal of SI is to enhance supply chain visibility, enabling companies to forecast raw material needs, accelerate response times, and optimize operational costs (Zhao et al., 2013).

2.2. Customer integration

CI encompasses collaborative efforts to strengthen relationships and improve information flow between a company and its downstream partners. According to (Flynn et al., 2010) this integration is reflected in the active involvement of customers in the product design process, ensuring that the developed features and quality align with actual market needs. In addition, intensive communication regarding customer needs, preferences, and satisfaction levels enables firms to respond more accurately to fluctuations in demand. High responsiveness to market dynamics is further reinforced by utilizing customer feedback as a basis for continuous quality improvement. Thus, CI plays a critical role in creating operational processes that are more adaptive, innovative, and customer-oriented.

CI helps companies understand market trends more quickly, adjust production to meet consumer needs, and strengthen customer loyalty. Previous literature shows that external integration is closely linked to SCC. Integration with suppliers provides information on supply conditions, raw material risks, and innovation opportunities (sensing). Integration with customers strengthens a company's ability to seize market opportunities (seizing). Continuous collaboration with both external parties enables companies to adjust their supply chain structure and processes (reconfiguration) (Brusset & Teller, 2016; Miocevic & Morgan, 2018).

In the Indonesian context, external integration is increasingly important, given that the manufacturing industry still faces significant challenges, including limited logistics infrastructure, dependence on imported raw materials, and the dynamics of domestic and global market demand. Therefore, strengthening external integration not only improves operational efficiency but also provides an adaptive advantage in the face of uncertain business conditions.

Prior empirical studies frequently report a positive relationship between CI and supply chain performance, particularly in developed-economy contexts where demand information is digitally integrated, customers are strategically involved in joint planning, and long-term relational governance mechanisms are well established (Shen et al., 2023; Zhang et al., 2024). In such settings, CI enhances sensing capability by enabling firms to detect demand shifts early and translate market knowledge into operational adjustments. However, other studies note that the performance benefits of CI are contingent upon contextual and institutional conditions, including relationship maturity, information standardization, and decision autonomy (Prajogo & Olhager, 2012). These contrasting findings suggest that CI does not universally function as a value-creating routine but may instead operate as a context-dependent mechanism whose effectiveness varies across institutional environments.

2.3. Supply chain capability

SCC refers to an organization's ability to manage, coordinate, and integrate supply chain activities to achieve competitive advantage and enhance both operational and strategic performance (Wu et al., 2006). This concept has evolved as companies increasingly face a business environment characterized by dynamism, complexity, and uncertainty. SCC represents not only daily operational abilities but also strategic capabilities that support long-term organizational sustainability.

The literature highlights three essential dimensions of SCC. The sensing capability reflects a firm's capacity to detect changes in customer needs, market trends, competitive dynamics, and potential disruptions, enabling proactive responses to risks and opportunities (Miocevic & Morgan, 2018). The seizing capability encompasses the ability to make strategic decisions and allocate resources effectively to capitalize on emerging opportunities, such as deeper supplier–customer collaboration, new product development, and enhanced operational flexibility (Dubey et al., 2018). The reconfiguration capability involves restructuring processes, technologies, assets, and supply chain networks to remain competitive and aligned with environmental changes (Wilden et al., 2016). Together, these capabilities strengthen supply chain resilience, operational efficiency, and global competitiveness (Ali et al., 2017; Beske et al., 2014). SCC also serves as a critical mechanism linking supply chain integration practices with improved organizational performance. By integrating closely with suppliers and customers, firms can reinforce their SCC by enhancing information flows, coordination, and strategic collaboration (Singh & Modgil, 2024; Vanpoucke et al., 2014).

In emerging economies such as Indonesia, the urgency of strengthening SCC is heightened by structural challenges, including limited logistics infrastructure, market fluctuations, and dependence on imported raw materials. Research on SCC, therefore, offers both theoretical value and practical guidance for improving supply chain adaptability and robustness.

