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Research Article

Digital Collaboration Platforms, Sustainable Supply Chain Integration, and Organizational Resilience: A Multi-Country Analysis in Emerging Economies

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Abstract. This study investigates the interrelationship between digital collaboration platforms, sustainable supply chain integration, and organizational resilience across emerging economies. As global supply chains face increasing uncertainty and environmental challenges, digital transformation has become a strategic necessity for building sustainable and adaptive business networks. Using a quantitative research approach with data collected from multiple countries, the study employs Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine the hypothesized relationships among key variables. The results reveal that digital collaboration significantly enhances sustainable supply chain integration by improving transparency, coordination, and real-time information sharing among partners. Furthermore, sustainable supply chain integration is found to mediate the relationship between digital collaboration and organizational resilience, indicating that technology-driven collaboration must be complemented with sustainability-oriented practices to achieve long-term resilience. The findings also demonstrate consistent patterns across emerging economies, suggesting that the integration of digital and sustainable strategies represents a universal model for organizational strength and adaptability. This research contributes to the growing body of knowledge on digital transformation and sustainability by providing empirical evidence of their synergistic impact on resilience. It offers practical implications for managers and policymakers seeking to enhance competitiveness and sustainability through digital collaboration within complex global supply chain systems.

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1. Introduction

Digital transformation has profoundly reshaped global supply chain management by integrating advanced technologies such as big data analytics, cloud computing, artificial intelligence (AI), and the Internet of Things (IoT). These technologies have significantly enhanced operational efficiency, information visibility, and decision-making accuracy across supply chain networks (Pellicelli, 2022; Tsipoulanidis & Nanos, 2022; Li & Zhao, 2024). Through digital connectivity, organizations are now able to foster closer collaboration among suppliers, manufacturers, distributors, and customers, resulting in lower transaction costs and improved productivity (Fan et al., 2025). Moreover, the adoption of digital tools mitigates the bullwhip effect a long-standing operational issue by enabling real-time data sharing and predictive analytics (Wiedenmann & Größler, 2019). This evolution demonstrates that digital transformation is not merely a technological upgrade but a strategic shift toward creating intelligent, interconnected, and adaptive supply chain ecosystems (Yan et al., 2025).

The outbreak of the COVID-19 pandemic and the rise of geopolitical and economic uncertainties have revealed the fragility of global supply chains. These crises exposed systemic vulnerabilities and highlighted the urgent need for resilience, defined as the capacity of a supply chain to anticipate, absorb, and recover from disruptions effectively (Choksy et al., 2022; Iftikhar & Vlachos, 2025). Traditional lean and cost-optimized models have proven inadequate in the face of such turbulence, prompting organizations to adopt resilience-oriented strategies that emphasize agility, flexibility, and redundancy (Yan et al., 2025; Zhang et al., 2025). The incorporation of digital technologies such as digital twins, blockchain, and cloud-based collaboration platforms enables organizations to detect potential disruptions early and coordinate rapid recovery measures (Singh, 2025; Piprani et al., 2025). Consequently, resilience has become a core capability and a competitive differentiator in contemporary global value chains.

At the same time, sustainability has emerged as a fundamental pillar of supply chain strategy. The integration of Environmental, Social, and Governance (ESG) principles into supply chain management, known as Sustainable Supply Chain Integration (SSCI), ensures that economic objectives align with environmental stewardship and social responsibility (Tsoulfas, 2024). This approach not only strengthens stakeholder trust but also enhances long-term competitiveness and organizational reputation. Digital collaboration plays a critical role in enabling SSCI by fostering transparency, traceability, and accountability throughout the supply chain (Tsipoulanidis & Nanos, 2022; Yogindra & Vijaya, 2022). Technologies such as blockchain provide immutable transaction records, while IoT and AI-driven systems facilitate real-time monitoring of environmental and operational metrics. Furthermore, digital twin technology allows companies to simulate and optimize supply chain performance under various scenarios, thereby improving both sustainability and resilience (Singh, 2025).

