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Sustainable Supply Chain Management: Opportunities & Challenges

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Abstract

Sustainable Supply Chain Management (SSCM) has emerged as a strategic imperative for businesses aiming to align economic performance with environmental stewardship and social responsibility. This book chapter explores the concept, principles, and growing significance of SSCM in the global and Indian contexts. It highlights the key opportunities offered by SSCM—such as green logistics, sustainable procurement, and carbon footprint reduction—while also critically examining challenges including cost implications, supplier engagement, and infrastructure limitations. The objective of the study is to understand SSCM's core framework, analyse its practical implementation in India, and assess both government and private sector efforts in advancing sustainable supply chains. Particular emphasis is placed on government schemes like the National Logistics Policy and initiatives under “Make in India,” as well as private sector innovations that integrate environmentally and socially responsible practices into procurement, manufacturing, and distribution. Using a descriptive research methodology, this chapter draws on secondary data from scholarly articles, government documents, and industry case studies to provide a nuanced understanding of SSCM. The study reveals how Indian organizations are gradually embedding sustainability into their supply chain strategies through digitalization, stakeholder collaboration, and green certification programs. It also outlines the policy environment shaping SSCM and identifies gaps that require further intervention and innovation. By offering a well-rounded view of opportunities and constraints, this chapter aims to support academia, practitioners, and policymakers in designing resilient and future-ready supply chains that contribute to inclusive and sustainable development.

Keywords: *Sustainable Supply Chain, Green Logistics, Socially Responsible Supply Chain, Carbon Footprint Reduction, Sustainable Procurement.*

Introduction

Sustainable Supply Chain Management (SSCM) is the integration of environmentally and socially responsible practices into the entire supply chain lifecycle, from the sourcing of raw materials to the final delivery of products and services to consumers. The primary objective of SSCM is to minimize the negative environmental impacts and promote social equity while maintaining or improving economic performance. It focuses on reducing waste, lowering carbon emissions, conserving natural resources, and ensuring fair labour practices across suppliers, manufacturers, logistics providers, and retailers. By embedding sustainability into procurement, production, and distribution strategies, businesses can meet the demands of environmentally conscious stakeholders, comply with regulatory frameworks, and secure long-term profitability.

One of the key elements of SSCM is the adoption of green practices, such as energy-efficient transportation, the use of recyclable or biodegradable packaging materials, and waste minimization techniques. Companies are increasingly collaborating with suppliers to ensure the sourcing of raw materials follows sustainable and ethical standards. For example, many global firms now require their suppliers to comply with sustainability certifications and codes of conduct related to labour rights, environmental protection, and community development. Technology also plays a crucial role in SSCM by enabling better traceability, data monitoring, and performance analysis, allowing firms to make informed decisions about resource usage and supplier compliance.

Furthermore, SSCM goes beyond environmental concerns by embracing the Triple Bottom Line (TBL) approach, which emphasizes people, planet, and profit. It encourages companies to take accountability not just for their financial outcomes, but also for their social and ecological footprint. Through sustainable supply chain initiatives, companies can build stronger relationships with customers, improve brand image, and gain competitive advantage in markets that value ethical conduct and transparency. In the long run, a well-designed SSCM framework fosters resilience against supply chain disruptions, reduces costs through efficiency, and supports global efforts to address climate change and social injustice. Therefore, SSCM is not just a strategic choice but a necessity in today's rapidly evolving and sustainability-driven business landscape.

Advantages

Implementing Sustainable Supply Chain Management (SSCM) is no longer just an ethical choice; it's a strategic imperative for modern businesses. It involves integrating environmental, social, and economic considerations into every facet of the supply chain, from the initial sourcing of raw materials to the final delivery and even disposal of products. This holistic approach yields a multitude of benefits, driving not

only positive societal and environmental impacts but also significant business advantages. Embracing SSCM transforms traditional supply chains into resilient, responsible, and economically viable systems. Here are six key major advantages:

- **Reduced Environmental Impact:** SSCM prioritizes minimizing the negative effects of operations on the environment. This includes efforts to reduce carbon emissions through optimized logistics and energy-efficient practices, decrease waste generation through recycling and reuse programs, and conserve natural resources by utilizing eco-friendly and renewable materials. By actively seeking to lower their ecological footprint, companies contribute to a healthier planet.
- **Cost Savings and Increased Efficiency:** While initial investments might be required, SSCM often leads to significant long-term cost reductions. By optimizing resource use, minimizing waste in production and packaging, and adopting energy-efficient technologies, companies can lower operational expenses. Furthermore, streamlined processes, improved inventory management, and better transportation planning contribute to enhanced overall efficiency throughout the supply chain.
- **Enhanced Brand Reputation and Customer Loyalty:** Consumers are increasingly conscious of a company's commitment to sustainability and ethical practices. By demonstrating a strong dedication to environmental and social responsibility, businesses can significantly improve their brand image and build trust with customers. This leads to increased customer loyalty, as a growing segment of the market is willing to pay a premium for products from socially and environmentally responsible companies.
- **Improved Risk Management and Resilience:** Sustainable supply chains are inherently more resilient to disruptions. By diversifying suppliers, reducing reliance on finite resources, and adopting ethical labour practices, companies can mitigate risks associated with resource scarcity, regulatory non-compliance, and reputational damage from unethical practices. This proactive approach helps businesses navigate unforeseen challenges and maintain operational continuity.
- **Regulatory Compliance and Future-Proofing:** Governments worldwide are implementing stricter environmental and social regulations. By adopting sustainable supply chain practices, businesses can ensure compliance with current laws and be better prepared for future regulatory changes. This proactive stance helps companies avoid potential fines, legal issues, and negative publicity, positioning them as responsible industry leaders.

- **Fosters Innovation and New Opportunities:** Embracing sustainability often drives innovation within the supply chain. Companies are encouraged to develop new, eco-friendly products, explore sustainable technologies, and implement more efficient processes. This focus on innovation can lead to new business opportunities, strategic partnerships with like-minded organizations, and the development of competitive advantages in a rapidly evolving market.

Challenges

While the pursuit of Sustainable Supply Chain Management (SSCM) offers significant long-term benefits, its implementation is rarely without hurdles. Organizations embarking on this journey frequently encounter a range of complex challenges that can impede progress, increase costs, and test commitment. These limitations often stem from the inherent complexities of global supply chains, the diverse interests of numerous stakeholders, and the evolving nature of sustainability itself. Addressing these challenges requires strategic planning, collaborative efforts, and a willingness to overcome obstacles that can make the path to a truly sustainable supply chain a demanding one.

- **High Initial Costs:** Transitioning to a sustainable supply chain often requires substantial upfront investment. This can include upgrading machinery for energy efficiency, sourcing more expensive sustainable materials, investing in new technologies for tracking and transparency, or overhauling logistics networks. For many businesses, particularly small and medium-sized enterprises (SMEs), these initial costs can be a significant barrier, leading to a focus on short-term financial gains over long-term sustainability benefits.
- **Lack of Supply Chain Visibility and Transparency:** Modern supply chains are incredibly complex, often spanning multiple tiers of suppliers across different countries and regions. Gaining full visibility into every step of the supply chain – from raw material extraction to final product delivery – is a monumental challenge. Without this transparency, it's difficult to monitor and verify the sustainability practices of all partners, making it hard to identify and address issues like unethical labour practices or environmental non-compliance.
- **Supplier Reluctance and Lack of Collaboration:** For SSCM to be truly effective, all partners in the supply chain, especially suppliers, must be on board. However, suppliers may be reluctant to adopt new sustainable practices due to increased costs, lack of understanding, or a perception that it's not a priority. Convincing diverse suppliers with varying levels of resources and capabilities to align with a company's sustainability goals and actively collaborate can be a significant challenge.

- **Data Management and Measurement Difficulties:** Effectively measuring and reporting on sustainability performance requires robust data collection and analysis. This involves tracking a wide range of metrics, from carbon emissions and water usage to labour conditions and waste generation, across disparate systems and geographical locations. The lack of standardized metrics, inconsistent data formats, and the sheer volume of information can make it difficult to gather accurate, reliable, and actionable data for performance evaluation.
- **Regulatory Complexity and Inconsistency:** The landscape of sustainability regulations is constantly evolving and varies significantly across different countries and regions. This complexity can be a major challenge for companies operating globally, as they must navigate a patchwork of diverse laws, reporting requirements, and compliance standards. Keeping up with these changes and ensuring adherence across the entire supply chain requires significant resources and expertise.
- **Balancing Cost, Quality, and Sustainability:** Businesses often face a dilemma when trying to balance the triple bottom line of economic viability, social equity, and environmental protection. For example, sourcing sustainable materials might increase production costs, potentially impacting competitiveness or consumer prices. Achieving sustainability goals without compromising product quality or customer satisfaction can be a delicate act, requiring careful strategic planning and trade-offs.