3. Theoretical and Hypothesis Development

3.1. Dynamic capability view (DCV)

DCV was first introduced by Teece et al as an extension of the resource-based view (RBV) framework. The RBV emphasizes the importance of possessing valuable, rare, inimitable, and non-substitutable (VRIN) resources as the basis for competitive advantage, while

DCV emphasizes that these resources are not static. Instead, organizations must possess dynamic capabilities to build, integrate, and reconfigure their resources and competencies to remain relevant in a rapidly changing business environment. In increasingly volatile supply chain environments marked by market uncertainty, supply disruptions, and global complexity, three dynamic capabilities become central for sustaining competitive advantage: sensing, seizing, and reconfiguration.

Sensing capability refers to a firm's ability to identify opportunities, detect potential disruptions, and interpret shifts in customer needs or supplier conditions (Chari et al., 2022; Miocevic & Morgan, 2018; Raj et al., 2022). Seizing capability involves a firm's ability to mobilize resources and make strategic decisions to capitalize on sensed opportunities, such as through collaboration, innovation, or redesign of operations (Dubey et al., 2018). Reconfiguration capability reflects a firm's ability to realign processes, technologies, and supply chain networks to maintain alignment with a changing environment (Wilden et al., 2016). External integration with suppliers and customers is a significant enabler of these dynamic capabilities, as it enhances information flows, coordination, and collective responsiveness across the supply chain. Thus, external integration can be understood as a critical antecedent to the development of strong SCC (Ali et al., 2017; Wilden et al., 2016).

Thus, DCV provides a solid theoretical foundation for examining how external integration can affect SCC, particularly in a developing country like Indonesia. This is crucial for addressing the challenges of market uncertainty and logistical complexity, while simultaneously enhancing the competitiveness of the national manufacturing industry in the era of globalization.

3.2. SI and SCC

Close collaboration with suppliers provides firms with early visibility into upstream changes, enabling them to interpret better signals related to supply risks, technological shifts, or market volatility. Prior studies show that supplier relationships can enhance firms' responsiveness and adaptability by improving information accuracy and joint decision-making (Dubey et al., 2018; Miocevic & Morgan, 2018). Such collaboration also facilitates adjustments in sourcing strategies or production arrangements, supporting the firm's reconfiguration capability (Wilden et al., 2016). Based on this theoretical grounding, SI is expected to strengthen all three dimensions of SCC.

H1a: Supplier integration positively influences sensing capability

H1b: Supplier integration positively influences seizing capability.

H1c: Supplier integration positively influences reconfiguration capability.

3.3. CI and SCC

Integration with customers provides direct access to downstream information, enabling firms to detect shifting preferences, emerging trends, and fluctuations in demand. Prior literature indicates that customer collaboration enhances firms' ability to interpret market signals and translate them into timely decisions (Fianko et al., 2023; Nikookar & Yanadori, 2022). Furthermore, customer-driven feedback supports structural adjustments in production, distribution, and product offerings, strengthening reconfiguration efforts (Wilden et al., 2016). Therefore, CI is expected to positively influence the development of sensing, seizing, and reconfiguration capabilities.

H2a: Customer integration positively influences sensing capability.

H2b: Customer integration positively influences seizing capability.

H2c: Customer integration positively influences reconfiguration capability.