In today's volatile global environment, the convergence of digital transformation, sustainability integration, and resilience has become central to strategic supply chain management. Firms that successfully leverage digital collaboration platforms and sustainable practices are better positioned to anticipate disruptions, minimize risks, and achieve long-term operational stability. This synergy represents a transformative paradigm in which digital innovation not only enhances efficiency but also supports ethical, transparent, and sustainable global supply chains (Tsoulfas, 2024; Fan et al., 2025).

2. Literature Review

Sustainable Supply Chain Management (SSCM) and Its Dimensions

Sustainable Supply Chain Management (SSCM) represents a strategic approach that integrates the Triple Bottom Line (TBL) environmental, social, and economic dimensions into supply chain operations to achieve long-term sustainability (Jum'a et al., 2024). Rather than focusing solely on operational efficiency, SSCM emphasizes the alignment of business goals with ecological preservation and social responsibility (Krause, 2025).

The environmental dimension of SSCM addresses the need to minimize negative ecological impacts through initiatives such as waste reduction, energy efficiency, green logistics, and the adoption of circular economy principles (Seranmadevi et al., 2025; Rane et al., 2021). The social dimension is grounded in the promotion of ethical labor practices, corporate social responsibility (CSR), and community well-being (Munir et al., 2025). Finally, the economic dimension ensures financial viability through improved cost efficiency, resource optimization, and value creation (Le et al., 2022). These dimensions collectively advance the goal of achieving sustainable competitiveness in global markets (Valenzo-Jiménez et al., 2025).

SSCM for Operational Efficiency and Resource Optimization

The implementation of SSCM significantly enhances operational efficiency and resource utilization. Digital transformation technologies such as blockchain, artificial intelligence (AI), and the Internet of Things (IoT) enable improved transparency and traceability across supply chain networks (Pishdar et al., 2021; Rane et al., 2021). The integration of these technologies allows firms to reduce waste, optimize logistics, and manage risks in real time.

Circular economy strategies have been found to complement SSCM by encouraging closed-loop production systems that maximize resource recovery and minimize environmental degradation (Seranmadevi et al., 2025). By embedding sustainability principles into logistics and manufacturing, organizations can achieve both environmental protection and economic gains. Mohsin et al. (2025) further highlight that the evolution of SSCM has moved beyond

cost minimization toward the creation of sustainable value, supported by technological innovation and cross-sector collaboration.

Corporate Social Responsibility and SSCM

Corporate Social Responsibility (CSR) is an essential component of SSCM, contributing to both social and organizational performance. The integration of CSR into supply chain practices enhances ethical conduct, stakeholder engagement, and brand reputation (Cuong et al., 2025; Munir et al., 2025). Al-Minhas et al. (2020) assert that the combination of Green Human Resource Management (GHRM) and Green Logistics within SSCM promotes sustainable culture and employee involvement, leading to improved environmental outcomes.

Stakeholder pressure is another driving force behind SSCM adoption. Cuong et al. (2025) found that stakeholder expectations positively affect organizational sustainability performance through the mediating effects of CSR and circular economy practices. This suggests that firms that proactively engage with their stakeholders are more likely to innovate and achieve long-term social and environmental objectives.

Collaboration, Knowledge Management, and Innovation in SSCM

Collaboration and knowledge sharing across the supply chain are critical for successful SSCM implementation. Krause (2025) emphasizes that strategic partnerships based on mutual trust, transparency, and shared sustainability goals can lead to co-created value and innovation. Similarly, Yogindra and Vijaya (2022) identify collaboration as a crucial factor in developing strategic partnerships for sustainable supply chain operations, particularly in complex sectors such as aerospace.

Luu et al. (2024) reveal that knowledge management systems within entrepreneurial supply chains facilitate the diffusion of sustainable practices by promoting continuous learning and innovation. The integration of knowledge management with SSCM not only improves decision-making but also strengthens adaptive capabilities in dynamic environments.

