

SUSTAINABLE SUPPLY CHAIN MANAGEMENT

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Abstract— Sustainable Supply Chain Management (SSCM) is a strategy that requires supply chains to be competitive and sustainable to satisfy consumer demands (Seuring and Muller, 2008). It is an approach that uses environmentally and socially responsible methods to safeguard people and the environment across the supply chain. It increases its long-term viability by incorporating social, economic, and environmental factors into supply chain activities. It facilitates more equitable labor practices, lessens the impact on the environment, and ensures supply chain economic efficiency. SSCM is simply adding the 'sustainable' aspect in each phase of supply chain such as Sustainable Sourcing, Life Cycle Assessment, Green Logistics, adoption of Circular Economy principles etc. By implementing technologies like blockchain for transparency, renewable energy to reduce carbon footprints, and waste reduction strategies, it helps businesses comply with laws and regulations, improve cost-cutting strategies, and gain customers' trust. Competent SSCM reduces risk, fosters resilience and creativity in the face of environmental, social, and economic difficulties. On that account, SSCM is now essential for organizations looking forward to maintaining their competitiveness while having a positive influence on the environment and society.

Keywords— *Sustainable Supply Chain Management (SSCM), Long-term viability, Sustainability and Environment.*

1. INTRODUCTION

1.1 DEFINITION

'Supply Chain Management' (SCM) is an activity of supervising control over the flow of goods and services from the procurement of raw materials to the delivery of final products or services to the end user. However, the concept of "sustainability" refers to achieving current requirements without endangering the capacity of future generations to satisfy their own. Combining both, a 'Sustainable Supply Chain' is one that uses environmentally and socially sustainable practices at every single stage to protect the people and environment across the whole supply chain. Hence, it can be said that SSCM is a wide perspective which integrates economic, social and environmental considerations into the management of supply chain activities to promote long-term sustainability.

1.2 PILLARS OF SUSTAINABILITY

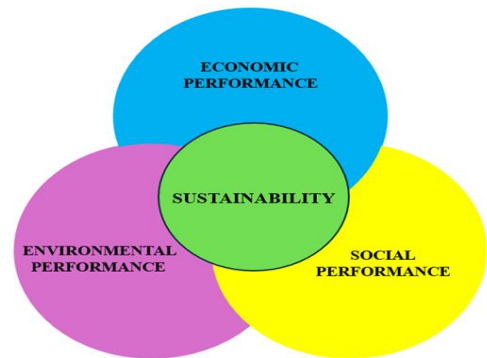


FIGURE NO.1: PILLARS OF SUSTAINABILITY

The term 'Sustainability' comprises of three main pillars, representing 'Economic Performance,' 'Social Performance' and 'Environmental Performance'.

- Economic Performance:** From the economic viewpoint, SSCM seeks to balance cost efficiency and value creation for all the stakeholders of the company, ensuring that supply chains are flexible, resilient and capable of mitigating risks effectively (Sroufe et al., 2009; Carter & Rogers, 2008).
- Social Performance:** From the social perspective, SSCM emphasizes on various social responsibilities of the business incorporating ethical labor practices, positive community engagement and optimizing the use of natural resources (Locke et al., 2009; Elkington, 1997).
- Environmental Performance:** SSCM targets to minimize negative environmental impacts by enhancing resource efficiency and adopting suitable sustainable procurement practices (Seuring & Muller, 2008).