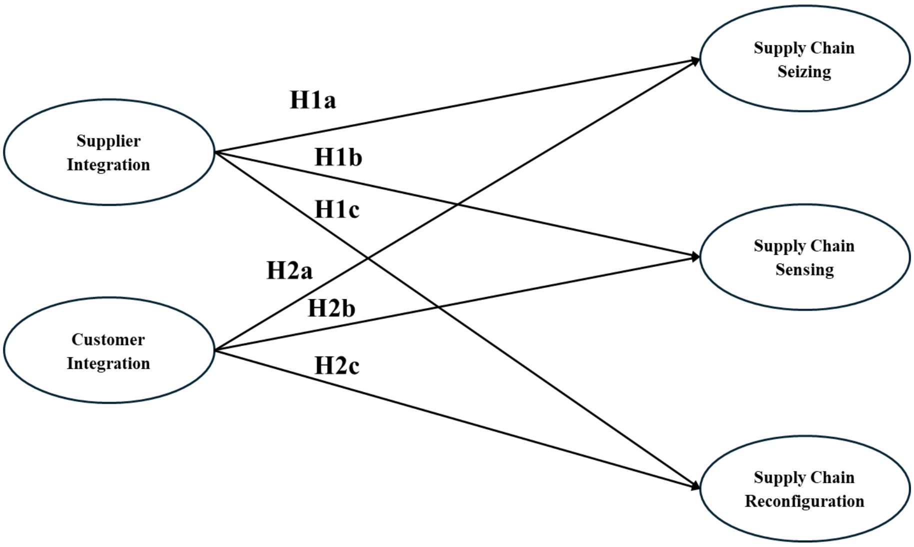

Fig. 1: Conceptual Model.

4. Method

4.1. Population and data collection

The target population of this study consists of individuals who hold managerial responsibilities in supply chain–related functions within the manufacturing sector in East Java. This includes supply chain managers, directors, and supervisors, as these roles are directly involved in operational decision-making, external integration, and capability development within the supply chain. Using the previous sampling frame done by Andrina & Sutrisno, which was sourced from the Indonesian Production and Operations Management Society (IPOMS), this paper also utilizes the same platform, a professional association with a database of 1,955 registered members working in production, operations, and supply chain management across Indonesia. This population is considered appropriate because its members possess sufficient expertise and practical experience to provide accurate and relevant responses to the constructs examined in this study.

A total of 120 responses were collected during the data-gathering period. Upon screening for data quality and relevance, five responses were excluded because the respondents were not employed in the manufacturing industry. Thus, 115 valid responses were retained for further analysis. This number is considered adequate based on PLS-SEM guidelines, which emphasize statistical power rather than minimum sample size, and is acceptable given the model's complexity and target effect sizes (Hair et al., 2019; Sarstedt et al., 2017).

4.2. Measurement and data analysis

The measurement instrument used in this study was developed based on established scales widely adopted in the supply chain management literature. All constructs, including SI, CI, and SCC, were measured using multiple-item statements on a seven-point Likert scale ranging from 1 = strongly disagree to 7 = strongly agree. The Likert format was selected because it is effective for capturing attitudinal and perceptual assessments in organizational research.

The initial questionnaire was developed in English, following the phrasing of previously validated measurement items. To ensure clarity and linguistic appropriateness for respondents in Indonesia, the questionnaire was then translated into Indonesian by a lecturer specializing in operations management. Subsequently, a back-translation procedure was conducted in which the Indonesian version was translated back into English by the same expert. The original English version and the back-translated version were compared to identify discrepancies and ensure semantic equivalence. This process ensured the reliability and conceptual accuracy of the translated survey items.

Data analysis was conducted using Partial Least Squares Structural Equation Modelling (PLS-SEM) with SmartPLS 4. PLS-SEM was selected because it is well-suited to predictive research, allows simultaneous estimation of complex relationships among latent variables, and is robust for studies with relatively small to medium sample sizes (Sarstedt et al., 2017). The analysis was carried out in two stages: an assessment of the measurement model, which evaluated indicator reliability, internal consistency, convergent validity, and discriminant validity. Assessment of the structural model, which examined the coefficient of determination (R^2) and path coefficients to test the proposed hypotheses. This analytical approach enables a comprehensive examination of how external integration influences SCC.

5. Results and Discussion

5.1. Demographic profile

The respondent's profiles are summarized in Table 1, which includes their job title, industry, company size (number of employees), and geographical location.

