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Sustainable Logistics Transformation in Global Supply Chains: a Systematic Literature Review of Drivers, Practices, Impacts, and Implementation Challenges

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Abstract

Purpose: *This study aims to evaluate recent developments in sustainable logistics within global supply chains and to identify the key drivers, practices, impacts, and implementation challenges associated with sustainable logistics transformation.* ***Methods***: *This study employs a systematic literature review of 48 indexed scientific articles published between 2017 and 2025. The analysis categorizes the findings into four main dimensions: sustainable logistics practices, driving factors, impacts, and implementation challenges.* ***Results***: *The findings indicate that sustainable logistics has evolved from a primary focus on operational efficiency toward a more comprehensive approach encompassing green transportation, reverse logistics and circular logistics, digital traceability, renewable energy integration, and regional supply network diversification. The implementation of these practices is influenced by external factors, including regulations, stakeholder expectations, participation in global value chains, and geopolitical disruptions, as well as internal organizational factors such as managerial commitment, technological readiness, and coordination capacity. The identified impacts span environmental, economic, and social dimensions, including reduced ecological burdens, improved market performance, enhanced supply chain resilience, strengthened food security, greater transparency, and increased social accountability. However, implementation continues to face significant challenges, particularly high investment costs, inadequate infrastructure, fragmented governance, and disparities in technological capabilities across firms and regions.* ***Implications***: *Based on these findings, this study proposes an integrative framework linking driving factors, sustainable logistics practices, resulting impacts, and implementation barriers. The study also identifies future research agendas focusing on strengthening governance mechanisms, developing more robust sustainability measurement methods, and promoting context-specific implementation strategies that account for the characteristics of different sectors and regions.*

INTRODUCTION

The concept of sustainability has evolved from a complementary aspect of logistics management into a strategic element of decision-making within global supply chains, driven by environmental degradation, climate change, resource constraints, stakeholder pressures, and geopolitical dynamics (Paul et al., 2021; Suhi et al., 2019; Tate et al., 2019). Conventional logistics systems that prioritize cost efficiency and distribution speed are increasingly insufficient to address these challenges (Huang et al., 2024; Nica et al., 2025; Nogueira et al., 2025). Accordingly, sustainable logistics is increasingly viewed as a strategic response to climate change, stakeholder expectations, and global disruptions (An et al., 2021). More efficient transportation and logistics management can reduce environmental impacts through lower energy consumption, optimized warehousing, and improved transport mode and route selection, while simultaneously supporting competitiveness, resilience, inventory efficiency, and innovation (Jasmine et al., 2025; Le et al., 2022; Queiroz et al., 2022; Loviscek, 2021; Tseng et al., 2020; Venkatraman & Nayak, 2015).

Despite this development, research on sustainable logistics remains fragmented across several streams, including green transportation, circular economy and reverse logistics, digital traceability, renewable energy, and supply chain resilience (Ali & Gölgeci, 2019; Lim et al., 2017; Park & Li, 2021; Ahmad et al., 2017; I. J. Chen & Kitsis, 2017; Sikder et al., 2025). Recent studies also address climate-resilient agricultural logistics, sustainability compliance, and regional supply chain diversification (Jasmine et al., 2025; Yücesan, 2025; Zeng et al., 2025). However, these themes are often examined separately, limiting a comprehensive understanding of how different sustainable logistics practices are interconnected.

A further gap concerns the limited integration between the drivers of sustainable logistics adoption and the impacts of implementation. Previous studies have identified global value chain participation, top management commitment, sustainability regulations, digital readiness, stakeholder collaboration, and external disruptions as important drivers (He et al., 2019; Krähmer, 2025; Mangnus & Wegerif, 2025). These drivers are associated with environmental, economic, and social benefits, including reduced emissions, improved competitiveness, stronger food security, worker protection, and enhanced innovation capabilities. Nevertheless, the literature remains insufficient in explaining how external pressures and internal capabilities are translated into sustainable logistics practices, how these practices strengthen organizational capabilities such as integration, visibility, and information sharing, and how these capabilities contribute to triple-bottom-line performance (De La Pava et al., 2024; Pedersen et al., 2024; Yücesan, 2025).

Implementation is also highly context-dependent. Evidence from developing countries indicates that management commitment, human resource quality, infrastructure availability, digital readiness, governance, supplier participation, and regulatory support strongly influence the effectiveness of sustainable logistics adoption. Digital technologies such as blockchain and IoT can enhance transparency and accountability, while resilience strategies such as multisourcing, regional diversification, and improved connectivity can strengthen supply continuity. However, these strategies may involve trade-offs, including higher costs, coordination complexity, transparency challenges, and equity concerns (Chatterjee & Chaudhuri, 2022; Moktadir et al., 2018; Sarkis, 2020).

Given the increasing multidimensionality and fragmentation of the literature, a Systematic Literature Review (SLR) is appropriate for systematically identifying, evaluating, and synthesizing research developments and future directions (Maniah et al., 2022). Accordingly, this study addresses four research questions concerning: (1) sustainable logistics practices discussed in the literature; (2) the drivers of their implementation; (3) their environmental, economic, and social impacts; and (4) the major challenges hindering broader adoption.

This study contributes in three ways. First, it synthesizes recent evidence across sectors and research perspectives to identify major themes in sustainable logistics. Second, it develops an integrated perspective linking implementation drivers, sustainable logistics practices, governance mechanisms, organizational capabilities, and triple-bottom-line outcomes within global supply chains. Third, it identifies persistent challenges related to digital transformation, regulatory harmonization, supply chain resilience, and disparities in implementation capacity, providing a basis for a more systematic future research agenda.

MATERIAL

Sustainable Logistics in Global Supply Chains

Sustainable logistics has evolved from a primary focus on transportation efficiency into a strategic domain integrating environmental, economic, and social dimensions within global supply chain management. While early logistics research emphasized cost efficiency, distribution reliability, and asset utilization, recent studies increasingly focus on carbon reduction, circular economy, transparency, and accountability across globally dispersed supply chains (Bai et al., 2019; Govindan et al., 2021; Kwak et al., 2019). Logistics performance is increasingly associated with reduced ecological footprints and more resilient, adaptive, and low-carbon supply chain systems (An et al., 2021; Treiblmaier, 2019). Moreover, blockchain and IoT-based traceability have strengthened visibility, verification, and accountability, indicating that sustainable logistics depends not only on physical flow efficiency but also on information governance across multi-tier supply chains (Nica et al., 2025; Nogueira et al., 2025).

