Unraveling the Impact of Supplier Collaboration, Digital Analytic Capability, and Sourcing Strategy on Supply Chain Performance: Mediation Effect of Agility

Hendy Tannady[1*] , Harits Hijrah Wicaksana[2] , Michael A. Aloria[3] , Edi Purwanto[4] , Filscha Nurprihatin[5]

[1] Department of Master of Management, Universitas Esa Unggul, West Jakarta 11510, Indonesia
[2] Department of Master of Public Administration, Universitas Esa Unggul, West Jakarta 11510, Indonesia
[3] Department of Mechanical Engineering, Batangas State University, Batangas City 4200, Philippines
[4] Department of Management, Universitas Pembangunan Jaya, South Tangerang 15413, Indonesia
[5] Department of Industrial Engineering, Sampoerna University, South Jakarta 12780, Indonesia

Corresponding Author Email: hendy.tannady@esaunggul.ac.id

ABSTRACT

This study aims to analyze the effect of supplier collaboration, digital analytic capability, and sourcing strategy on supply chain performance with agility as a mediating variable. In the era of Industry 4.0, companies are required to improve supply chain efficiency through collaboration and the use of digital technology. Data were collected from 120 respondents who were logistics and procurement managers at manufacturing companies in West Java. Hypothesis testing was conducted using Structural Equation Modeling (SEM) based on Partial Least Squares (PLS). The results of the analysis show that supplier collaboration, digital analytic capability, and sourcing strategy have a significant effect on agility, and agility significantly mediates the relationship between the three variables and supply chain performance. These findings support the dynamic capability theory, which states that agility is an important element in responding to the dynamics of the business environment. The practical implications of this study emphasize the importance of integrating digital analytics technology and adaptive sourcing planning to improve overall supply chain agility and performance. This study provides theoretical contributions by empirically testing the mediating role of agility in the context of the Indonesian manufacturing industry supply chain. Further research is recommended to expand the scope of the industry and consider other moderating variables, such as environmental uncertainty.

1. INTRODUCTION

Market dynamic shifts and pressures of globalization drive companies to improve supply chain effectiveness. Supplier partnership is an important initiative in this context, which can facilitate the movement of goods as well as information [1]. Partnership with suppliers improves coordination and trust development among supply chain stakeholders. Various studies have assumed that collaborative relationships positively affect a company's operational performance [2]. However, inconsistency of empirical evidence still exists regarding the extent to which collaboration affects supply chain performance [3, 4]. This research thus again places the supplier collaboration variable in the limelight to be examined more extensively with respect to taking into account the mediating role of agility.

Aside from teamwork, digital analytic capability is likewise a top priority in the modern era of digitalization. Digital analytic capability enables firms to navigate and assess information in real-time, and thus enhance decision-making at the strategic level [5]. In this study, Digital analytic capability refers to the organizational ability to leverage advanced digital technologies such as Artificial Intelligence (AI) for demand forecasting, Internet of Things (IoT) for real-time supply chain monitoring, Big Data Analytics for predictive decision-making, and integrated digital dashboards for managerial control. These technologies collectively enable firms to transform raw data into actionable insights that enhance agility. The technology enables firms to become more sensitive to adjustments in market demand. Research has discovered that firms with better analytical capabilities acquire a competitive edge with regard to coping with environmental dynamics [6]. Yet, comparatively fewer studies have been carried out looking into how this ability promotes agility and thus enhances supply chain performance. Because of this, digital analytic capability is rendered an independent variable for this research [7, 8].

According to Teece et al. [9] and Teece [10], dynamic capabilities refer to a firm's ability to sense opportunities and threats, seize opportunities, and reconfigure resources to maintain competitiveness. Within this framework, supply chain agility can be seen as a concrete manifestation of dynamic capabilities, as it allows firms to rapidly reconfigure processes, suppliers, and technologies in response to environmental turbulence.