Tabel 1: Sample Demographic Profile

Items	Category	Frequency[1]	Percentage
	Manager	103	89,6%
Job Title	Supervisor	7	6,1%
	Director	5	4,3%
	Fast Moving Consumer Goods (FMCG)	32	27.8%
	Food & Beverages	28	24.3%
	Publishing and Printing	12	10.4%
	Building Materials	11	9.6%
Industry	Wood and Furniture	10	8.7%
	Metal, Mechanical, and Engineering	9	7.8%
	Pharmaceutical and Medical	6	5.2%
	Textile	4	3.5%
	Rubber and Plastics	3	2.6%
	101–500	60	52,2%
Company size (the number of employees)	≤100	54	47%
	501–1000	1	0,9%
	>1000	0	0%
	East Java	42	36.5%
	Central Java	26	22.6%
	West Java	21	18.3%
	Jakarta	10	8.7%
Geographical location	Banten	7	6.1%
	Kalimantan	4	3.5%
	Riau	3	2.6%
	Yogyakarta	1	0.9%
	Bali	1	0.9%

[1]n=115.

A total of 115 valid responses were obtained from professionals working in the manufacturing industry in Indonesia. The respondents represented a diverse range of industrial sectors, with the most considerable proportions coming from Fast Moving Consumer Goods (27.8%) and Food & Beverages (24.3%), followed by publishing and printing (10.4%), building materials (9.6%), wood and furniture (8.7%), and metal, mechanical, and engineering (7.8%). Smaller industry segments such as pharmaceutical and medical (5.2%), textile (3.5%), and rubber and plastics (2.6%) were also included, ensuring broad coverage of the manufacturing landscape. Geographically, the sample was dominated by respondents from East Java (36.5%), followed by Central Java (22.6%), West Java (18.3%), and Jakarta (8.7%), reflecting the national distribution of major industrial zones. Additional respondents were from Banten (6.1%), Kalimantan (3.5%), Riau (2.6%), Yogyakarta (0.9%), and Bali (0.9%). In terms of organizational roles, the respondents comprised supply chain managers, directors, and supervisors, all of whom were directly responsible for decision-making and operational execution in supply chain processes. This demographic composition ensures that the data reflect a wide spectrum of supply chain perspectives across different industries, regions, and hierarchical levels within Indonesia's manufacturing sector.

5.2. Confirmatory factor analysis

Before conducting the structural analysis, the measurement model was evaluated to ensure the reliability and validity of the constructs. Indicator reliability was assessed using outer loadings; items with loadings below 0.70 were removed to improve measurement quality. For CI, only CI2, CI6, and CI10 were retained from the original 11 indicators. In SI, 10 of 12 indicators were kept after eliminating SI4 and SI6. Sensing Capability retained four indicators (S4–S7) out of nine, while Seizing Capability kept five indicators (SZ1, SZ3, SZ4, SZ5, SZ6) from ten. Reconfiguration Capability retained four indicators (T1, T2, T5, T6) from six. Removing low-loading indicators strengthened the model by ensuring that each item meaningfully reflected its construct. The following section examines construct reliability, convergent validity, and discriminant validity to confirm the soundness of the measurement model.