Review of Literature

Carter and Rogers (2008) laid a foundational understanding of sustainable supply chain management by integrating environmental, social, and economic performance. They emphasized that long-term financial success is achievable only when supply chains strategically embed sustainability practices across all functions. Their work initiated critical debates on the triple bottom line in supply chain research.

Seuring and Müller (2008) categorized SSCM strategies into supplier management for risks and performance and the integration of sustainability throughout the supply chain. Their framework provided clarity on managing trade-offs and stakeholder pressure, helping firms identify suitable SSCM pathways depending on their industry context.

Pagell and Wu (2009) argued that truly sustainable supply chains require reconfiguration of traditional supply chain logic, including collaborating with non-traditional partners and redefining efficiency metrics. Their qualitative case study illuminated the complexity and innovation necessary for achieving long-term sustainability goals.

Zhu, Sarkis, and Lai (2013) explored SSCM in the Chinese manufacturing sector, identifying the influence of external pressures—especially governmental regulations and market competitiveness—on the adoption of green supply chain practices. Their empirical findings highlighted the importance of institutional pressures in shaping SSCM decisions.

Golicic and Smith (2013) conducted a meta-analysis on the impact of sustainable practices on supply chain performance. Their study confirmed that integrating environmental and social responsibility positively correlates with firm performance, particularly in customer loyalty, brand value, and risk mitigation.

Tachizawa and Wong (2014) examined the role of third-party logistics providers in enabling SSCM. Their research found that external logistics actors can significantly enhance environmental and social performance through technology, innovation, and efficient coordination—particularly in globalized networks.

Ahi and Searcy (2015) provided a comprehensive definition of SSCM by synthesizing over 200 existing definitions. Their work clarified conceptual boundaries and offered an inclusive framework combining environmental, social, and economic aspects, thus facilitating more structured academic research in the domain.

Objective of the Study

The primary objective of the study is:

- To understand the concept, principles, and significance of Sustainable Supply Chain Management (SSCM).
- To explore the key opportunities and challenges associated with implementing SSCM.
- To analyse the current status and practices of SSCM in the Indian context.
- To examine government initiatives aimed at promoting and sustaining SSCM in India.
- To highlight private sector initiatives and innovations contributing to SSCM development.

Methodology

This book chapter adopts a descriptive research methodology to explore the multifaceted opportunities and challenges of Sustainable Supply Chain Management (SSCM). The study is based on an extensive review of secondary data collected from peer-reviewed journals, government reports, industry publications, and relevant case studies. By synthesizing existing literature and real-world practices, the chapter aims to provide a comprehensive understanding of SSCM frameworks, strategies, and outcomes. The descriptive approach allows for an in-depth analysis of emerging trends, sustainability metrics, and policy implications, offering valuable insights for

academics, practitioners, and policymakers interested in promoting sustainable and resilient supply chains.

Overview of the Study

Sustainable Supply Chain Management (SSCM) in India

Sustainable Supply Chain Management (SSCM) in India has emerged as a crucial strategic focus for businesses seeking long-term resilience, environmental compliance, and global competitiveness. SSCM involves incorporating environmental, social, and ethical considerations into every phase of the supply chain — from sourcing and manufacturing to distribution and end-of-life product management. With increasing global awareness of climate change, carbon emissions, and ethical sourcing, companies in India are adopting SSCM frameworks to align with both international expectations and domestic sustainability mandates.

As of 2024, the Indian sustainable supply chain market is witnessing strong growth, driven by government initiatives, digital innovation, and consumer demand for green products. According to reports from the Confederation of Indian Industry (CII) and various market analysts, the Indian SSCM market is valued at approximately USD 45–50 billion and is expected to grow at a CAGR of over 20% through 2030. This is part of the larger global SSCM market, which was valued at over USD 900 billion in 2023, with projections indicating it could cross USD 1.5 trillion by 2030, reflecting a global shift toward green procurement, circular economies, and carbon-neutral operations.