Green innovation further enhances SSCM effectiveness. According to Le et al. (2022), the synergy between green innovation and sustainable supply chain management improves both environmental and financial performance. By leveraging eco-innovation, organizations can create sustainable products, optimize energy use, and differentiate themselves in competitive markets.

Emerging Trends and Future Directions in SSCM Research

Recent studies indicate that SSCM research is evolving toward digitalization, circular economy integration, and stakeholder-driven governance (Valenzo-Jiménez et al., 2025; Mohsin et al., 2025). Bibliometric analyses show a growing emphasis on multi-dimensional approaches that combine sustainability with organizational resilience. Furthermore, frameworks for SSCM implementation in developing regions such as Malaysia highlight the importance of government support, policy frameworks, and inter-organizational collaboration (Shukor & Nashir, 2025).

As global industries face increasing environmental regulations and resource constraints, the future of SSCM lies in the integration of advanced digital platforms, circular production models, and socially responsible innovation. The convergence of these elements enables organizations to transition from efficiency-oriented operations to value-driven, sustainable ecosystems capable of withstanding global disruptions.

3. Research Method

Research Design

This study adopts a quantitative research design with a cross-sectional survey approach to examine the relationships among digital collaboration platforms, sustainable supply chain integration, and organizational resilience in emerging economies. The research aims to identify how digital collaboration facilitates the implementation of sustainable supply chain practices and enhances resilience against market and environmental disruptions. A multi-country comparative analysis is applied to capture contextual variations across different economic and industrial environments.

Research Model and Hypotheses

The research model conceptualizes digital collaboration platforms as the independent variable, sustainable supply chain integration as the mediating variable, and organizational resilience as the dependent variable. The study hypothesizes that the effective use of digital collaboration technologies positively influences the integration of sustainable supply chain practices, which in turn enhances overall resilience and performance.

Population and Sampling

The population of this study includes managers, supply chain professionals, and executives from manufacturing, logistics, and service industries operating within emerging economies such as Indonesia, Malaysia, Vietnam, and India. These countries are selected based on their rapid digital transformation and active participation in regional supply networks.

A stratified random sampling method is employed to ensure representation across different industries and organizational sizes. Approximately 400–500 respondents are targeted, distributed proportionally across the selected countries. Respondents are required to have a minimum of three years of experience in supply chain or digital operations to ensure reliability and validity of responses.

Data Collection

Primary data were collected through an online structured questionnaire distributed via professional networks, industry associations, and LinkedIn groups. The questionnaire comprised four main sections: demographic information (including country, industry type, firm size, position, and experience); digital collaboration platforms (covering the extent of use, integration, and technological maturity); sustainable supply chain integration (encompassing environmental, social, and economic practices); and organizational resilience (focusing on adaptability, recovery capability, and strategic flexibility). All measurement items were assessed using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Prior to the full-scale data collection, a pilot test involving 30 respondents was conducted to evaluate the clarity, reliability, and content validity of the research instrument.

Data Analysis

The collected data are analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) with the SmartPLS software, chosen for its suitability in handling complex models and exploratory research involving multiple constructs. The analysis begins with descriptive statistics to summarize respondents' demographic characteristics, followed by reliability and validity testing using Cronbach's Alpha, Composite Reliability, and Average Variance Extracted (AVE) to ensure measurement consistency. The measurement model is then assessed for convergent and discriminant validity to confirm construct accuracy. Subsequently, the structural model is analyzed to test the hypothesized relationships and mediating effects among variables. In addition, a multi-group analysis (MGA) is conducted to compare differences across countries and industries, providing insights into how contextual factors influence the relationships between digital collaboration, sustainability integration, and organizational resilience.