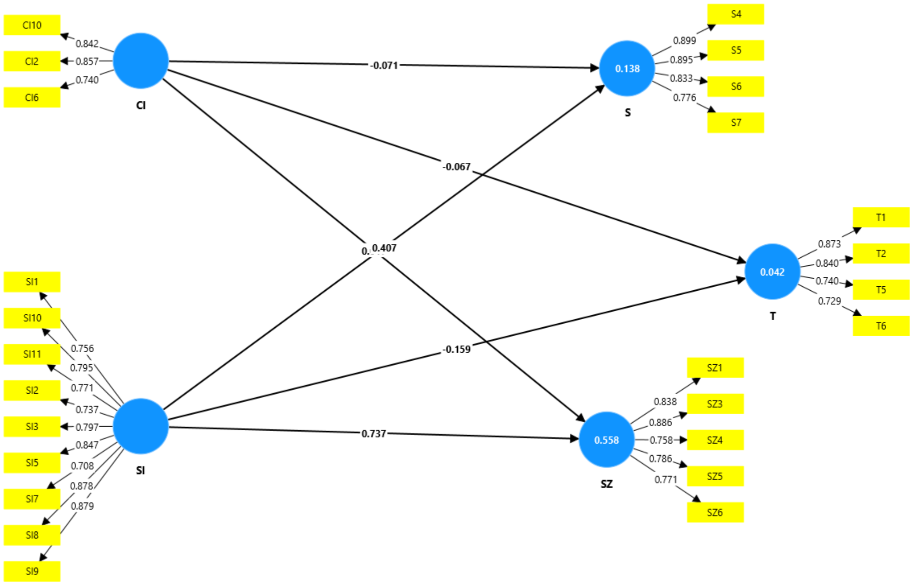

Fig. 2: Output Model.

Based on Table 2, all remaining indicators meet the standards for evaluating the excellence of the values, with values above 0.7. The constructs' overall Cronbach's alpha indicates good reliability (α > 0.5), and the composite reliability (CR) supports the constructs' reliability (CR > 0.7). The average variance extracted (AVE) is also above 0.5 for all constructs. Based on these standards, the measurement model is supported, and the model proceeds to the structural model, which shows that supply chain seizing accounts for 57.7% of the variance, with sensing and seizing accounting for the remaining variance.

Tabel 2: Sample Demographic Profile

Construct		Indicator	Factor loading	Cronbach's alpha	CR	AVE	R^2
		SI1	0.756				
		SI2	0.737				
		SI3	0.797				
		SI5	0.847				
	SI	SI7	0.708	0.747	0.933	0.638	-
		SI8	0.878				
EI		SI9	0.879				
		SI10	0.795				
		SI11	0.771				
		CI10	0.842				
	CI	CI2	0.857	0.869	0.769	0.664	-
		CI6	0.740				
		S4	0.899				
	S	S5	0.895	0.877	0.907	0.727	0.138
		S6	0.833				
		S7	0.776				
		SZ1	0.838				
		SZ3	0.886				
SCC	SZ	SZ4	0.758	0.868	0.877	0.655	0.558
		SZ5	0.786				
		SZ6	0.771				
		T1	0.873				
	T	T2	0.840	0.817	0.866	0.636	0.042
		T5	0.740				
		T6	0.729				

6. Hypothesis Testing

A hypothesis is supported if the p-value is less than 0.01 at a 1% significance level, less than 0.05 at a 5% significance level, or less than 0.10 at a 10% significance level. For this study, a 5% significance level ($p < 0.05$) is used as the threshold for acceptance. The results of the hypothesis testing are presented in Table 3. For CI, none of the paths were statistically significant: CI → S (β = -0.071, t = 0.704, p = 0.482), CI → SZ (β = 0.017, t = 0.254, p = 0.799), and CI → T (β = -0.067, t = 0.604, p = 0.546), indicating that CI does not have a significant effect on Sensing, Seizing, or Reconfiguration capabilities. In contrast, SI showed significant positive effects on Sensing (β = 0.407, t = 3.451, p = 0.001) and Seizing capabilities (β = 0.737, t = 12.104, $p < 0.001$), while the path to Reconfiguration capability was not significant (β = -0.159, t = 1.503, p = 0.133). These results suggest that SI plays a more influential role than CI in enhancing dynamic capabilities.