Several Indian companies are leading this transformation. Tata Group is at the forefront — Tata Steel has introduced green steel initiatives, while Tata Communications implements a Sustainable Supply Chain Framework that audits suppliers' environmental and social compliance. Infosys and Wipro are pioneers in integrating sustainability into IT-driven supply chain solutions. Infosys, for example, uses AI and blockchain to track carbon footprints and supplier sustainability. ITC Limited has adopted zero waste-to-landfill practices and promotes sustainable agriculture sourcing for its FMCG products. Reliance Industries has begun large-scale integration of green hydrogen and renewable energy into its supply chain operations. In the logistics sector, TVS Supply Chain Solutions and Mahindra Logistics are incorporating electric vehicles and energy-efficient warehouses.

India's policy landscape also supports this shift. The National Logistics Policy (NLP) 2022 and PM Gati Shakti Mission emphasize infrastructure modernization and emissions reduction in supply chain networks. Corporate ESG compliance and stakeholder pressure are pushing organizations to prioritize SSCM. With the convergence of digital innovation, policy support, and rising global market integration, India is poised to become a key hub in the global sustainable supply chain ecosystem — balancing profitability with planetary responsibility.

- National Logistics Policy (NLP) – 2022: Implemented in September 2022, the National Logistics Policy represents a watershed moment for SSCM in India. With logistics costs comprising up to 16% of GDP—far above the global benchmark of ~8%—NLP seeks to halve these costs by 2030. Its centrepieces, the Comprehensive Logistics Action Plan (CLAP), focuses on eight critical areas: digital integration, physical asset standardization, human resource development, state engagement, export-import logistics, service quality, sectoral planning, and infrastructure expansion (logistics parks). A flagship component, the Unified Logistics Interface Platform (ULIP), integrates data from seven ministries and multiple digital systems under one platform—driving visibility, transparency, and efficiency for SSCM stakeholders. Additionally, NLP's emphasis on formalizing warehousing, transport, tracking, and performance metrics helps standardize logistics practices aligned with environmental and social performance benchmarks.

For SSCM, NLP's focus on reducing freight lead times, and improving intermodal transport, fleet efficiency, and warehousing, directly contributes to minimizing carbon footprints and waste. The policy's digital tools enhance supply chain traceability—vital for verifying green standards, ethical sourcing, and compliance. Human resource and capacity-building elements further embed SSCM competencies into the workforce, promoting sustainable operations as standard practice rather than niche effort. As a cross-sectoral mechanism, NLP enhances SSCM linkage across value chains—from suppliers to consumers—while setting up national-level targets and KPIs for environmental performance.

- PM Gati Shakti National Master Plan – 2021: Launched in August and formally approved in October 2021, PM Gati Shakti is India's visionary \$1.2 trillion infrastructure and connectivity plan. Its primary goal is seamless multi-modal connectivity—linking roads, railways, ports, and inland waterways—for fast, efficient movement of goods. The plan leverages GIS-enabled digital infrastructure to avoid redundant projects, streamline logistics timelines, and enhance resilience. Evidence of its impact includes CCEA's approval of multi-tracking rail projects in Maharashtra and Madhya Pradesh. These upgrades aim to relieve congestion, handle an additional 18.4 million tonnes of freight annually, and reduce carbon emissions via rail modal shifts. From the SSCM perspective, Gati Shakti introduces a paradigm shift in supply chain planning. By synchronizing infrastructure across modes and agencies, it shortens lead times, eases bottlenecks, reduces idle times and fuel consumption, and mitigates supply chain fragility. The digital 'Master Plan' supports data-driven decision making, resilient sourcing routes, and just-in-time logistics. By redefining national corridors and including development of

logistics parks via PPP models, it creates the physical spine for green logistics networks. Ultimately, Gati Shakti serves as infrastructure-level support for sustainability, integrating SSCM into national developmental goals.