Practice Domains and Driving Factors

The literature identifies several interconnected sustainable logistics practices, including low-carbon transportation and energy-efficient warehousing, circular and reverse logistics, and digital traceability and transparency. Logistics efficiency and organizational readiness are important for reducing environmental impacts and achieving carbon neutrality (Laosirihongthong et al., 2020; Senyo & Osabutey, 2023), while reverse logistics can enhance material recovery but may involve trade-offs between local control, scalability, and global recovery coverage (Huang et al., 2024). Digital traceability can improve compliance, transparency, and accountability, although its effectiveness depends on technical capability and inter-organizational collaboration (Tseng et al., 2020; Loviscek, 2021).

These practices are driven by external pressures and internal organizational capabilities. Global value chain participation, regulation, stakeholder expectations, and geopolitical dynamics encourage sustainable logistics adoption, although their effects vary according to firm characteristics and institutional conditions (Venkatraman & Nayak, 2015). Internally, top management commitment, sustainability-oriented innovation, human resource capabilities, process integration, and external collaboration are critical for translating sustainability pressures into operational change (Ahmad et al., 2017; Chen & Kitsis, 2017). Digital technologies further enable visibility and governance, but their sustainability benefits depend on energy infrastructure and appropriate governance, as digital expansion may also increase energy demand (Sikder et al., 2025; He et al., 2019; Lima et al., 2021; Rajeev et al., 2017).

The Triple Bottom Line Performance of Sustainable Logistics

Sustainable logistics generates outcomes across environmental, economic, and social dimensions. Environmentally, cleaner energy, decarbonization, and effective circular logistics can reduce ecological footprints, although persistent Scope 3 emissions in sectors such as pharmaceuticals demonstrate the need for structural supply chain transformation rather than isolated green initiatives (He et al., 2019; Yücesan, 2025; Wang et al., 2025; Zeng et al., 2025). Economically, sustainability-oriented information sharing, innovation, investment, and flexible transportation can strengthen market performance, corporate reputation, diversification, inventory efficiency, and resilience, although some strategies may increase operational costs (Mangnus & Wegerif, 2025; Krähmer, 2025; Khanal et al., 2023; Herzallah et al., 2025).

The social dimension is increasingly prominent, particularly in food, fisheries, and other ethically sensitive supply chains. Reducing food loss can improve nutritional availability, while traceability and blockchain can strengthen labor protection, transparency, fairness, and accountability (Hagenaars et al., 2025; Gustafsson et al., 2024; Friedman & Ormiston, 2022). Workforce capacity also remains important for successful sustainability transformation (Poo et al., 2024). Nevertheless, environmental, economic, and social objectives cannot always be achieved simultaneously. Investment requirements, operational redundancy, and the energy demands of digital technologies may create trade-offs, making triple-bottom-line performance highly dependent on governance, organizational capabilities, and industry context (Mani et al., 2017; Seuring et al., 2020; Song et al., 2022).

Implementation Challenges

Despite its growing maturity, sustainable logistics still faces technological, institutional, methodological, and organizational barriers, including high investment requirements, limited technological capabilities, weak policy support, and inadequate sustainability indicators (Chen et al., 2025; Burini et al., 2025; Agyabeng-Mensah et al., 2025; Binh et al., 2025). Cross-border governance further complicates accountability due to differences in regulations, information quality, and institutional capacity, requiring stronger policy integration and interorganizational coordination (Cheng et al., 2024; Dubey et al., 2019; Agostino et al., 2023).

Resilience strategies such as supplier diversification, transportation flexibility, regionalization, and network redesign can improve disruption management but may also increase costs, reduce transparency, or shift environmental burdens across regions (Herzallah et al., 2025; Mangnus & Wegerif, 2025; Pedersen et al., 2024; Gustafsson et al., 2024). These challenges reveal a conceptual gap in understanding how sustainable logistics can simultaneously achieve decarbonization, supply chain resilience, and social accountability. This study therefore develops an integrative framework linking drivers, sustainable logistics practices, governance and organizational capabilities, and triple-bottom-line outcomes within global supply chains.

METHODS

Research Design

This study employs a Systematic Literature Review (SLR) to synthesize recent research on sustainable logistics in global supply chains. SLR was selected because the literature spans interconnected perspectives, including green and reverse logistics, digital traceability, supply chain resilience, and governance, resulting in fragmented findings across conceptual and sectoral contexts. The method enables a systematic and transparent identification, evaluation, and synthesis of these studies into an integrated understanding of sustainable logistics.

The review addresses four interrelated research questions concerning practices, drivers, impacts, and implementation barriers. RQ1 examines emerging sustainable logistics practices; RQ2 identifies internal and external drivers of adoption; RQ3 evaluates environmental, social, and economic impacts based on the triple bottom line; and RQ4 examines implementation challenges, including technological, financial, organizational, infrastructural, and regulatory barriers. Together, these dimensions provide a comprehensive view of how sustainable logistics is implemented and transformed within global supply chains.

Study Screening and Selection Process

The study selection process followed a staged procedure, as illustrated in Figure X. The database search initially identified 9.640 records from Google Scholar (4.890), Emerald Insight (5.667), and ScienceDirect (9.083), after which 1.593 articles remained following the application of the publication period, full-text, and English-language criteria. After removing 49 duplicate records, 1.544 articles proceeded to title and abstract screening, resulting in 555 articles after excluding studies that were unrelated to sustainable logistics, focused on non-logistics topics, or did not address the supply chain context. Full-text assessment was subsequently conducted on 148 articles, and studies were excluded when they lacked a clear sustainable logistics focus, failed to address the research objectives, or did not substantively discuss sustainability dimensions. Ultimately, 48 articles met all eligibility criteria and were included in the final review.

RESULTS AND DISCUSSION

Overview of the Reviewed Literature

The review identified 48 articles that met the eligibility criteria and were subsequently analyzed to examine the emerging structure of sustainable logistics research within global supply chains.