1.3 EVOLUTION OF SUPPLY CHAIN MANAGEMENT TOWARDS SUSTAINABILITY

The evolvement of SCM towards sustainability exhibits a growing recognition of the economic, social and environmental considerations incorporated with traditional supply chains. Primarily, SCM focused on efficient cost management, reliability and speed, often at the cost of environmental and social aspects (Carter & Rogers, 2008). Eventually with the increased global awareness of resource depletion, climate

change and social disparities, businesses began to integrate sustainability and supply chains. Incorporation of sustainability into traditional supply chains was propelled by regulatory pressures, rising consumer demand for ethical products and services and the realization that eco-friendly practices can lead to long-term economic benefits of the business (Seuring & Muller, 2008). The initial decade of 2000s perceived the integration of environmental management practices into supply chains as waste reduction and energy efficiency, which marked the beginning of greening the supply chains known as, 'Green SCM' (Rao & Holt, 2005). As of late, the concept of SSCM has widened to encompass not only environmental but also social dimensions focusing on ethical labor practices, human rights and societal consequences (Pagell & Wu, 2009). SSCM is currently recognized as a holistic strategy contributing to the overall sustainability of businesses and their supply chains by aligning economic goals with environmental governance and social responsibilities (Tate, Ellram, & Kirchoff, 2010).

1.4 IMPORTANCE OF SSCM

SSCM is significant for various reasons, particularly, reflecting its eminence across Economic, Social and Environmental aspects.

- a) **Economic Efficiency:** Businesses can optimize resource use, cut expenses through efficient use of energy and improve the overall effectiveness of their supply chain operations by emphasizing on sustainability. Eco-friendly practices often lead to long-term cost savings and improved profitability. Carter and Rogers (2008) implied that SSCM can lead to economic benefits through cost cutting, competitive advantage and improved reputation.
- b) **Social Responsibility:** SSCM assures that businesses preserve human rights across their supply chains, encourages ethical labor practices and enhances good working conditions thereby addressing certain issues and unethical practices such as forced labor and child labor. According to Pagell and Wu (2009) supported the fact arguing that sustainable supply chains address not only environmental concerns but also social issues, ensuring that businesses contribute positively to society.
- c) **Environmental Protection:** SSCM assists companies reduce their adverse environmental impact by limiting waste, minimizing greenhouse gas emissions and conserving natural resources. Implementation of environmentally conscious practices aids businesses lessen their environmental effect and better comply with regulations. According to Seuring and Muller (2008), sustainable supply chains integrate environmental dimensions into SCM to lessen the adverse environmental effects of manufacturing and distribution processes.
- d) **Risk Management:** Sustainable practices in supply chains can lead to better risk management by reducing exposure to environmental and social risks, Rao and

Holt (2005). Sustainability in SCM will help the businesses in lowering the risks of scarce resources, changing rules & regulations and reputational harm. It enables businesses to build robust supply chain networks that can endure changes in the environment and economy.

- e) **Consumer Demand and Market Positioning:** In the modern world, sustainable and ethically procured products are in high demand amongst consumers. Companies may better meet these goals, strengthen their brand image, and win over customers by adopting sustainable supply chains. Tate, Ellram, and Kirchoff (2010) further noted in their study that businesses are adopting sustainable supply chain methods because of growing customer awareness and increasing demand for sustainability

2. PRINCIPLES OF SUSTAINABLE SUPPLY CHAIN

The principles of SSCM are fundamental measures that help organizations orient their supply chains with sustainability goals. These principles prioritize the integration of economic, social and environmental dimensions into supply chain practices. Major principles include:

a) Economic Viability

Sustainable supply chain strategies must be economical alongside contributing to the organization's future growth to be considered 'Economically Viable.' The present strategy emphasizes meeting sustainability targets whilst optimizing expenses, enhancing productivity and adding value for all stakeholders. According to Carter and Rogers (2008), an essential principle of SSCM is Economic Viability, which assures that sustainability efforts do not negatively impact the company's financial performance.

b) Social Responsibility

Maintaining ethical labor standards, encouraging diversity, and protecting human rights are all part of SSCM's social obligation. Another part of this idea is that it adds a great deal to the communities where the supply chain is located. Carter and Jennings (2002) state that social responsibility, which obligates businesses to handle issues like labor laws, community involvement, and sustainable procurement is a crucial component of SSCM.