Table 3: Hypothesis Testing

Hypothesis	Path Coefficient	T statistics	P values	Result
SI -> S (H1a)	0.407	3.451	0.001	Supported
SI -> SZ (H1b)	0.737	12.104	0.000	Supported
SI -> T (H1c)	-0.159	1.503	0.133	Not Supported
CI -> S (H2a)	-0.071	0.704	0.482	Not Supported
CI -> SZ (H2b)	0.017	0.254	0.799	Not Supported
CI -> T (H2c)	-0.067	0.604	0.546	Not Supported

The results indicate that CI does not significantly influence SCC, while SI positively affects Sensing and Seizing but not Reconfiguration. This suggests that, within Indonesian manufacturing firms, upstream supplier relationships are more critical than downstream customer interactions for developing dynamic capabilities. The substantial impact of SI on Sensing and Seizing aligns with the DCV, emphasizing that effective sensing of market and technological changes and the ability to seize opportunities rely on active collaboration and information sharing with suppliers. The non-significant effect on Reconfiguration capability implies that reconfiguring internal processes may require other internal factors, such as managerial decision-making or organizational flexibility.

Contextually, the sample mainly consists of managers (89.6%) and supervisors (14.8%) from medium-sized manufacturing firms (52% with 101–500 employees, 47% with ≤100 employees), predominantly located in East and Central Java (59.1%). Industries represented include FMCG (27.8%), Food & Beverages (24.3%), and Publishing & Printing (10.4%), reflecting a diverse but concentrated manufacturing sector. This demographic profile suggests that the findings are particularly relevant for medium-sized manufacturing companies in Java, where supplier relationships may play a central role in shaping dynamic capabilities. Managers in these contexts may benefit from focusing on supplier collaboration, information exchange, and joint problem-solving to strengthen Sensing and Seizing capabilities. At the same time, additional strategies may be needed to enhance Reconfiguration capability.

7. Discussion

The non-significant effect of CI on dynamic SCC warrants careful interpretation. While prior studies conducted in developed economies often report strong performance and capability benefits from close downstream collaboration, such effects appear contingent on market structure and relational governance. In the Indonesian manufacturing context, customer relationships are frequently transactional rather than strategic, particularly in fast-moving consumer goods and commodity-oriented sectors. Buyers often exert dominant bargaining power, emphasizing price and delivery reliability over joint planning or knowledge sharing. Under such conditions, CI may enhance operational coordination but does not necessarily contribute to higher-order sensing or seizing capabilities. This finding aligns with recent research suggesting that the value of CI is context-dependent and may be constrained in emerging markets characterized by demand volatility, asymmetric power relationships, and limited digital connectivity (e.g., Shen et al., 2023; Zhang et al., 2024). Accordingly, CI should not be assumed to universally foster dynamic capability development.

The low explanatory power observed for reconfiguration capability ($R^2 = 0.042$) suggests that external integration alone may be insufficient to explain firms' ability to fundamentally restructure resources and processes. From a dynamic capability perspective, reconfiguration is often internally driven, relying on managerial cognition, organizational learning, governance flexibility, and strategic decision-making rather than external collaboration per se. While SI and CI may support sensing and seizing activities, reconfiguration frequently requires internal authority, investment discretion, and organizational redesign that extend beyond inter-organizational routines.

This result is consistent with prior studies that position reconfiguration as a deeply embedded, firm-specific capability that is less responsive to external relational mechanisms (Teece, 2007; Wilden et al., 2019). Consequently, future research should incorporate internal antecedents such as leadership orientation, digital maturity, or organizational structure to better explain reconfiguration capability. From a DCV, reconfiguration capability represents the firm's ability to realign internal structures, processes, and resource configurations in response to environmental change. While external integration with suppliers and customers may signal the need for adaptation, the execution of reconfiguration remains predominantly internally anchored. Reconfiguration involves decisions related to cross-functional coordination, process redesign, capacity reallocation, and governance realignment, which are typically controlled by managerial cognition and internal decision-making routines rather than external partners. This helps explain why internal integration plays a more central role in translating resilience into performance, whereas externally oriented integration mechanisms exhibit weaker or indirect effects. In the Indonesian manufacturing context, where firms often face infrastructural constraints and heterogeneous partner capabilities, reliance on internally controlled reconfiguration mechanisms becomes even more critical for sustaining operational continuity under disruption.