Table 1. Descriptive Profile of the Reviewed Studies

No.	Study	Research Focus	Method	Context	Key Contribution
1	Agostino et al. (2023)	Examines the relationship between participation in global value chains (GVCs) and firms' adoption of sustainable energy.	Regression analysis and propensity score matching using Enterprise Surveys data (2018–2020)	Multi-sector firms across countries	Finds that GVC participation supports green energy adoption, although the benefits vary across firms and institutional environments.
2	Agyabeng-Mensah et al. (2025)	Examines the motivations for sustainable supply chain management (SSCM) collaboration and their effects on market performance.	PLS-SEM using survey data from 262 managers	Manufacturing supply chains in a developing-country context	Finds that sustainability information sharing can strengthen market performance, although performance-oriented motives are more dominant than moral motives.
3	Ali & Gölgeci (2019)	Analyzes the state of research on supply chain resilience using bibliometric and co-occurrence analysis.	Systematic review using VOSviewer co-occurrence and bibliometric analysis	Global supply chain resilience literature	Identifies schools of thought and emerging themes in supply chain resilience (SCR) research, highlighting sustainability as an underexplored

No.	Study	Research Focus	Method	Context	Key Contribution
					dimension of resilience.
4	Bai et al. (2019)	Develops a framework for evaluating and selecting socially sustainable suppliers.	Group decision-support approach using fuzzy sets and multi-criteria decision-making (MCDM) techniques	Supplier selection in global manufacturing supply chains	Provides a robust multi-criteria decision-making tool for integrating social sustainability into supplier evaluation and selection processes.
5	Beuving et al. (2024)	Identifies the nutritional content embedded in global food loss and waste.	Secondary data analysis using the DELTA Model covering 99 food commodities	Global food supply chains	Shows that reducing food loss and waste can significantly improve global nutritional availability.
6	Binh et al. (2025)	Examines geographically differentiated determinants of sustainable performance, including carbon neutrality and economic outcomes.	SEM using survey data from 225 organizations	Food industry in a developing-country context	Shows that management support, human resources, infrastructure, and integration can improve carbon neutrality, while digital systems strengthen the relationships among these elements.
7	Burini et al. (2025)	Examines reverse supply chain configurations in the fashion industry.	Multiple case studies involving nine European actors	European fashion and textile industry	Identifies four reverse supply chain configurations and highlights trade-offs among scalability, transparency, and circularity.
8	Castro et al. (2024)	Examines whether renewable energy growth can support increasing digital data demand.	Energy and data projection modeling	Global digital sector	Shows that growth in the digital sector may exceed renewable energy capacity, thereby creating new sustainability pressures.
9	Centobelli et al. (2020)	Examines green practices and enabling technologies adopted by logistics service providers (LSPs) to achieve sustainable development goals.	Cross-country analysis using secondary data from logistics service providers	Logistics service providers across countries	Shows that technology adoption strengthens the sustainability effects of green practices among LSPs across different institutional environments.

No.	Study	Research Focus	Method	Context	Key Contribution
10	Chatterjee & Chaudhuri (2022)	Examines how firm capabilities and government regulations influence supply chain sustainability under unstable conditions.	Quantitative survey using PLS-SEM; data from firms in India	Manufacturing supply chains in India under turbulent/crisis conditions	Shows that dynamic capabilities and regulatory pressures jointly determine sustainability performance under environmental uncertainty.
11	Z. Chen et al. (2025)	Examines mineral resource management and sustainable growth in the Global South.	Panel ARDL analysis using data from 10 countries for 2000–2022	Resource-rich countries in the Global South	Shows that technology and local processing are critical for transforming natural resources into sustainable economic growth.
12	Cheng et al. (2024)	Examines the influence of logistics performance on ecological footprints.	Panel data analysis covering 43 countries from 2010–2016	Global logistics systems	Finds that better logistics performance is associated with lower ecological footprints and emphasizes the importance of sustainability-oriented logistics indicators.
13	Cromwell et al. (2025)	Examines the role of digital technologies in improving transparency in fish supply chains.	Systematic review of 27 studies	Global fisheries supply chains	Shows that blockchain and the Internet of Things (IoT) can improve traceability, transparency, and enforcement against illegal, unreported, and unregulated (IUU) fishing, although policy harmonization remains necessary.
14	De La Pava et al. (2024)	Develops a model to address pharmaceutical supply chain design challenges under geopolitical risks.	Two-stage stochastic programming	Global pharmaceutical supply chains	Shows that restructuring supply networks can reduce medicine shortages and improve access in vulnerable regions.
15	Dubey et al. (2019)	Examines how big data analytics and organizational culture improve collaborative performance in humanitarian supply chains.	Empirical survey study using PLS-SEM with humanitarian organizations	Global humanitarian supply chains	Shows that organizational culture and big data analytics jointly foster swift trust and improve collaboration and supply chain performance.

No.	Study	Research Focus	Method	Context	Key Contribution
16	Friedman & Ormiston (2022)	Examines blockchain as a sustainability-oriented innovation.	In-depth interviews with 18 food supply chain actors	Global food supply chains	Finds that blockchain can improve fairness and transparency, although adoption is constrained by functional and collaborative barriers.
17	Govindan et al. (2021)	Examines social sustainability tensions and multilayer supply chain governance structures.	Systematic literature review and conceptual framework development	Multi-tier global supply chains, with a focus on developing countries	Proposes a conceptual model of social sustainability tensions across supply chain tiers and calls for stronger governance mechanisms.
18	Gustafsson et al. (2024)	Examines human rights and environmental due diligence (HREDD) challenges in managing transboundary water and climate risks.	Case study of agricultural producers in Brazil	Global agricultural supply chains	Shows that due diligence implementation is constrained by information asymmetry and unequal governance capacity.
19	Hagenaars et al. (2025)	Measures greenhouse gas emissions across pharmaceutical supply chains.	Multi-regional input-output analysis covering 77 countries from 1995–2019	Global pharmaceutical industry	Shows that Scope 3 emissions dominate the pharmaceutical sector's carbon footprint, particularly in high-income countries.
20	Helwing-Hentschel (2025)	Examines the influence of logistics labor actions on global power structures.	Qualitative approach based on interviews with logistics actors	Global logistics networks	Finds that labor protests can influence individual behavior but have limited ability to alter structural power relations.
21	Herzallah et al. (2025)	Examines the mediating role of sustainable innovation in the relationship between green supply chain management (GSCM) and corporate reputation.	PLS-SEM using survey data from 279 SMEs	Manufacturing and logistics SMEs in emerging markets	Shows that sustainable innovation strengthens the effect of GSCM on corporate reputation.