Sourcing strategy is an important factor in ascertaining the

supply chain's efficiency and sustainability. Sourcing strategy addresses how firms choose, assess, and oversee suppliers [11]. An adaptive sourcing strategy has been known to enhance agility and performance in fulfilling production demands. The function of sourcing strategy on the supply chain's performance, however, is not quite clear, particularly for Indonesian firms [12]. This research will examine whether the sourcing strategy affects performance directly or indirectly via agility as a mediator variable. In this way, more understanding can be gained on the contribution of sourcing strategy to supply chain superiority [13].

Supply chain agility is the capacity of an organization to react to changes in the market in a timely and effective manner. In this uncertain world of business, among the differentiating factors of excellent from mediocre companies is agility. Several studies have stressed the need for inducing supply chain performance through agility, yet its mediating effect is relatively less explored [14]. Agility in this research is placed as an intervening variable that connects the impact of collaboration, digital capability, and sourcing strategy on supply chain performance. The model cites the dynamic capability theory that focuses on organizational adaptation and agility [15].

Hence, this study integrates three strategic capabilities, sourcing strategy, digital analytic capability, and supplier collaboration, and their collective effect on performance through agility [16]. By positioning agility as a central mediating construct, this model goes beyond linear cause-effect and instead captures the dynamic process of supply chain capability development [17]. The contributions of this study are expected to provide both theoretical and practical implications for supply chain strategists. Theoretically, the model develops a better conceptualization of agility as a dynamic capability [18, 19]. Practically, the model can be applied as a decision-making framework for companies to structure their supply chain improvement efforts. The integrative approach closes the research-practice gap in supply chain agility studies [20].

In the past several years, the Indonesian manufacturing industry has been hard hit by supply chain disruptions in the face of global uncertainties. The COVID-19 pandemic, geopolitical trade rebalancing, and raw material shortages have exposed the weakness of traditional supply chain practices. These tests and hardships underscore the need to shift from reactive supply chain methods to proactive, agile-based frameworks [21]. Agility allows firms to quickly reassemble operations, suppliers, and logistics to match dynamic needs [22]. However, achieving agility must be underpinned by an alignment of organizational competencies, processes, and technological infrastructure [23, 24]. This research aims to explore how such alignment can be achieved in practice by leveraging collaboration, data analytics, and sourcing strategies [25, 26].

Though many Indonesian companies have begun investing in technology and digital systems, there is a gap between investment and capability use. Digital analytics systems continue to be disconnected from strategic decision-making processes. The disconnection results in inefficiency and a delay in response timing to market changes. Digital analytic capability is therefore not merely an issue of tool ownership but also the institutional ability to interpret and react to data insights [27]. The function of agility as a mediating factor can possibly account for the way digital capability is translated to performance outcomes [28]. This finding is imperative to increase the degree of maturity of Indonesian manufacturers' digitalization.

Also, sourcing strategy is often restricted to traditional cost-based approaches that don't take into consideration adaptability and risk management [29]. Firms tend to prioritize price negotiation instead of building robust sourcing frameworks. Hence, they are vulnerable to supply chain disruption and supplier failure during times of crisis. An agile sourcing approach must focus on flexibility, diversification of suppliers, and local-global sourcing equilibrium [30, 31]. This paper highlights how strategic sourcing helps achieve agility and how this agility, in turn, enhances supply chain resilience and effectiveness. The link between sourcing decisions and agility becomes particularly important amidst growing supply chain uncertainty.

This research seeks to validate: (1) the impact of supplier collaboration on agility, (2) the impact of digital analytic capability on agility, (3) the impact of sourcing strategy on agility, (4) the impact of agility on supply chain performance, and (5) the mediating role of agility among the three independent variables and supply chain performance. This research is anticipated to fill the literature gap pertaining to the mechanism of agility mediation within the manufacturing industry context. Therefore, the findings of this research can be a valuable guideline to formulate a technology-based and collaboration-based supply chain strategy.