- **Faster Adoption and Manufacturing of Electric Vehicles (FAME) Scheme – 2015/2019:** The FAME Scheme launched in 2015, with an expanded Phase II in April 2019, allocates more than ₹10,000 crore to catalyse electric mobility expansion. It encompasses incentives for purchase of EVs, including light commercial and cargo vehicles critical for logistics, along with infrastructure deployment—charging stations and battery-swapping systems. The policy purposefully targets electrification of last-mile delivery and intracity logistics, ensuring a green transition for urban supply chain operations. FAME's relevance to SSCM is immense. By enabling electric fleets in distribution, warehousing, and cargo movement, it cuts GHG emissions in supply chain transport—a major environmental hotspot. The EV infrastructure rollout also enhances utilization efficiency, reduces downtime, and introduces new digital integration needs for fleet management and energy-tracking. As Phase II currently subsidizes specific vehicle categories like e-three wheelers (used by small suppliers and last-mile services), it supports inclusion and addresses equity by enabling micro-entrepreneurs. Strategically, FAME accelerates clean mobility ecosystems that underlie the green logistics spine of SSCM.
- **Extended Producer Responsibility (EPR) Policy – Plastic Waste – 2016 & 2022 Amendment:** Initially notified in 2016 and amended in February 2022, India's EPR Policy for plastic waste places accountability on Producers, Importers, and Brand Owners (PIBOs) to manage and recover packaging waste. The 2022 amendment introduced a phased ban on 19 Single-Use Plastics and mandated plastic waste recycling targets: 50% rigid plastics by 2024–25 and 70% by 2025–26, along with 30% reuse for rigid packaging. It also introduced a centralised portal for EPR compliance, oversight, and transparency. As of 2022–23, over 6,000 PIBOs registered under EPR rules collectively responsible for ~2.32 million tonnes of plastic packaging, supported by 1,715 waste processors with 17 million tonnes/year processing capacity.

In SSCM contexts, EPR reinforces circular supply chains by compelling upstream product redesign for end-of-life management. It significantly affects procurement, packaging design, supplier accountability, waste logistics, and reverse logistics. Companies are now required to build closed-loop systems involving waste collection, recycling, and reused content—spurring partnerships with informal recyclers and supporting integration of marginalized labour segments. The portal

ensures data-driven oversight, KPIs, and reporting. However, execution challenges persist, including data integrity, inclusion of informal sectors, and MLP packaging gaps. Overall, EPR is catalysing systemic circularity within SSCM.

- **National Electric Mobility Mission Plan (NEMMP) – 2013:** Released in 2013 as India's long-term EV blueprint (2020–30), NEMMP supports the emerging EV ecosystem: vehicle production, R&D, infrastructure, and skills. As the umbrella policy underpinning electric mobility, it's tightly integrated with FAME's financial incentives. It aims to create a comprehensive EV value chain—from manufacturing components to building charging networks and incentivizing R&D in batteries and green hydrogen—aligned with “Make in India” targets. Within SSCM frameworks, NEMMP serves as a foundation for sustainable transport and logistics. By promoting EV manufacturing and local value chains, it reduces dependence on fossil fuel imports and carbon-intensive supply chains. It emphasizes domestic production of key components—such as batteries and motors—bolstering in-country capabilities and lowering ecological footprints. For supply chain designers, NEMMP opens streams of green transport options, energy tracking needs, partnerships with manufacturers, and skill-building for EV maintenance. Combined with FAME, it injects scale and coherence into India's green logistics transformation.
- **Perform, Achieve, and Trade (PAT) Scheme – 2012 to Present:** As part of the 2008 National Mission on Enhanced Energy Efficiency (NMEEE) under NAPCC, the PAT scheme launched in 2012 and operates in multi-year cycles. PAT Cycle I (2012–15) targeted 478 energy-intensive units across eight sectors, surpassing its goal with savings of 8.67 MTOE, avoiding ~31 Mt CO₂. Cycle II (2016–19) expanded to 621 units across 11 sectors, achieving savings of ~14.08 MTOE (68 Mt CO₂). Subsequent cycles (III to VI) under rolling notifications aim for ~26 MTOE in total savings by 2023–2. PAT also features tradable Energy Saving Certificates (ESCerts); Cycle I alone traded 1.3 million units (₹100 crore), fuelling ~₹2,600 crore in energy-efficient investments. PAT's relevance to SSCM lies in driving energy efficiency in manufacturing segments of the supply chain. By incentivizing firms to reduce their “gate-to-gate” energy intensity, PAT enhances the sustainability profile of suppliers. The ESCert trading mechanism creates a market value for efficiency, encouraging investment in renewable energy, retrofits, and process optimization. Over time, PAT expands across sectors (including refineries, railways, buildings), embedding SSCM strategies in core supply chain assets. It effectively aligns SSCM objectives—cost reduction, emissions reduction, and innovation—with regulatory and financial motivations.