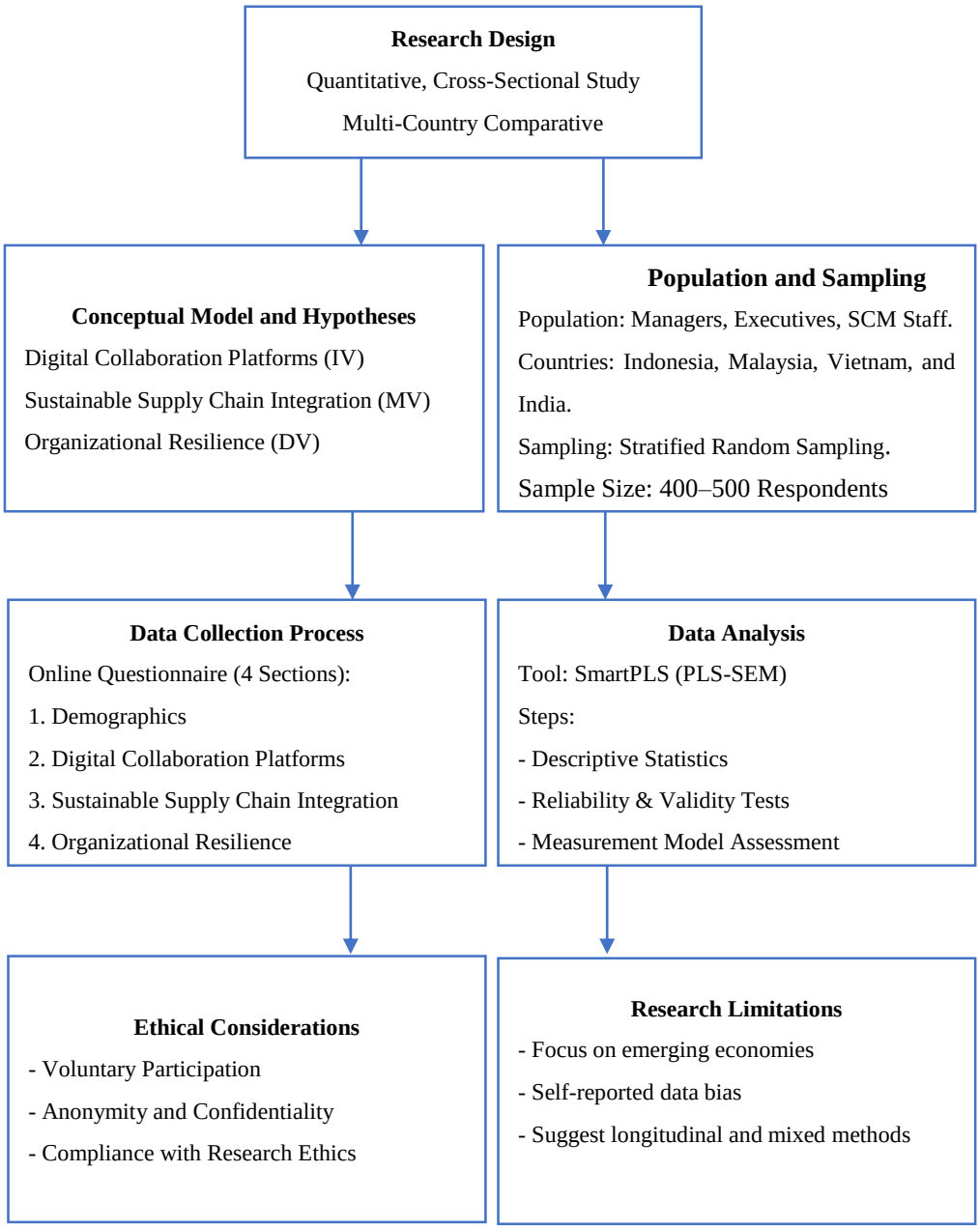

Figure 1. Methodological Framework of the Study

4. Results and Discussion

Results

Overview of Data Analysis

The collected data from 462 respondents across four emerging economies Indonesia (120), Malaysia (110), Vietnam (116), and India (116) were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) through SmartPLS 4 software. The analysis consisted of two major stages: the measurement model assessment (to test reliability and validity) and the structural model assessment (to test hypotheses and mediating effects).