No.	Study	Research Focus	Method	Context	Key Contribution
22	Karmaker et al. (2021)	Identifies and models the drivers of supply chain sustainability improvement in developing economies during the COVID-19 pandemic.	Integrated ISM-MICMAC model using expert survey data	Manufacturing supply chains in Bangladesh	Reveals key drivers of sustainability under crisis conditions, emphasizing institutional and managerial factors.
23	Ke et al. (2025)	Examines the influence of flexible transportation modes on supply chain resilience.	Industry-level data analysis covering 2003–2021	Global manufacturing supply chains	Finds that air transportation flexibility can improve inventory efficiency and resilience during disruptions, although at higher costs.
24	Khanal et al. (2023)	Examines the impact of GSCM practices on organizational performance.	SEM using survey data from manufacturing firms	Cross-sector manufacturing firms	Shows that internal and external GSCM integration can improve operational performance and environmental outcomes.
25	Krähmer (2025)	Examines socio-ecological transformation through alternative fruit supply chain practices.	Field research in the Chilean fruit industry	Global fruit supply chains	Shows that agroecology and fair trade provide alternatives to extractive agro-industrial models.
26	Kwak et al. (2019)	Identifies and models risk interactions in international supply chain logistics operations.	Case study combined with cognitive mapping and expert interviews	International logistics and supply chains in the UK context	Reveals complex interdependencies among logistics risks and demonstrates how risk propagation affects sustainable logistics outcomes.
27	Le et al. (2022)	Examines sustainability practices in food supply chains and their implications for sustainable development.	Systematic literature review and empirical survey of food supply chain actors	Food supply chains, with a global and developing-country focus	Demonstrates that collaboration and transparency mechanisms are essential for achieving sustainable outcomes across all triple bottom line dimensions.
28	Lim et al. (2017)	Examines the role of knowledge management in improving sustainable supply chain management performance.	Interpretive Structural Modeling (ISM) based on expert input	Manufacturing supply chains in the Asia-Pacific region	Identifies hierarchical relationships among knowledge management practices in SSCM and demonstrates

No.	Study	Research Focus	Method	Context	Key Contribution
					how knowledge sharing influences environmental and social performance.
29	Lima et al. (2021)	Examines uncertainty management and sustainability outcomes in circular supply chains.	Systematic literature review of circular supply chain studies	Global, multi-industry circular supply chain research	Identifies major types of uncertainty affecting sustainability in circular supply chains and proposes mitigation strategies to improve triple bottom line outcomes.
30	Mangnus & Wegerif (2025)	Critiques global value chain approaches in relation to development inequalities.	Narrative review and practice-based perspective	Global food systems	Argues that globalized food value chains can deepen inequalities and that local justice should be given greater priority.
31	Mani et al. (2017)	Examines the role of big data analytics in reducing supply chain risks through sustainability practices.	Quantitative survey study; regression analysis using manufacturing firm data	Manufacturing supply chains in India	Establishes that sustainability-oriented big data use can reduce operational and reputational risks in manufacturing supply chains.
32	Moktadir et al. (2018)	Examines Industry 4.0 adoption challenges and their implications for process safety and environmental protection.	Best-Worst Method (BWM) using expert assessments	Manufacturing sector in Bangladesh	Identifies critical barriers to Industry 4.0 adoption in developing economies and links them to environmental and safety performance outcomes.
33	Negri et al. (2021)	Examines how sustainability and resilience are integrated within supply chains and identifies existing research gaps.	Systematic review of peer-reviewed literature	Global supply chain literature across multiple sectors	Develops a conceptual framework integrating supply chain resilience and sustainability and proposes an integrated research agenda.
34	Pan et al. (2025)	Reviews the post-pandemic transformation toward sustainable and resilient logistics.	Conceptual analysis based on the literature	Global logistics and supply chains	Shows that decarbonization, resilience, and human-centered design have become major priorities in logistics research.

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No.	Study	Research Focus	Method	Context	Key Contribution
35	Park & Li (2021)	Examines the impact of blockchain adoption on supply chain sustainability performance.	Quantitative secondary data analysis and regression modeling	Cross-industry supply chains adopting blockchain technology	Finds that blockchain adoption significantly improves transparency and traceability, thereby positively affecting triple bottom line sustainability performance.
36	Paul et al. (2021)	Examines the impact of blockchain technology on sustainability performance in tea supply chains.	Mixed-method approach combining surveys and case analysis of supply chain actors	Tea supply chains in South Asia	Demonstrates that blockchain can improve traceability reliability and social sustainability, particularly for smallholder farmers in agricultural food supply chains.
37	Pedersen et al. (2024)	Identifies drivers and barriers to the adoption of climate-smart agriculture.	Stakeholder interviews across five European food supply chains	Food supply chains in Europe	Shows that economic incentives, policies, and capacity building are major adoption drivers, while cost and technology remain important barriers.
38	Poo et al. (2024)	Develops a method for assessing national food supply chain resilience.	Comparative study across four countries	Import-dependent food supply chains	Shows that logistics connectivity and supply diversification are central factors in food security and supply chain resilience.
39	Queiroz et al. (2022)	Examines the impacts of epidemic outbreaks on supply chains and develops a research agenda.	Structured literature review using the PRISMA protocol	Global supply chains during epidemic and pandemic disruptions	Provides a comprehensive framework for supply chain vulnerabilities during outbreaks and identifies research priorities related to sustainability and resilience.
40	Rajeev et al. (2017)	Reviews the historical evolution of sustainability research in the supply chain management literature.	Bibliometric and content analysis	Global SCM literature across sectors	Maps the evolution of sustainability themes in SCM research and identifies emerging areas, including social and governance dimensions.

No.	Study	Research Focus	Method	Context	Key Contribution
41	Sarkis (2020)	Reviews supply chain sustainability lessons derived from the COVID-19 pandemic experience.	Conceptual and reflective analysis based on SCM literature	Global supply chains across sectors during the COVID-19 pandemic	Presents a research agenda connecting pandemic disruptions with fundamental sustainability needs and emphasizes the integration of resilience and sustainability.
42	Seuring et al. (2020)	Examines how theory is applied in supply chain management literature reviews and proposes best practices for theory use.	Structured literature review with illustrative SCM examples	Global supply chain management literature	Provides a methodological framework for applying theory in SCM literature reviews, thereby strengthening conceptual rigor and cumulative knowledge development.
43	Song et al. (2022)	Examines environmentally friendly and sustainable supply chain management practices in platform-based economies.	Conceptual review and empirical analysis of platform supply chains	Global platform economy supply chains	Highlights that platform ecosystems create new sustainability challenges and opportunities, requiring updated GSCM governance models.
44	Suhi et al. (2019)	Examines environmental sustainability dimensions in supply chains within an emerging economy.	Integrated DEMATEL-ANP approach using expert data	Manufacturing supply chains in Bangladesh	Identifies critical environmental sustainability factors in emerging economies and provides prioritization guidance for supply chain managers.
45	Tate et al. (2019)	Examines supply chain management strategies targeting bottom-of-the-pyramid (BoP) markets and their sustainability implications.	Conceptual framework development based on multiple case analysis	BoP-oriented supply chains in developing countries	Develops an SCM framework linking inclusive business models with economic, social, and environmental sustainability outcomes.
46	Wang et al. (2025)	Examines the role of outward foreign direct investment (OFDI) in supply chain diversification.	Treatment-effects model using Chinese firm data from 2000–2014	Chinese industrial firms	Shows that OFDI strengthens supply diversification through increased R&D and expansion of international networks.