Private Sector Initiatives in Sustainable Supply Chain Management in India

- **Lloyds Metals & Energy – Surjagarh “Green Mine” Initiative (2025):** In early 2025, Lloyds Metals & Energy Ltd (LMEL) launched India’s first-ever “green mine” at the Surjagarh iron ore site in Maharashtra’s Gadchiroli district. This bold initiative integrated decarbonization throughout the supply chain—from energy use in drilling operations to logistics and even afforestation. LMEL reports annual CO₂ reductions of 32,000 tonnes, with eventual targets of 50,000 tonnes once full renewable integration is achieved. A centrepiece is the 87-km slurry pipeline (implemented June 2025), which replaced heavy truck convoys, reducing carbon emissions by 55% in ore transport. The company also planted over 300,000 trees for ecological restoration and established in-house EV charging capabilities, establishing a blueprint for the green steel sector.

This initiative exemplifies SSCM by targeting both upstream and downstream stages: sourcing, movement, processing, and reclamation. The slurry pipeline represents an eco-efficient logistics innovation that replaced fossil-fuel transport; trees serve as natural carbon sinks; electrified fleets signal long-term cleaner-value chain logistics. By embedding sustainability into mining, LMEL sets a precedent for industrial SSCM, combining environmental stewardship with operational innovation.

- **GreenLine Mobility Solutions – LNG & EV Truck Fleet (2025):** In April 2025, Essar Group’s GreenLine Mobility announced a transformative \$275 million investment into decarbonizing heavy-duty logistics. Their plan includes the deployment of 10,000 LNG and electric trucks, 100 nationwide LNG refuelling and EV charging stations, and battery-swap facilities. Already operating 650 LNG trucks, the company has cut emissions by 30% across 38 million km, saving ~10,000 tonnes of CO₂. Strategic partnerships include deployments to Flipkart and other major corporates. GreenLine is redefining green logistics, with clear carbon offsets and infrastructure expansion. In SSCM terms, GreenLine integrates green mobility into core logistics: bulk freight now runs on cleaner energy; refueling/charging infrastructure creates resilience; tie-ups with FMCG and e-commerce anchor sustainability in real delivery lines. Their model stresses a shift from fossil to green energy systems, institutionalizing eco-efficiency in long-haul supply chain movement across India.
- **Yulu – Electric Micro-Mobility & “Green Deliveries” (From 2017):** Since 2017, Yulu Bikes, based in Bengaluru, Mumbai, Delhi and other metros, has scaled up shared two-wheeler electric mobility—now totaling 45,000 dockless EVs. Users have covered 850 million km, saving an estimated 32 million kg CO₂, and supporting over 240 million eco-friendly deliveries. Moreover, a 2022 joint

- venture with Magna International launched an India-first battery-as-a-service (BaaS) model, simplifying battery swapping and reuse.
- Yulu contributes to SSCM by replacing polluting last-mile delivery engines with shared EVs. Their BaaS model ensures batteries are decoupled from vehicle lifespans, facilitating circular use and reducing e-waste—showing a full lifecycle sustainability approach. Yulu’s scalable metro impact makes it a template for urban green logistics.
 - Recykal – Digital EPR & Waste Ecosystem Platform (2016): Founded in 2016, Recykal is India’s premier digital waste management platform, digitizing collaboration between informal collectors, brands, and recyclers. Initially a plastic-waste marketplace, it pivoted to end-to-end EPR solutions for corporate responsibility programs by 2019. By 2021, the platform had processed over 200,000 MT of waste, expanded into 30+ states, and facilitated brand compliance tracking. In 2022, Recykal launched India’s first digital Deposit Refund System in Uttarakhand and earned global recognition across climate innovation forums. To date, over 1 million MT of waste has been recycled via its network including 620+ brands and 5,000+ aggregators. This initiative touches on circular SSCM principles. It enables traceability of packaging waste, supports producer responsibility mandates, empowers local collectors, and injects transparency into recycling—ensuring recoverability is native to supply chain closure. Such a model allows companies to operationalize EPR mandates and reduce virgin plastic dependency sustainably.
 - StarAgri – Blockchain-Enabled Agri-Commodity Infrastructure (2006–2024): Since its founding in 2006, StarAgri Warehousing & Collateral Management has evolved to integrate sustainable logistics into Indian agriculture. By 2023, the company managed 1,380 warehouses, and by 2024, introduced geo-tagging, farmland cadastral mapping, remote sensing crop estimation, and blockchain-based collateral management systems. Their e-marketplace, Agritrade, launched in 2016, digitized supply-side procurement. Partnerships with 24 banks, including NBFC lending to smallholder farmers, exemplify inclusive SSCM integration. StarAgri’s contribution lies in structuring agricultural supply chains with enhanced traceability, reduced spoilage, fairer loan collaterals, and minimized inefficiencies. Blockchain ensures provenance accuracy; farm-level mapping optimizes logistics; financial inclusion supports broader supply chain participation. Such models combine sustainability with rural socioeconomic uplift.
 - EKA Mobility – Electric Buses & Small Commercial EVs (2019): Launched in 2019 as a subsidiary of Pinnacle Industries, EKA Mobility, based in Pune, manufactures electric buses and small commercial vehicles. In partnership with Skyline Motors, they began deploying city e-bus fleets in Uttarakhand in