c) Environmental Stewardship

With several strategies like waste reduction, energy conservation, and mindful handling of resources, this principle suggests limiting the detrimental consequences of supply chain operations on the environment. Companies are being urged to reduce pollution and their carbon footprint by implementing eco-friendly procedures and technology. Seuring and Muller (2008) went on to say that companies should concentrate on lowering their ecological impact throughout the supply chain and that environmental stewardship is of paramount importance for SSCM.

d) Transparency and Accountability

In any type of business, communication with stakeholders, detailing the functioning of the supply chain and related sustainability policies is vital. Communication should be transparent meaning that the organization should have open, clear and honest discussions with its stakeholders. Parallely, accountability should also be ensured on part of the organization, highlighting the social and environmental impacts of the supply chain performance. Pagell and Wu (2009) valued the importance of transparency and accountability in supply chains and added that these factors enhance confidence and assurance to sustainability standards.

e) Collaboration and Stakeholder Engagement

‘Collaboration’ and ‘Stakeholder Engagement’ are important principles for sustaining the supply chain, as they assist in ensuring the best sustainable practices Vachon and Klassen (2008). In simple terms, collaboration means working together for a common objective. The organization should involve various stakeholders like suppliers, clients, business partners, professional institutions, experts etc. engaged in each stage of supply chain and work towards a common goal. Engaging various stakeholders ensures that sustainability standards are achieved as per the needs and requirements of all parties associated with the process of supply chain operations.

The above principles guide companies in creating and managing supply chains that are not just profitable and energy-efficient, but also ethical and sustainable in every facet.

3. TOOLS AND TECHNIQUES FOR SUPPLY CHAIN SUSTAINABILITY

Achieving economic viability, promoting social responsibility, and meticulously lowering environmental impact all depend on the effective implementation of tools and techniques in supply chain sustainability. Companies may identify and reduce environmental hazards across the supply chain with the help of appropriate techniques such as Life Cycle Assessment (LCA) and Environmental Management Systems (EMS). This results in optimum utilization of resources and decreased emissions (Seuring & Muller, 2008). According to Carter & Rogers, 2008, some strategies like green procurement and supplier sustainability scorecards can help companies in ensuring their suppliers’ adherence to sustainability standards, facilitating a strong supply chain network. According to Rao & Holt, 2005, techniques like reverse logistics and sustainable packaging can help companies reduce waste and improve material effectiveness, eventually contributing to a sustainable economy. In addition to improving supply chain sustainability, the strategic execution of these tools and techniques offers competitive benefits through cost reduction, risk mitigation and improved brand image (Vachon & Klassen, 2008).

TECHNIQUES	PURPOSE	APPLICATION
Life Cycle Assessment (LCA)	To evaluate the environmental impact(s) associated with all stages of a product's life cycle, from raw material extraction to disposal.	Identifies areas for improvement in product design, manufacturing, and end-of-life processes to reduce environmental impact.
Sustainable Sourcing	To procure materials and services from suppliers that meet environmental and social standards.	Ensures that suppliers use sustainable practices such as reducing waste, conserving energy, and treating workers fairly.
Green Logistics	To minimize the environmental impact of logistics activities, including transportation, warehousing, and distribution.	Techniques include optimizing delivery routes, using energy-efficient vehicles, and reducing packaging waste.
Circular Economy Practices	To create a closed-loop system where products and materials are reused, repaired, or recycled.	Involves designing products for longevity, encouraging product returns for recycling, and finding secondary uses for waste materials.
Supplier Relationship Management (SRM)	To collaborate with suppliers to achieve sustainability goals.	Involves setting sustainability criteria for suppliers, monitoring their performance, and working together on improvement initiatives.
Carbon Footprint Analysis	To measure the greenhouse gas emissions generated by supply chain	Helps companies identify the most significant sources of