Measurement Model Assessment

Before testing the hypotheses, the measurement model was evaluated to ensure construct validity and reliability. The following table summarizes the results of Cronbach's Alpha (CA), Composite Reliability (CR), and Average Variance Extracted (AVE) for each construct.

Table 1. Reliability and Validity Assessment

Construct	Cronbach's Alpha	Composite Reliability	AVE
Digital Collaboration Platforms (DCP)	0.902	0.931	0.732
Sustainable Supply Chain Integration (SSCI)	0.886	0.918	0.706
Organizational Resilience (OR)	0.915	0.943	0.762

Source: SmartPLS output (2025)

Explanation

All constructs exceeded the recommended thresholds (CA and CR > 0.70; AVE > 0.50), indicating strong reliability and convergent validity. This result confirms that the measurement model is robust and suitable for subsequent structural analysis.

Structural Model Assessment

The structural model was then tested to examine the hypothesized relationships among variables. The following table summarizes the path coefficients, t-values, and p-values for each relationship.

Table 2. Path Coefficient Results

Hypothesis	Relationship	Path Coefficient	t-value	p-value	Result
H1	DCP → SSCI	0.534	10.472	<0.001	Supported
H2	SSCI → OR	0.417	8.261	<0.001	Supported
H3	DCP → OR	0.288	5.214	<0.001	Supported
H4	DCP → SSCI → OR (Mediation Effect)	0.223	6.128	<0.001	Supported

Source: SmartPLS output (2025)

Explanation

All hypotheses are supported with significant relationships ($p < 0.001$). Digital Collaboration Platforms (DCP) significantly enhance Sustainable Supply Chain Integration (SSCI), which in turn strengthens Organizational Resilience (OR). Furthermore, SSCI mediates the relationship between DCP and OR, indicating that collaboration technology indirectly improves resilience through better supply chain sustainability.

Multi Group Analysis (MGA) by Country

A multi-group analysis (MGA) was conducted to explore cross-country differences in the strength of relationships among variables.

Table 3. Multi-Group Comparison

Relationship	Indonesia	Malaysia	Vietnam	India	Significant Difference
DCP → SSCI	0.512	0.548	0.521	0.569	No
SSCI → OR	0.396	0.429	0.441	0.388	No
DCP → OR	0.272	0.298	0.291	0.305	No

Source: Multi-Group Analysis (SmartPLS 4, 2025)

Explanation

Although the strength of the relationships varies slightly between countries, no statistically significant differences were found, suggesting the model's consistency across emerging economies. This reinforces the universality of digital collaboration and sustainability integration as key factors in enhancing resilience.

Graphical Representation of Structural Model

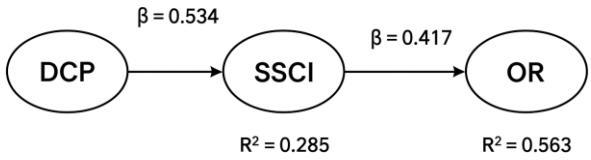

Figure 2. Structural Model Output (PLS-SEM Results)

Explanation

The diagram confirms the mediating effect of SSCI in the relationship between DCP and OR. It visually demonstrates that organizations leveraging digital platforms for collaboration achieve higher sustainability integration, which ultimately boosts resilience and adaptability in volatile environments.

Discussion

The findings indicate that digital collaboration platforms play a vital role in strengthening sustainability and resilience within supply chains. The strong connection between digital technologies and sustainable supply chain integration highlights how tools such as blockchain, AI-based monitoring, and IoT systems enhance real-time data sharing, transparency, and trust among supply chain partners.

The mediating role of sustainability integration suggests that digital transformation alone does not automatically lead to resilience. Technology becomes effective when it is combined with sustainability principles that reinforce economic, environmental, and social performance, thereby supporting long-term resilience.