2. METHODOLOGY

This study uses a quantitative approach with a survey method to collect data. The population in this study is a manufacturing company operating in West Java. The sampling technique used is purposive sampling, with the criteria of managers or department heads who understand supply chain practices in their companies. The number of samples collected was 120 respondents from various manufacturing sectors, such as food, textiles, and automotive. To further clarify the sample's representativeness, the respondents were distributed across several major manufacturing industries in West Java. Specifically, 35% came from the food and beverage industry, 25% from the textile and apparel sector, 20% from the automotive and components sector, 10% from the electronics and electrical equipment sector, and the remaining 10% from other manufacturing industries (including furniture, paper, and chemicals). This distribution reflects the dominant industrial structure of West Java, where food, textiles, and automotive are among the most significant contributors to regional GDP. Hence, the sample composition strengthens the study's external validity by representing the diversity of manufacturing activities in the region.

Data collection was conducted between March and August 2024, when Indonesian manufacturing industries were recovering after the COVID-19 pandemic. This context may have influenced managerial perceptions of agility and performance, as firms adapted their supply chains to post-pandemic challenges.

The variables used in this research are supplier collaboration, digital analytic capability, sourcing strategy, agility, and supply chain performance. These variables are measured using indicators from previous studies and modified according to the local situation. All constructs in this study were measured using validated indicators adopted from prior research and adjusted to the Indonesian manufacturing context. A five-point Likert scale (1 = strongly disagree, 5 = strongly

agree) was used. Table 1 presents the variables, indicators, and sources of measurement items.

Table 1. Constructs, indicators, and sources

Variable	Indicators	Sources
Supplier Collaboration (SC)	SC1: We jointly plan demand and supply with key suppliers. SC2: We share real-time information with suppliers. SC3: We collaborate in solving operational problems. SC4: We build long-term trust-based partnerships with suppliers.	Chen et al. [4]
Digital Analytic Capability (DAC)	DAC1: Our company uses big data analytics to forecast demand. DAC2: We employ AI/IoT applications for supply chain decision-making. DAC3: We integrate digital dashboards for real-time monitoring. DAC4: We utilize predictive analytics to identify risks.	Tannady et al. [7]; Chandrasekaran et al. [26]
Sourcing Strategy (SS)	SS1: We adopt multiple sourcing to reduce supply risk. SS2: Supplier selection considers flexibility and reliability. SS3: We diversify between local and global suppliers. SS4: We apply risk-based supplier evaluation.	Mishra et al. [21]; Boukherroub et al. [22]
Agility (AGI)	AGI1: Our company can rapidly adjust production schedules. AGI2: We quickly respond to sudden changes in demand. AGI3: We can reconfigure supply chain processes when disruptions occur. AGI4: We are flexible in collaborating with new suppliers.	Teece et al. [9] and Teece [10]
Supply Chain Performance (SCP)	SCP1: On-time delivery to customers. SCP2: Cost efficiency in supply chain operations. SCP3: Customer satisfaction with responsiveness. SCP4: Improved product/service quality.	Jaegler [28]; Alam et al. [11]

Construct validity is examined by assessing the loading factor value, Average Variance Extracted (AVE), and Composite Reliability (CR). The discriminant validity test is conducted using the Fornell-Larcker and HTMT approaches. For testing the hypothesis, path coefficient value, t-value, and p-value were utilized with bootstrapping of 5,000 sub-samples. For testing mediation, the VAF approach was utilized. The VAF value was used to determine the mediation type, with thresholds commonly applied in SEM analysis: VAF < 20% indicates no mediation, $20\% \leq VAF \leq 80\%$ indicates partial mediation, and VAF > 80% indicates complete mediation [32].

Prior to the analysis of the structural model, the outer model test was first carried out to determine if or not the indicators utilized had good measurement quality. Then the structural model (inner model) was examined in an attempt to determine the influence effect among variables. R-squared was utilized to determine the extent to which the model predicts the dependent variable. In addition, the effect size (f^2) and predictive relevance (Q^2) values were also considered to determine the significance and predictive relevance of the model. All procedures of analysis were performed step by step in order to obtain valid and reliable findings.