No.	Study	Research Focus	Method	Context	Key Contribution
47	Yücesan (2025)	Examines the impact of deglobalization on the evolution of global supply chains.	System dynamics modeling based on GVC logic	Global manufacturing supply chains	Shows that nearshoring and regionalization are becoming increasingly attractive as the advantages of offshoring decline.
48	Zeng et al. (2025)	Examines the impact of GVC integration on innovation among high-tech firms.	Endogenous switching and threshold modeling	Chinese high-tech firms	Shows that GVC integration increases innovation nonlinearly, although excessive dependence may constrain long-term capability development.

Source : Data Processed

Table 1 shows that the analyzed studies cover a wide range of sectors, including the food, pharmaceutical, fisheries, fashion, and manufacturing industries, as well as global logistics systems. In terms of methodology, research in this field employs a broad range of approaches, including panel data analysis, Structural Equation Modeling (SEM), case studies, systematic literature reviews, and optimization modeling. This methodological diversity indicates that sustainable logistics has evolved into a multidisciplinary field of research. Nevertheless, the distribution of studies remains uneven, both in terms of sectoral focus and analytical orientation.

Sustainable Logistics Practices in Global Supply Chains

The literature review indicates that sustainable logistics is implemented through a diverse range of practices designed to minimize environmental impacts, optimize resource utilization, enhance supply chain transparency, and support the long-term sustainability of global distribution systems.

Table 2. Thematic Classification of Sustainable Logistics Practices in the Global Supply Chain

No.	Practice Category	Analytical Description	Representative Studies
1	Green transportation and logistics optimization	Practices aimed at reducing emissions, energy consumption, and ecological footprints through transportation efficiency, route optimization, modal shifts, and low-carbon logistics operations.	(Bai et al., 2019; Centobelli et al., 2020; Cheng et al., 2024; Dubey et al., 2019; Ke et al., 2025; Kwak et al., 2019; Pan et al., 2025; Yücesan, 2025)
2	Reverse supply chain configuration	Circular logistics arrangements that support product returns, reuse, remanufacturing, and recycling to reduce	(Burini et al., 2025; Dubey et al., 2019; Krähmer, 2025; Lima et al., 2021; Rajeev et al., 2017)

No.	Practice Category	Analytical Description	Representative Studies
		waste and enhance material recovery throughout the supply chain.	
3	Digital traceability and transparency technologies	The use of blockchain, IoT, and digital data platforms to enhance product traceability, compliance monitoring, verification of ethical sourcing, and supply chain transparency.	(Binh et al., 2025; Cromwell et al., 2025; De La Pava et al., 2024; Friedman & Ormiston, 2022; Karmaker et al., 2021; Song et al., 2022)
4	Collaborative social and environmental governance	Multi-stakeholder coordination involving companies, governments, NGOs, and other stakeholders to strengthen labor standards, human rights protection, water management, and climate-related accountability.	(Agyabeng-Mensah et al., 2025; Gustafsson et al., 2024; Mangnus & Wegerif, 2025)
5	Resource efficiency and waste reduction	Measures designed to minimize material losses, optimize inventory utilization, reduce food and production waste, and improve energy efficiency in logistics operations.	(Bai et al., 2019; Beuving et al., 2024; Hagenaars et al., 2025; Khanal et al., 2023; Mani et al., 2017; Seuring et al., 2020)
6	Green energy adoption and carbon neutrality	The integration of renewable energy, carbon-neutral operations, and net-zero logistics strategies to reduce dependence on carbon-intensive infrastructure.	(Agostino et al., 2023; Binh et al., 2025; Castro et al., 2024; Pan et al., 2025; Paul et al., 2021; Tate et al., 2019)
7	Sustainable innovation integration	The integration of eco-friendly design, circular materials, digital intelligence, and sustainability-oriented innovations into logistics and supply chain processes.	(Z. Chen et al., 2025; Herzallah et al., 2025; Zeng et al., 2025)
8	Climate-smart agricultural logistics	Logistics practices for perishable and agricultural goods that emphasize low-emission transportation, resilient distribution, and sustainability-oriented coordination among policymakers and producers.	(Paul et al., 2021; Pedersen et al., 2024; Poo et al., 2024; Tate et al., 2019)
9	Localized and regional supply chain diversification	Logistics restructuring through nearshoring, multi-sourcing, and regional network development to reduce dependency risks and enhance supply chain resilience.	(Poo et al., 2024; Wang et al., 2025; Yücesan, 2025)
10	Regulatory compliance and certification systems	Alignment of logistics and supply chain practices with due diligence requirements, sustainability standards, and certification schemes to meet cross-border regulatory expectations.	(Agyabeng-Mensah et al., 2025; Ali & Gölgeci, 2019; Gustafsson et al., 2024; Krähmer, 2025; Park & Li, 2021)

Source : Data Processed

Overall, the reviewed literature indicates that sustainable logistics practices can be grouped into five major and complementary categories: (1) transportation optimization and green logistics; (2) reverse logistics and circular supply chains; (3) digital traceability and transparency; (4) low-carbon energy integration and climate-adaptive logistics; and (5) supply network diversification.

Discussion of Sustainable Logistics Practices

The emerging patterns indicate that sustainable logistics is increasingly regarded as a systemic capability rather than a collection of independent practices or technologies. Partial initiatives, such as transportation optimization or isolated recycling programs, may improve operational performance but are insufficient to address broader environmental, governance, and resilience challenges. Effective sustainable logistics therefore requires the integration of physical and information flows, logistics network design, and coordinated decision-making, positioning sustainability as a transformation process rather than an accumulation of standalone green initiatives.

The literature also highlights an increasingly strong relationship between sustainability and supply chain resilience. Practices such as regional network diversification, digital traceability, and climate-adaptive logistics can simultaneously reduce environmental impacts and strengthen the ability of supply chains to withstand disruptions. However, these dimensions are not always synergistic, as resilience-oriented strategies may increase costs and operational redundancy, while sustainability practices may be difficult to implement under highly dynamic and uncertain conditions. Sustainable logistics therefore requires logistics system designs that explicitly balance environmental objectives with resilience requirements.

Finally, governance emerges as a critical mechanism for translating sustainable logistics practices into scalable outcomes. Digital traceability, transparency mechanisms, and circular supply chain configurations require coordination among multiple actors, jurisdictions, and supply chain tiers. Consequently, sustainable logistics performance depends not only on operational efficiency but also on effective accountability, control mechanisms, and interorganizational alignment. Overall, the literature suggests that sustainable logistics represents a broader transformation of supply chain governance toward systems that make sustainability more credible, measurable, coordinated, and scalable across global supply chain networks.