	activities.	emissions and develop strategies to reduce them.
Blockchain Technology	To enhance transparency and traceability in the supply chain.	Records and verifies transactions throughout the supply chain, ensuring that products meet sustainability standards.
Renewable Energy Integration	To reduce reliance on fossil fuels by using renewable energy sources in supply chain operations.	Involves using solar, wind, or bioenergy for powering production facilities, transportation, and other supply chain activities.
Environmental Management Systems (EMS)	To systematically manage and improve environmental performance.	Standards like ISO 14001 provide a framework for organizations to reduce their environmental impact.
Sustainable Packaging	To reduce the environmental impact of packaging materials.	Involves using recyclable, biodegradable, or reduced packaging materials.
Waste Minimization and Recycling	To reduce the amount of waste generated by supply chain activities.	Techniques include process optimization, waste audits, and establishing recycling programs.
Energy Efficiency Programs	To reduce energy consumption in supply chain operations.	Implementing energy-efficient technologies and practices in production, transportation, and warehousing.
Social Compliance Audits	To ensure suppliers adhere to social and ethical standards.	Regular audits assess labor practices, workplace conditions, and human rights

		compliance.
Technology and Automation	To optimize supply chain operations and reduce environmental impact.	Utilizing technologies such as IoT, AI, and big data to improve efficiency and reduce waste.
Consumer Education and Engagement	To promote sustainable consumption practices.	Educating consumers about the environmental impact of their purchases and encouraging sustainable choices.

4. CASE STUDIES

4.1 EVOLUTION OF SUPPLY CHAIN MANAGEMENT TOWARDS SUSTAINABILITY

a) UNILEVER



When it comes to implementing sustainability into supply chain, Unilever has advanced significantly in recent years. The company's "Sustainable Living Plan" aims to reduce the harmful environmental effects of its products in order to enhance the lives of those connected to its supply chain. Some remarkable initiatives of the company include lowering greenhouse gas emissions throughout the supply chain, accelerating water efficiency and procuring 100 percentage of its agricultural raw materials sustainably. Unilever has made substantial progress in sourcing sustainable tea and palm oil which is in line with its larger sustainability goals. (Unilever, 2023, *Unilever Sustainable Living Plan*).

b) PATAGONIA



The outdoor apparel company Patagonia is widely renowned for its dedication and commitment to environmental sustainability. The business prioritizes fair labor practices and utilizes recycled materials into its products. Furthermore, Patagonia promotes campaigns like the "Worn Wear", which encourages clothing repair and reuse as an alternative to new buys. This initiative reduces wastage and drives a circular economy (Patagonia, 2023, *Worn Wear*).

e) **IKEA**



IKEA has taken several steps to incorporate sustainability into its supply chain. By 2030, the company plans to manufacture all its products using recycled or renewable materials, and it has committed to procure all its wood from sustainable sources. Additionally, in the current scenario, IKEA's supply chain employs energy-saving and carbon-emissions-reducing strategies (IKEA, 2023, *People & Planet Positive*).

d) **NIKE**



Nike's "Move to Zero" project, which aspires to achieve zero waste and zero carbon, has implemented a few sustainable practices into their supply chain. Nike is currently embracing

eco-friendly materials in their products, like organic cotton and recycled polyester. To minimize waste and energy usage in its manufacturing processes, the corporation also invests in cutting-edge technologies including digital transformations (Nike, 2023, *Move to Zero*).

e) **STARBUCKS**



Starbucks has proved its commitment to sustainability by implementing several supply chain initiatives. Coffee and Farmer Equity (C.A.F.E.) Practices, which promote ethical coffee procurement is one such remarkable initiative. The corporation stresses lowering its environmental impact, safeguarding ethical procurement of raw materials for its products, and upgrading the economic and social circumstances of coffee farmers across the world (Starbucks, 2023, *Ethical procurement*).

The above case studies demonstrate how leading companies around the world are incorporating sustainability into their supply chains through various strategies, ranging from sourcing and inventory management to maintaining energy efficiency and waste minimization.