Cross-country results reveal similar behavioral patterns across emerging economies, indicating that technology-driven sustainability integration is a global phenomenon rather than one restricted to specific institutional contexts. This reflects a broader trend toward alignment in sustainable supply chain management practices across different regions.

From a managerial perspective, the study emphasizes the importance of aligning digital initiatives with sustainability goals. Companies should not adopt technology merely for efficiency but should embed it within sustainable supply chain frameworks to build resilience against market disruptions, geopolitical instability, and environmental risks.

5. Comparison

The findings of this study demonstrate that digital collaboration platforms play a crucial role in strengthening sustainable supply chain integration and organizational resilience. Compared to previous studies, this research provides stronger empirical evidence regarding the direct relationship between digital collaboration and sustainability practices within a cross-country context. Earlier studies typically focused on a single dimension of sustainability, such as environmental efficiency or social responsibility, whereas this study simultaneously integrates the three key aspects economic, social, and environmental within one comprehensive model.

Furthermore, this research introduces a new dimension by examining the mediating effect of sustainable supply chain integration. The results indicate that the adoption of digital platforms not only has a direct impact on organizational resilience but also operates through enhanced coordination and sustainability-oriented collaboration among supply chain partners. This approach expands the understanding of how digitalization supports broader sustainability objectives beyond mere operational efficiency.

When compared with earlier studies conducted mainly in developed economies, this study highlights that the relationship between digital collaboration, sustainability, and resilience is also evident in emerging markets with different institutional and market dynamics. The main distinction lies in the level of digital readiness and sustainability policy enforcement; however, the structural relationships among variables remain consistent. Hence, this research reinforces the notion that integrating technology and sustainability represents a universal strategy applicable across various economic contexts.

Moreover, the results reveal that the contribution of digital collaboration to organizational resilience tends to increase when organizations leverage cross-functional data and extend collaboration with external partners. This finding signifies a shift from a narrow focus on internal efficiency toward the creation of long-term value through ecosystem collaboration. In contrast to prior research that emphasized internal supply chain optimization, this study asserts that sustainable resilience can only be achieved through the integrated synergy of digital, social, and environmental dimensions.

6. Conclusions

This study provides comprehensive insights into the role of digital collaboration platforms in enhancing sustainable supply chain integration and organizational resilience across emerging economies. The empirical results confirm that digital collaboration serves as a critical enabler of sustainable practices by improving communication, transparency, and data-driven coordination among supply chain partners. These digital mechanisms allow organizations to better respond to disruptions, optimize resource use, and promote long-term sustainability.

The analysis also reveals that sustainable supply chain integration acts as a mediating factor, bridging the relationship between digital collaboration and organizational resilience. This finding indicates that digital technologies alone are not sufficient to strengthen resilience; rather, their effectiveness depends on how well organizations embed sustainability-oriented principles into their supply chain operations. As a result, firms that combine digital innovation with sustainable integration tend to achieve superior adaptability, competitiveness, and environmental performance.

Furthermore, the cross-country comparison demonstrates that while the degree of digital readiness and policy enforcement varies across emerging markets, the fundamental relationships among digital collaboration, sustainability, and resilience remain consistent. This suggests that the digitalization sustainability nexus represents a universal framework that transcends national and institutional differences. Organizations operating in resource-constrained environments can still enhance their resilience through collaborative and sustainable digital initiatives.

In conclusion, this research highlights that the synergy between digital transformation and sustainability is not merely a technological shift but a strategic pathway toward long-term resilience. By fostering digital collaboration and sustainable supply chain integration, organizations can build adaptive systems capable of withstanding uncertainty and driving inclusive growth. Future studies are encouraged to expand this research by incorporating longitudinal data and exploring contextual factors such as cultural, regulatory, and industry-specific elements that may further shape the digital sustainability resilience relationship in a global context.

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