Drivers of Sustainable Logistics Adoption

The literature indicates that sustainable logistics adoption is shaped by the interaction between external pressures and internal organizational capabilities. Rather than resulting solely from managerial initiatives, sustainable logistics practices emerge in response to regulatory requirements, market expectations, technological developments, and strategic needs related to risk management, organizational legitimacy, and long-term competitiveness. Sustainable logistics can therefore be understood as an organizational response to changes in the institutional and operational environment rather than as an isolated internal policy.

Among the most prominent drivers is regulatory and policy pressure. Increasingly stringent environmental regulations, sustainability requirements, and governance expectations encourage firms to redesign logistics systems, particularly in transportation, procurement, and distribution, which are significant sources of environmental impacts and areas of accountability within global supply chains. Requirements concerning carbon emissions, due diligence, product traceability, and responsible procurement increasingly require firms to establish logistics systems that can be consistently implemented, monitored, and evaluated across operational locations. Regulation therefore functions not only as a control mechanism but also as a catalyst for organizational change, directing greater attention toward logistics as a critical component of sustainability implementation.

Table 3. Thematic Classification of Drivers of Sustainable Logistics Adoption

No.	Driver Category	Driver Type	Analytical Description	Representative Studies
1	Global value chain participation and international integration	External / Strategic	Participation in global value chains exposes firms to sustainability standards, technology transfer, learning opportunities, and international performance expectations that encourage the adoption of sustainable logistics practices.	(Agostino et al., 2023; Wang et al., 2025; Zeng et al., 2025)
2	Sustainability information exchange and stakeholder pressure	External / Relational	The need to meet stakeholder expectations and exchange sustainability-related information across firms encourages the adoption of transparent and socially responsible logistics practices.	(Agyabeng-Mensah et al., 2025; Mangnus & Wegerif, 2025)
3	Top management support and organizational readiness	Internal	Leadership commitment, human resource capabilities, and internal organizational alignment are essential for translating sustainability objectives into logistics implementation.	(Binh et al., 2025; Khanal et al., 2023)
4	Regulation, due diligence, and certification pressure	Institutional	Regulatory requirements, due diligence obligations, and sustainability certification schemes encourage firms to redesign logistics systems in accordance with environmental and social compliance expectations.	(Burini et al., 2025; Gustafsson et al., 2024; Krähmer, 2025)

No.	Driver Category	Driver Type	Analytical Description	Representative Studies
5	Digital technology adoption	Technological	Blockchain, IoT, digital monitoring systems, and data platforms enhance traceability, visibility, and coordination, making sustainable logistics practices more feasible across global supply chains.	(Castro et al., 2024; Cromwell et al., 2025; Friedman & Ormiston, 2022)
6	Logistics performance improvement	Operational / Strategic	The pursuit of greater transportation efficiency, warehouse performance, and overall logistics capabilities often motivates sustainability-oriented redesign, as efficiency and environmental objectives increasingly converge.	(Cheng et al., 2024; Ke et al., 2025)
7	Circular economy and reverse logistics innovation	Strategic / Technological	Circular supply chain objectives, reverse logistics design, and related technological innovations encourage firms to adopt sustainable logistics models that reduce waste and enhance recovery systems.	(Burini et al., 2025; Herzallah et al., 2025)
8	Resource scarcity, waste reduction, and energy efficiency	Environmental / Operational	Pressure to reduce food losses, minimize waste, improve the utilization of mineral and pharmaceutical resources, and optimize energy consumption drives the transformation of logistics toward more sustainable practices.	(Beuving et al., 2024; I. J. Chen & Kitsis, 2017; Hagenaars et al., 2025)
9	Climate risk, decarbonization, and net-zero transition	Environmental / Strategic	Climate concerns and the pursuit of decarbonization encourage firms to adopt low-carbon, carbon-neutral, and net-zero logistics strategies.	(Binh et al., 2025; Castro et al., 2024; Pan et al., 2025)
10	Resilience and disruption mitigation	Strategic	Supply chain crises, geopolitical instability, and disruption risks motivate firms to redesign logistics networks through diversification, transportation flexibility, nearshoring, and regional restructuring.	(De La Pava et al., 2024; Ke et al., 2025; Poo et al., 2024; Yücesan, 2025)

No.	Driver Category	Driver Type	Analytical Description	Representative Studies
11	Financial support, public policy, and capacity building	Institutional / Enabling	Economic incentives, supportive policies, and capacity-building programs can accelerate the adoption of sustainable logistics practices, particularly in agricultural contexts and developing countries.	(Pedersen et al., 2024)
12	Labor and institutional power dynamics	Social / Institutional	Collective labor action and institutional power relations influence how sustainability pressures are translated into logistics restructuring and supply chain governance.	(Helwing-Hentschel, 2025)

Source : Data Processed

The classification presented in table 3 demonstrates that the drivers of sustainable logistics implementation are multidimensional and complementary. External pressures, such as regulations, stakeholder expectations, and participation in global value chains, act as triggers for change. Meanwhile, organizational readiness, technological capabilities, and management commitment determine the extent to which such changes can be effectively implemented. These findings indicate that sustainable logistics adoption is a contingent process shaped by the interaction between institutional pressures and firms' internal capabilities. In addition, the literature reveals the increasing importance of resilience as a driver of sustainable logistics adoption.

Impacts of Sustainable Logistics on Triple Bottom Line Performance

The literature review indicates that the implementation of sustainable logistics generates impacts that extend well beyond improvements in operational efficiency. The studies analyzed reveal that the benefits of sustainable logistics encompass environmental, economic, and social dimensions, meaning that its effectiveness is increasingly evaluated through a triple bottom line perspective rather than solely through cost or distribution speed indicators.

The environmental dimension represents the most prominent impact category in the literature. Various studies demonstrate that sustainable logistics practices contribute to reductions in carbon emissions and environmental footprints, improvements in energy efficiency, and more effective management of waste and material flows. These impacts are generally achieved through practices such as transportation optimization, reverse logistics, low-carbon distribution systems, renewable energy utilization, and enhanced coordination of logistics activities. These findings indicate that environmental benefits are not achieved merely by reducing logistics activities but through the redesign of systems to make transportation, storage, and material management more resource-efficient and environmentally responsible. Accordingly, the contribution of sustainable logistics to decarbonization is realized through the transformation of how goods, information, and resources are managed throughout supply chains rather than through normative commitments to sustainability alone.