4.2 **CASE STUDIES FROM DIFFERENT SECTORS HIGHLIGHTING THE IMPLEMENTATION OF SUSTAINABLE SUPPLY CHAIN PRACTICES**

SECTOR	COMPANY	DESCRIPTION	REFERENCE
Retail Sector	Walmart	Walmart Inc., an American multinational retail corporation also known as global retail giant has made tremendous efforts for <u>greening the business, particularly sustaining the supply chain.</u> One such effort is the newly launched 'Sustainability Index.' It evaluates the negative environmental impact of <u>the products it sells and takes necessary actions to further improvise it.</u> The corporation is also taking various eco-friendly initiatives such as limiting greenhouse gas emissions, improving energy efficiency and procuring sustainably. Another remarkable initiative is its 'Project Gigaton', which involves collaborating with suppliers to reduce emissions in its supply chain operations. Through this initiative, Walmart has pledged to limit its carbon footprint by One Gigaton by 2030.	Walmart. (2023). <i>Project Gigaton.</i>
Automotive Sector	BMW Group	Recently the automotive sector is <u>gaining importance due to its increasing widespread range of companies including BMW, Mercedes Benz, Ford, Chevrolet, Toyota etc.</u> BMW is one such remarkable example in this sector which has integrated sustainability into its supply chain operations, through its "Sustainable Value Report. The report highlights the company's commitment to the environment and society. The corporation has its <u>own guidelines for betterment of the</u>	BMW Group. (2023). <i>Sustainable Value Report.</i>

		environment and society which <u>includes elimination of CO₂ emissions and ensuring renewable energy throughout its supply chain operations.</u> BMW has made noteworthy investments in electric vehicle technology and <u>came up with an initiative known as "Supplier Engagement Program" ensuring sustainability among its stakeholders.</u>	
Technology Sector	Apple	In the technology sector, an American multinational corporation and technology company, 'Apple Inc.' has gained immense popularity over the years. Through its "Environmental Responsibility Report," the company has made significant progress in SSCM. At present, the company has made an extraordinary move to 100% recycled aluminum for its products and is also prospecting green energy solutions with its stakeholders. For its long-term viability, the company targets reducing its carbon footprint, using recycled materials, and ensuring responsible sourcing of materials thereby enhancing fair labor and eco-friendly practices in its supply chain operations.	Apple. (2023). <i>Environmental Responsibility Report</i>
Food and Beverage Sector	Danone	The French multinational food-products corporation, 'Danone,' has launched " <u>One Planet One Health</u> " framework in 2017 which highlights its commitment towards SSCM. Through the framework, it highlights different ways through which sustainable	Danone. (2023). <i>One Planet One Health.</i>

		agriculture can be achieved. Accordingly, it invests in <u>different projects which help in enhancing water management, promoting eco-friendly agriculture and limiting the pollution caused by greenhouse gas emissions.</u> It also strictly follows the principle of transparency and accountability for incorporating sustainability into its supply chain.	
Pharmaceutical Sector	Johnson & Johnson	In the Pharmaceutical Sector, American multinational pharmaceutical, Johnson & Johnson Pvt Ltd. (J&J) is a leading company which <u>has achieved enormous acceptance over the years.</u> Ensuring energy-efficient resources, waste management and water conservation are some of its outstanding initiatives. The company has successfully implemented sustainability into its supply chain through its "Health for Humanity" initiative, where it focuses on sustainable procurement of raw materials. The company also strictly follows the principles of transparency and accountability for better adaptation of SSCM.	Johnson & Johnson. (2023). <i>Health for Humanity Goals.</i>

These case studies illustrate how companies across various sectors are integrating sustainability into their supply chains, addressing environmental, social, and economic issues thereby achieving significant impacts in their respective industries.