3. RESULTS AND DISCUSSION

The results of the construct validity test show that all variables have a Composite Reliability (CR) value above 0.70 and an AVE value above 0.50, which means that the construct has met the convergent validity criteria. All indicators have a loading factor above 0.70, indicating that each indicator is able to represent the construct being measured (see Table 2). These results are in line with previous studies, which state that measurement validity is the main requirement in the SEM model. Thus, the data is declared suitable for use in testing the structural model.

Path coefficients are shown in Figure 1 on the arrows, with asterisks indicating significance levels (***p < 0.001; **p < 0.01; *p < 0.05). All relationships were found significant at the 0.01 level or better.

Table 2. Construct validity and reliability test results

Variable	Composite Reliability (CR)	Average Variance Extracted (AVE)	Loading Range
Supplier collaboration	0.89	0.65	0.71-.084
Digital Analytic Capability	0.91	0.68	0.75-0.86
Sourcing Strategy	0.88	0.64	0.70-0.83
Agility	0.90	0.69	0.76-0.85
Supply Chain Performance	0.92	0.70	0.78-0.87

Source: Data Processing (2025)

Table 3. Hypothesis testing results

| Hypothesis	Path Coefficient	t-Statistic	p-Value	Remark
Supplier Collaboration → Agility	0.31	3.82	0.000	Significant
Digital Analytic Capability → Agility	0.28	3.45	0.001	Significant
Sourcing Strategy → Agility	0.34	4.15	0.000	Significant
Agility → Supply Chain Performance	0.52	5.87	0.000	Significant
Mediation by Agility (VAF = 67%)	-	-	-	Partial Mediation

Source: Data Processing (2025)
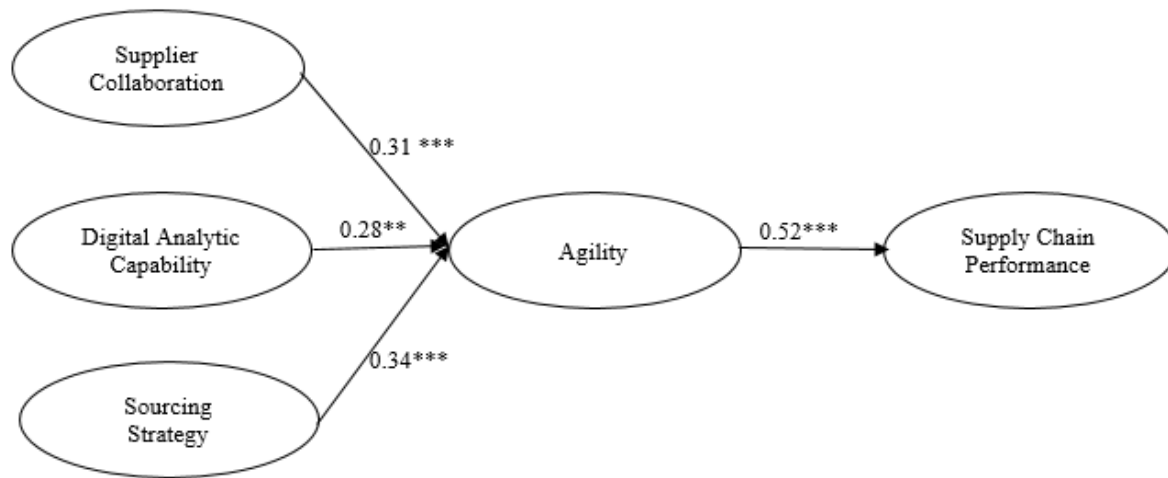
Figure 1. Structural model with path coefficients and significance levels

Table 4. Mediation analysis: Indirect effect via agility

Causal Pathway	Indirect Effect	Variance Accounted For (VAF)	Type of Mediation
Supplier Collaboration → Agility → SCP	0.1612	66.4%	Partial Mediation
Digital Capability → Agility → SCP	0.1456	65.1%	Partial Mediation
Sourcing Strategy → Agility → SCP	0.1768	67.9%	Partial Mediation

Source: Data Processing (2025)

Table 3 shows the results of the hypothesis test, which show that supplier collaboration has a positive and significant effect on agility with a coefficient of 0.31 and a p-value <0.001. This finding supports the results of previous studies, which state that collaboration with suppliers strengthens organizational flexibility and agility. Digital analytic capability is also proven to be significant for agility, with a t-statistic of 3.45. This is in line with studies from previous studies, which found that digital capabilities accelerate responses to market dynamics. Likewise with sourcing strategies have a significant effect on agility.