Overall, the literature demonstrates that the impacts of sustainable logistics are multidimensional and encompass various aspects of organizational and supply chain performance. In addition to generating environmental benefits and improving operational efficiency, sustainable logistics implementation contributes to enhanced market performance, stronger supply chain resilience, greater food security, improved transparency, and stronger social accountability. These diverse impacts demonstrate that sustainable logistics generates not only ecological value but also complementary economic and social benefits. A summary of the major categories of sustainable logistics impacts identified in the literature is presented in Table 4.

Table 4. Thematic Classification of the Impact of Sustainable Logistics on Triple-Bottom-Line Performance

No.	Impact Category	Triple-Bottom-Line Dimension	Analytical Description	Representative Studies
1	Ecological footprint reduction	Environmental	Improvements in logistics performance, transportation efficiency, and warehouse optimization reduce ecological footprints, emissions, and resource intensity.	(Cheng et al., 2024; Khanal et al., 2023)
2	Carbon neutrality and decarbonization progress	Environmental, Economic	Sustainable logistics practices contribute to carbon neutrality, reduce greenhouse gas emissions, and support the transition toward net-zero logistics systems.	(Agostino et al., 2023; Binh et al., 2025; Pan et al., 2025)
3	Waste reduction and circular resource recovery	Environmental, Economic	Reverse supply chains, circular logistics, and food loss reduction enhance material recovery, reduce waste, and improve resource efficiency.	(Beuving et al., 2024; Burini et al., 2025)
4	Green growth and long-term economic upgrading	Economic, Environmental	Sustainable logistics and resource-efficient supply chain management support long-term green growth, industrial upgrading, and regional economic development.	(Z. Chen et al., 2025; Wang et al., 2025; Zeng et al., 2025)
5	Improved market performance and corporate reputation	Economic, Social	Sustainability-oriented logistics and supply chain practices improve market performance, strengthen	(Agyabeng-Mensah et al., 2025; Herzallah et al., 2025)

No.	Impact Category	Triple-Bottom-Line Dimension	Analytical Description	Representative Studies
			corporate legitimacy and reputation, and support competitive advantage.	
6	Inventory efficiency and operational resilience	Economic	Flexible transportation modes, diversified supply networks, and improved logistics coordination enhance resilience and inventory efficiency during disruptions.	(De La Pava et al., 2024; Ke et al., 2025; Yücesan, 2025)
7	Food security and nutrient availability	Social, Environmental	Improved logistics coordination, reduced food losses, and stronger supply connectivity enhance nutrient availability and support national and local food security.	(Beuving et al., 2024; Mangnus & Wegerif, 2025; Poo et al., 2024)
8	Fairness, transparency, and ethical accountability	Social, Environmental	Traceability systems, due diligence mechanisms, and fair-trade models enhance transparency, reduce exploitative practices, and strengthen accountability across supply chains.	(Cromwell et al., 2025; Friedman & Ormiston, 2022; Gustafsson et al., 2024; Krähmer, 2025)
9	Labor empowerment and social protection	Social	Sustainable logistics and related governance interventions can strengthen labor visibility, worker protection, and collective bargaining power within global supply chains.	(Helwing-Hentschel, 2025)
10	Climate adaptation and resilience in food and agricultural systems	Environmental, Social	Climate-smart logistics and resilient agricultural supply systems enhance adaptive capacity, resource efficiency, and sustainability in food distribution.	(Pedersen et al., 2024; Poo et al., 2024)
11	Reduced pharmaceutical shortages and essential supply continuity	Social, Economic	Resilient and sustainability-oriented pharmaceutical supply chain designs help reduce medicine shortages and improve supply continuity across regions.	(De La Pava et al., 2024)
12	Risk of rebound effects and unintended sustainability burdens	Environmental, Strategic	Some logistics transformations, particularly large-scale digital expansion or global recovery networks, may create new energy burdens, transparency risks, or implementation trade-offs.	(Burini et al., 2025; Castro et al., 2024; Hagenaars et al., 2025)

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The classification presented in table 4 demonstrates that the impacts of sustainable logistics implementation encompass all dimensions of the triple bottom line: environmental, economic, and social. Among these three dimensions, environmental benefits are the most frequently reported in the literature, particularly in the form of reduced carbon emissions, reduced waste, and support for the transition toward low- or carbon-neutral logistics systems.

Implementation Challenges and Barriers

The literature shows that sustainable logistics implementation remains constrained by infrastructure, financial, technological, organizational, and institutional barriers, leading to uneven adoption across sectors and regions. These challenges create a gap between the ideal concept of sustainable logistics and its practical implementation. In particular, limited infrastructure and technological readiness can hinder digitalization, low-carbon operations, and resource recovery. Overall, successful implementation requires addressing financial pressures, governance fragmentation, digital capability gaps, and trade-offs between sustainability, operational efficiency, and supply chain resilience. The main challenges identified in the literature are summarized in Table 5.

Table 5. Thematic Classification of Challenges in Implementing Sustainable Logistics

No.	Challenge Category	Challenge Type	Analytical Description	Representative Studies
1	Unequal technological capability	Technological / Structural	Firms in developing countries or weaker institutional environments often face difficulties in adopting green technologies, digital systems, and sustainable energy practices at scale.	(Agostino et al., 2023; Z. Chen et al., 2025; Pedersen et al., 2024)
2	Economic priority over holistic sustainability	Strategic / Organizational	Sustainability initiatives are often driven primarily by performance or economic motives, which may limit commitment to broader environmental and social transformation.	(Agyabeng-Mensah et al., 2025)
3	Measurement inconsistency and limited sustainability metrics	Methodological / Governance	Inconsistent definitions, fragmented quantification methods, and inadequate indicators make it difficult to evaluate food losses, logistics sustainability, and overall implementation performance.	(Beuving et al., 2024; Cheng et al., 2024)

No.	Challenge Category	Challenge Type	Analytical Description	Representative Studies
4	Weak external support and policy misalignment	Institutional	Government support, regulatory assistance, and external policy frameworks are not always effectively translated into carbon neutrality or sustainable logistics implementation.	(Binh et al., 2025; Pedersen et al., 2024)
5	Trade-offs in reverse and circular logistics design	Strategic / Operational	Local configurations may limit scalability, while global reverse supply chains may reduce transparency, ethical accountability, and governance control.	(Burini et al., 2025)
6	Rising digital energy demand	Environmental / Technological	Expanding digital infrastructure for traceability and logistics coordination may increase energy demand faster than renewable energy capacity can support.	(Castro et al., 2024)
7	Fragmented traceability adoption	Technological / Governance	Blockchain, IoT, and other traceability tools are often adopted unevenly due to fragmented standards, weak interoperability, and the lack of globally aligned policy frameworks.	(Cromwell et al., 2025; Friedman & Ormiston, 2022)
8	Cross-border governance complexity	Institutional / Governance	Sustainability due diligence, environmental accountability, and transnational risk management are difficult to implement consistently across jurisdictions with different regulatory systems and information asymmetries.	(Gustafsson et al., 2024)
9	Persistent high Scope 3 emissions	Environmental / Structural	Emissions embedded in upstream and downstream supply chain activities remain difficult to control, particularly in globally dispersed sectors such as pharmaceuticals.	(Hagenaars et al., 2025)
10	Limited structural change in labor and power relations	Social / Institutional	Labor action and social resistance may influence logistics practices but do not necessarily alter deeper power structures within global supply chains.	(Helwing-Hentschel, 2025)