It is important to distinguish between capability development and operational performance in interpreting these findings. Supply chain resilience and integration represent adaptive capabilities and coordination routines, respectively, rather than immediate performance outcomes. Consistent with the DCV, these capabilities enable firms to repeatedly sense disruptions, seize adaptive responses, and reconfigure operations over time, but do not automatically generate performance gains in the absence of effective deployment. Supply chain performance, therefore, reflects the realized outcome of capability enactment rather than capability possession itself. This distinction clarifies why some integration dimensions exhibit weaker direct performance effects and reinforces the argument that performance improvements depend on how resilience is operationalized through internal and external coordination mechanisms.

8. Conclusion

This study examined the impact of CI and SI on SCC in Indonesia's manufacturing industry, focusing on medium-sized firms predominantly in Java. The findings reveal that SI significantly enhances sensing and seizing capabilities, whereas CI does not significantly affect any dynamic capability. Reconfiguration capability was not significantly influenced by either CI or SI, suggesting that its development may depend on internal factors beyond supply chain integration. Overall, the results underscore the importance of upstream supplier relationships in enabling firms to sense market changes and seize opportunities, consistent with the DCV.

Based on these findings, it is recommended that academics explore additional factors influencing the reconfiguration capability in the supply chain, such as internal process flexibility, managerial decision-making, or technology adoption, and consider conducting comparative studies across industries or countries to understand contextual influences on dynamic capabilities. For supply chain practitioners, managers in manufacturing firms should focus on strengthening collaborative relationships with suppliers through information sharing, joint problem-solving, and proactive engagement, as SI plays a key role in enhancing S and SZ. While CI provides valuable operational insights, the evidence suggests that SI is more critical for developing dynamic capabilities. Additionally, firms aiming to improve T should invest in internal processes, organizational agility, and continuous learning mechanisms to support effective reconfiguration.

The study involved the removal of several indicators during the measurement model assessment to ensure reliability and convergent validity. While such refinement is consistent with PLS-SEM best practices, it may also reduce construct breadth, particularly for CI and supply chain capability dimensions. This trade-off highlights the inherent tension between statistical parsimony and content validity. Although the retained indicators adequately capture the core theoretical meaning of each construct, future studies are encouraged to develop and validate richer measurement scales tailored to the contexts of emerging economies.

This study employs a cross-sectional survey design, which limits the ability to infer causality among integration practices, dynamic capabilities, and performance outcomes. Dynamic capabilities, by definition, evolve over time, and longitudinal research designs would offer deeper insight into how SI and CI shape capability development across disruption cycles. Future studies may also adopt multi-wave or panel data approaches to capture capability accumulation and decay processes.

From a policy perspective, the findings suggest that supplier development programs may be more effective than downstream integration initiatives in enhancing manufacturing resilience in Indonesia. Government-led initiatives that promote supplier capability upgrading, information sharing platforms, and collaborative risk management could strengthen firms' sensing and seizing capacities at the ecosystem level. Such policies align with national manufacturing competitiveness agendas and highlight the role of institutional support in fostering dynamic SCC.

Several opportunities for future research emerge from this study. First, longitudinal research designs could capture how resilience and integration capabilities evolve over time and how their performance effects unfold across different disruption phases. Second, future studies may examine the role of digital integration technologies such as real-time data platforms, analytics, and artificial intelligence as enablers of resilience deployment and coordination efficiency. Third, governance mechanisms, including trust, power asymmetry, and contractual arrangements, may serve as important boundary conditions shaping the effectiveness of integration routines. Exploring these dimensions would extend the present findings and contribute to a more comprehensive understanding of how dynamic capabilities are developed and leveraged in complex supply chain environments.

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