The result of the mediation test shows that agility partially mediates the effect of supplier collaboration, digital analytic capability, and sourcing strategy on supply chain performance (Table 4). The Variance Accounted For (VAF) scores for the three channels range from 65–68%, meaning that most of the effect of the three independent variables on supply chain performance is via agility. This result corroborates the Dynamic Capability theory that agility as a dynamic capability acts as a mediator for strategic adaptation to a changing environment. Other similar studies also found that agility performs a mediator function in the case of operational performance. Hence, the function of agility cannot be overlooked for enhancing supply chain performance.

Agility has been found to have a significant influence in impacting supply chain performance with a coefficient of 0.52. It means that when the supply chain agility is enhanced, the performance is also achieved at a greater level. Such performance includes the delivery speed, production flexibility, and customer satisfaction. Agility has been found in existing literature to increase the competitiveness of a company in handling the uncertainty of demand. That is to say, agility is not just an operational attribute, but also a competitive strategy. Therefore, firms should make agility a priority as a supply chain planning indicator.

Supplier coordination leads to greater agility due to better sharing of information and better coordinated production planning. Adoption of collaborative systems like vendor-managed inventory (VMI) and collaborative forecasting has been found to raise visibility and efficiency. Literature also indicates that vertical integration by way of collaboration enhances organizational agility. Here, cooperation not only creates long-term relationships but also serves as a driver of adaptive change in the supply chain. Hence, cooperative systems should be the focus of management investment.

Digital analytical capability allows firms to make fast and precise decisions informed by data. The capability allows firms to predict demand, identify risks early, and streamline logistics processes. Prior studies have established that firms with a data culture are more agile compared to firms that are still intuition-driven. In addition, the deployment of AI, IoT, and big data analytics technologies ensures that the supply chain system is more responsive. Digital infrastructure development is, therefore, a strategic enabler of operational agility.

Adaptive and risk-based sourcing strategies have also been found to enable agility. Firms that build up alternative suppliers and dual/multi-sourcing strategies are more capable of reacting to supply chain disruptions. For instance, in the event of a raw material shortage crisis, firms with adaptive sourcing strategies are still in a position to maintain production continuity. Diversification of sources of supply has previously been found to be crucial in reducing the risk of global supply chain disruption. Thus, it is the careful and pre-emptive planning of the sourcing that creates agility. The strategy component thus also influences operational agility.

Overall, this model is able to account for 62% of supply chain performance variance using the R-square metric. This indicates that agility through sourcing strategies, digital analytics capability, and collaboration play significant roles in enhancing performance. This model further affirms the argument that a responsive adaptive supply chain has a high possibility of realizing customer satisfaction and efficiency. Relative to previous studies, this model is more complete as it examines the indirect impact via the mediator of agility. As such, this model can be used to serve as a foundation for strategic decision-making in supply chain management.

Supplier collaboration and agility

The empirical findings of this study confirm the association between supplier collaboration and agility with a positive path coefficient. Supplier collaboration enables organizations to respond more quickly and better to market changes with improved communication and coordination. Organizations can reduce lead times and avoid delays by engaging suppliers in planning and forecasting. This alignment also lessens the bullwhip effect that traditionally afflicts supply chains with ineffective communication. Trust and long-term relationships with the suppliers promote responsiveness, which is needed in turbulent market management. From a practical perspective, supply chains that emphasize relationship management have better demand-supply alignment. Therefore, supplier cooperation must be understood not only as a functional operation but as a strategic facilitator of agility.