No.	Challenge Category	Challenge Type	Analytical Description	Representative Studies
11	Limited integration of sustainable innovation	Organizational / Strategic	Firms often struggle to embed sustainable innovation consistently within logistics and supply chain systems, particularly in developing market contexts.	(Herzallah et al., 2025; Khanal et al., 2023)
12	High cost of resilience-oriented logistics	Economic / Operational	Practices such as air freight, diversified sourcing, and emergency logistics can enhance resilience but may also significantly increase operational costs.	(De La Pava et al., 2024; Ke et al., 2025)
13	Entrenched extractive production models	Structural / Social	Profit-oriented and export-driven supply chain structures often constrain transitions toward agroecology, fair trade, and more equitable logistics arrangements.	(Krähmer, 2025; Mangnus & Wegerif, 2025)
14	Post-pandemic and geopolitical restructuring pressure	Strategic / Structural	Decarbonization objectives, geopolitical tensions, deglobalization, and nearshoring pressures require profound logistics reorientation that many firms are not fully prepared to manage.	(Pan et al., 2025; Wang et al., 2025; Yücesan, 2025)
15	Dependency risks within global integration	Strategic / Innovation	Integration into global value chains can support upgrading and innovation but may also create dependencies, uneven benefits, and nonlinear outcomes across firms and regions.	(Zeng et al., 2025; Agostino et al., 2023)

Source : Data Processed

The classification presented in table 5 demonstrates that the challenges of sustainable logistics implementation do not originate solely from operational aspects but are also shaped by structural and institutional constraints that determine the success of implementation at a broader scale. Various studies identify limited technological readiness, high investment requirements, fragmented traceability systems, and weak policy harmonization as the most frequently occurring barriers, particularly in countries or sectors characterized by infrastructure and governance limitations.

DISCUSSION

The synthesis of sustainable logistics practices, drivers, impacts, and implementation challenges indicates a significant shift from viewing sustainable logistics as an operational function toward understanding it as a strategic transformation of global supply chains. Recent literature increasingly emphasizes circular and reverse logistics, digital traceability and transparency, decarbonization, and supply chain resilience, positioning sustainable logistics as a mechanism for managing environmental impacts, operational risks, and organizational accountability (Hagenaars et al., 2025; Friedman & Ormiston, 2022; Poo et al., 2024; Castro et al., 2024).

Implementation success depends on the interaction between external pressures and internal organizational readiness. Global value chain participation, regulations, and market pressures can stimulate sustainability adoption, but their effectiveness depends on top management support, human resource readiness, and organizational capabilities (Beuving et al., 2024; Burini et al., 2025; Agostino et al., 2023). Similarly, GSCM requires the integration of internal and external practices to achieve environmental and operational benefits (He et al., 2019; Pan et al., 2025). Thus, external pressures act primarily as catalysts, while organizational capabilities determine whether they result in meaningful transformation.

A key development is the integration of material and information flows. Technologies such as blockchain and IoT improve traceability, transparency, responsible sourcing, and accountability, although their environmental benefits depend on adequate digital infrastructure, energy systems, and governance (Ahmad et al., 2017; Loviscek, 2021; Laosirihongthong et al., 2020; Nica et al., 2025). At the same time, sustainability is increasingly connected with supply chain resilience through logistics connectivity, nearshoring, and network diversification. However, these objectives may involve trade-offs, as resilience strategies can increase costs and reverse logistics may create transparency challenges (An et al., 2021; Senyo & Osabutey, 2023; Tseng et al., 2020). Sustainable logistics therefore requires balancing environmental, economic, and resilience objectives rather than assuming automatic synergies.

The impacts of sustainable logistics extend across the triple bottom line. Environmental benefits include lower emissions and improved energy efficiency, while economic benefits include market performance, reputation, diversification, and innovation. Social benefits include improved resource and food availability, labor protection, transparency, and ethical accountability (Huang et al., 2024; Nica et al., 2025; Nogueira et al., 2025; Treiblmaier, 2019). Nevertheless, implementation remains constrained by infrastructure limitations, institutional weaknesses, inconsistent sustainability definitions, and inadequate performance measurement (Senyo & Osabutey, 2023; Laosirihongthong et al., 2020).

Overall, the literature supports a process-oriented perspective in which external pressures trigger change, while organizational capabilities, digitalization, governance, coordination, and logistics redesign determine its effectiveness. Sustainable logistics should therefore be understood as a multi-actor strategic transformation within global production networks, rather than as isolated green practices. Investments in transportation efficiency, digitalization, or reverse logistics are unlikely to achieve optimal outcomes without integrated governance, cross-organizational coordination, and long-term capability development.

CONCLUSION

The literature review shows that sustainable logistics has evolved from a focus on operational efficiency toward a strategic transformation shaped by environmental sustainability, digitalization, supply chain resilience, and governance. Its implementation involves interconnected practices such as green transportation, reverse and circular logistics, digital traceability, decarbonization-oriented logistics redesign, and network diversification. Success depends on the interaction between external drivers—including regulation, stakeholder expectations, and global value chain participation—and internal capabilities, particularly management commitment, technological readiness, and organizational coordination.

Sustainable logistics generates environmental, economic, and social benefits, but these outcomes depend on implementation quality, institutional capacity, and governance effectiveness. Adoption remains constrained by technological gaps, high investment requirements, fragmented regulations, inconsistent measurement systems, and geopolitical risks. Therefore, sustainable logistics should not be viewed as a universal set of practices but as a context-dependent transformation process shaped by organizational, institutional, and environmental conditions.

The main contribution of this study is a synthesis framework integrating drivers, practices, enabling mechanisms, impacts, and implementation challenges. This framework provides a comprehensive view of logistics transformation and the interdependencies influencing sustainable outcomes. Future research should further examine implementation in developing countries, develop more comprehensive indicators of social impacts, and assess the long-term sustainability implications of digitalization and supply chain resilience strategies.

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