2024. Recognized under the national PLI scheme for advanced auto manufacturing, they stand at the frontline of India's electric public transport revolution. Within SSCM, EKA signifies supply-side decarbonization: its e-buses and small commercial EVs reduce operational emissions, especially in feeder logistics and intracity transport. By fostering localized EV production, it cuts up supply chain carbon footprints and energy imports while enabling public-private partnerships.

- **Magenta Mobility & Kuehne Nagel Hub and Spoke EV Freight (2024):** In June 2024, Magenta Mobility, operating in Mumbai's Bhiwandi logistics hub, collaborated with Kuehne + Nagel to launch "Project 302". Under this initiative, EV depot infrastructure supports a hub-and-spoke delivery model, targeting a 60% deployment of low-emission vehicles by 2030, with 10,000 EVs expected by September 2025. Logistics giant Ecom Express also deployed 175 EV/CNG vehicles by March 2024, while Amazon India replaced 5,300 tonnes of single-use plastic packaging across fulfilment networks. This shows corporate-level SSCM in e-commerce logistics. By introducing green fleets, optimizing routing, and recycling packaging, firms reduce emissions, plastic use, and energy waste. They exemplify the trifecta of EV logistics, digital planning, and circular packaging—all central SSCM components.
- **SAP India – Social Procurement Initiative (2025):** In January 2025, SAP India launched a Social Procurement Initiative, aimed at integrating social enterprises and women-led ventures into corporate supply chains. It supports over 100 social-enterprises, connected to platforms like GeM, ONDC, Make in India, and Farmer Producer Organizations (FPOs). SAP provides training, procurement readiness, and mentorship to sustainable and inclusive vendors. From an SSCM lens, this initiative expands sustainability to social dimensions: MSME/farmer participation, equitable procurement, and gender-diverse enterprise enablement. It moves supply chains from environmental-only sustainability to inclusive shared-value systems—linking brand responsibility with community development and transparency.

Conclusion

Sustainable Supply Chain Management (SSCM) represents a paradigm shift from traditional, cost-centred supply chain models to systems that value environmental stewardship, social responsibility, and economic viability in equal measure. Through the exploration of multiple frameworks, practices, and real-world applications in this chapter, it is evident that sustainability in supply chains is no longer an optional value addition but a strategic necessity. As global awareness of climate change, ethical labour practices, and resource scarcity intensifies, businesses face increasing regulatory, consumer, and investor pressures to adopt sustainable

operations. From integrating green procurement and cleaner production techniques to ensuring social compliance and ethical sourcing, SSCM enables firms to build resilience, reduce risks, and enhance long-term competitiveness. However, this transformation is not without its challenges. Issues such as high implementation costs, complexity in managing multi-tiered supplier networks, lack of standardization in sustainability metrics, and resistance to change still pose significant barriers to effective adoption.

Despite these challenges, SSCM opens up vast opportunities for innovation, collaboration, and long-term value creation. Future research and industry practice must move toward developing dynamic, data-driven decision-making tools that can balance trade-offs between cost, service, and sustainability. Digital technologies like blockchain, artificial intelligence, and the Internet of Things (IoT) can play a pivotal role in enhancing transparency, traceability, and operational efficiency across the supply chain. Furthermore, there is a growing need for context-specific models that reflect the diversity of sectors and geographies, especially in emerging economies. Future academic work should focus on developing frameworks that are inclusive of small and medium enterprises (SMEs), social enterprises, and informal supply chain actors. Collaborative partnerships among academia, industry, government, and civil society can further accelerate the transition to sustainable supply chains. Overall, the future of SSCM lies in strategic foresight, stakeholder engagement, and a shared commitment to ethical and environmentally conscious growth.

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