Furthermore, supplier collaboration facilitates performance by virtue of its capability-building role across the supply chain. As firms and suppliers work together on technology, process, and information, they jointly value and innovate. Vendor-managed inventory (VMI) systems and joint replenishment planning are a couple of mechanisms by which collaboration increases visibility and control. These enable companies to predict stockouts and accelerate inventory turnover. In addition, joint problem-solving mechanisms create collective resilience to supply chain disruption. The findings of the study affirm the Dynamic Capability Theory, where reconfiguration of resources in response to forthcoming conditions is facilitated through cooperation. Hence, building supplier relationships is a step towards building responsive and high-performance supply chains.

This result is in line with the findings of previous research, which concluded that close collaboration with suppliers improves coordination, responsiveness, and flexibility within supply networks. However, while Li's study focused on the automotive industry in the U.S., this study confirms the same pattern within the Indonesian manufacturing sector. The use of SEM-PLS and VAF analysis in this study further includes additional statistical strength in mediating the role of agility. Thus, while confirming existing research, this study further extends the extension of theory to the developing country context and offers finer-grained understanding of the mechanism of agility's performance.

Digital analytic capability and agility

The findings confirm that digital analytic capability, when supported by AI applications, IoT-based sensor systems, and big data platforms, significantly improves organizational agility. For instance, AI-powered predictive analytics enables better demand forecasting, while IoT provides real-time tracking of logistics flows. Big data analytics allows firms to anticipate risks and disruptions before they escalate. By integrating these technologies into decision-making processes, firms in emerging economies can reduce information delays and respond more effectively to dynamic market conditions.

The role of digital analytic capability has been demonstrated in this study as making a significant contribution to agility. Access to real-time data allows organizations to identify shifts in customers' preferences and make decisions in a timely manner. This responsiveness is a characteristic of flexible supply chains, in which sluggish decision-making can result in deteriorating performance. Organizations using effective data analytics can streamline procurement, production, and delivery processes. Predictive analytics, in particular, helps with demand forecasting and identifying latent chokepoints. This helps firms to pre-move before disruptions occur, thereby avoiding costly delays. Digital capability thus serves as a critical input into adaptability and operational agility.

Furthermore, firms with strong data-driven culture are well-positioned to transform raw data into useful insights. These insights lead to better alignment of operations with market demands, and this improves supply chain performance. The convergence of technologies like AI, machine learning, and IoT also makes this possible by automating decision-making. Human judgment is minimized, and process efficiency is improved. The evidence in this research verifies that digital analytic capability is an organizational strategic asset that is both an asset and a tool in augmenting organizational intelligence. In conjunction with agile practices, data analytics yields a decision quality feedback loop that continually reinforces decision quality. Therefore, the investment in data capability becomes inevitable for any company willing to compete in fast-changing environments.

This finding supports the previous research, which proved that big data analytics capability has meaningful effects on supply chain agility and performance. While Wamba only focused on global tech-based companies, this study affirms the same connection with Indonesian manufacturing companies as an example. Both studies emphasize the strategic nature of digital analytics, but this study also reiterates its mediating route through agility. Therefore, the current findings strongly prove that digital analytic capability is a cornerstone for agile and adaptive supply chains even in low digital intensity industries.

Sourcing strategy and agility

Sourcing strategy is revealed to directly and positively influence agility, affirming its importance in supply chain configuration. An adaptive strategy of sourcing allows firms to respond dynamically to shocks, such as supplier failure or market shocks. Dual or multi-sourcing firms reduce dependency upon a single supplier and thus become more robust. This dynamism lowers lead times and ensures continuity of supply even in extreme situations. Sourcing strategies-based agility allows for quicker switching between suppliers based on performance in real time and risk assessment. Supplier location, financial health, and risk exposure must also be considered in strategic sourcing choices. These considerations make sourcing strategy not merely a cost driver, but a critical agility enabler.

Furthermore, this study confirms that sourcing strategy drives supply chain performance through its effect on agility. Firms that implement risk-based and regionalized sourcing strategies stand a greater chance of weathering such global shocks as pandemics or trade wars. Supplier diversification and advanced risk screening are the pillars of such strategic agility. In actual life, such companies experience less delay and higher customer satisfaction since the processes do not get disrupted. The findings emphasize the significance of strategic models of sourcing involving scenario planning and supplier risk scoring. Aligning the sourcing policy with agility aims makes procurement a value-driving function. Hence, the role of sourcing will be required to shift from an Airbus-style tactical cost-reduction role to one of strategic supply chain agility and competitiveness support.

This conclusion is in line with that of previous research, which argued that there is a need for sourcing flexibility in managing uncertainty and disruption risk in global supply

chains. The model illustrated that firms with multiple sources are more responsive and recover faster. This study improves their work by empirically confirming the same mechanism in Indonesian producers and through agility as a mediator. Thus, in confirming previous theoretical assertions, this research makes a practical contribution by introducing agility as the most important result of sourcing decisions in emerging economies.

A comparative analysis of the three antecedents shows that while supplier collaboration ($\beta = 0.31$) and digital analytic capability ($\beta = 0.28$) both significantly enhance agility, sourcing strategy exerts the most substantial effect ($\beta = 0.34$). Similarly, the mediation analysis confirms that the highest VAF (67.9%) is observed in the sourcing strategy pathway. This indicates that in Indonesian manufacturing, adaptive sourcing practices represent the dominant driver of supply chain agility and performance. This finding underscores the strategic importance of building resilient and diversified sourcing frameworks, especially in volatile environments with prominent supply risks. Nevertheless, supplier collaboration and digital capability remain essential complementary enablers of agility.

4. CONCLUSION

This study shows that supplier collaboration, digital analytic capability, and sourcing strategy have a strong influence on supply chain agility. These three strategic dimensions contribute to the acquisition of operational agility, which is most crucial for reacting to uncertainty, disruption, and changing market requirements. The results of this study show that agility acts as a mediator that strengthens collaboration between the independent variables and supply chain performance. Variance Accounted For (VAF) measures reinforce this by showing that most of the effects from each independent variable are mediated through agility.

These results help to empirically validate that agility does not just result from technology sophistication, but also emerges from the intermixing of managerial strategy, process integration, and collaboration. Therefore, agility must be positioned as a priority in the company's supply chain planning. Firms that build agility on purpose, through investments in digital capability, strategic alliances, and versatile sourcing, will be better positioned to manage change and maintain high performance. Agility is a sustained competitive advantage that allows firms not only to survive but thrive in uncertain business environments.

Managerial implications of this research are that managers should invest in collaborative systems, analytical digital technology, and sourcing strategies that are adaptive. The supply chain managers must realize that agility does not stand alone but is characterized by an integration of technology, strategy, and partnerships with business partners. As such, in-house training to build digital skills of employees, increase the supplier base, and create integrated information systems must be implemented by companies. These steps will ensure supply chain performance at its best. Along with this, there needs to be coordination between the internal and external departments for better coordination and a quick response to the changes taking place in the market.

There are a few limitations in this research regarding the sample size, which was confined to only manufacturing firms in West Java and did not account for moderating factors like

environmental uncertainty or supply chain complexity. Another limitation relates to the data collection period, which took place during the post-COVID recovery phase. The context of pandemic recovery may have shaped managers' responses, especially regarding agility and sourcing strategies. Future studies should conduct longitudinal surveys across different periods to assess whether the observed relationships hold under more stable conditions.

Future studies are suggested to broaden the scope to other service industries and geographical locations. In addition, future studies could incorporate moderating variables such as environmental uncertainty or firm size, which may influence the strength of relationships in the supply chain agility framework. These moderators would provide deeper insights into the boundary conditions under which supplier collaboration, digital analytic capability, and sourcing strategy affect agility and performance. Researchers can also extend this model by including the function of digital leadership or supply chain transparency as another intervening variable. Longitudinal studies could also be carried out in order to trace the evolution of the variable relationship over a period of time. However, the findings of this research still make significant contributions to supply chain theory and practice development during the present digital age.

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