5. CHALLENGES/BARRIERS IN IMPLEMENTING SSCM

Implementing SSCM poses several challenges/barriers, which can complicate the adoption of sustainable practices across supply chains. These challenges include:

a) Cost Implications

Transitioning to sustainable practices often requires significant financial investment, such as in new technologies, infrastructure, and training. The initial costs can be prohibitive, particularly for small and medium-sized enterprises (SMEs). Pagell and Wu (2009) highlighted that the perceived high costs associated with sustainability initiatives are a major barrier to SSCM adoption.

b) Complexity of Supply Chains

Modern supply chains are often global and complex, involving numerous suppliers, partners, and stakeholders across different regions. It is quite challenging to coordinate and assure sustainability among all the entities. According to Seuring and Muller (2008), it is difficult to continuously evaluate and execute sustainable practices due to the complicated and varied nature of supply chains across the world.

c) Lack of Standardization

Lack of Standardization is one of the main barriers for the implementation of sustainability in the supply chain. As no specific standards and norms are mentioned for measuring sustainability, different

companies adopt different strategies which result in variations. Uniformity is hampered. Carter and Rogers (2008) also agree to this fact as they mention that ‘Implementation of sustainable supply chain may be affected by the lack of globally recognized standards for sustainability.’

d) Supplier Resistance

At times the suppliers become hesitant to supply eco-friendly raw materials for the production process which is a barrier for implementing sustainability into the supply chain operations. It may be due to inadequate knowledge of the suppliers relating to the greening of the supply chain. As suppliers are in the initial phase of the supply chain, this barrier is likely to affect the entire green supply chain operation. Vachon and Klassen (2008) highlighted ‘financial constraints’ as one of the main causes for supplier resistance.

e) Limited Consumer Awareness and Demand

End users of supply chain operations or ‘Consumers’ play a pivotal role in SSCM. Lack of consumer awareness can be one of the main barriers for failure of SSCM, Rao and Holt (2005). When consumers are less aware about eco-friendly practices, their demand for such products tend to decline, which indirectly affects the supply. Companies become less likely to invest in SSCM and the worldwide acceptance of sustainability might be affected.

f) Regulatory and Compliance Issues

Understanding the regulatory framework can be challenging, especially for companies that operate in different nations with varying social and environmental laws. Following these different rules could end up being complicated and expensive. Carter and Jennings (2002) added to this stating that legal obstacles requiring adherence to a range of international standards may have an impact on the adoption of SSCM.

g) Technological Challenges

Using SSCM frequently necessitates incorporating new technologies for tracking, communicating, reporting and enhancing sustainability programs. On the contrary, technological barriers, such as limited access to information or resources, may hamper advancement. Seuring and Muller (2008) also agreed to this by stating that, ‘It might be difficult for many companies worldwide to achieve the SSCM’s technology standards because they are purely changing.’

6. FUTURE TRENDS IN SSCM

Upcoming developments in SSCM will increasingly focus on incorporating cutting-edge technologies, enhancing transparency, and advocating for the circular economy’s

principles. The integration of digital transformation, such as blockchain technology and the Internet of Things (IoT), is expected to be crucial in promoting supply chain traceability and transparency. Blockchain supports ethical and sustainable procurement practices by offering safe, secure, and immutable records that facilitate tracking the movement and origin of items (Kshetri, 2018). According to Zhao et al., (2020), real-time supply chain tracking is made possible by IoT devices, which improves resource management and reduces waste. Plus, there is a growing trend in companies abandoning conventional supply chains in favor of models that emphasize product reuse, recycling, and waste reduction as a means of implementing circular economy strategies (Geissdoerfer et al., 2017). The shift helps to lessen the impact on the environment and encourages a more sustainable lifetime strategy. Likewise including social sustainability into SSCM is becoming more and more important to improve fair labor practices and fair civic engagement (Carter & Rogers, 2008).

7. SUMMARY OF KEY INSIGHTS AND STRATEGIC RECOMMENDATIONS FOR IMPLEMENTING SSCM

SSCM is a strategy made up of three pillars i.e. social performance, economic performance and environmental performance. To implement SSCM, an integrated strategy that combines social, economic, and environmental goals is required. Prominent discoveries underscore the importance of integrating modern innovations like blockchain and IoT to enhance transparency, accountability, reliability, traceability and agility across the supply chain. To minimize waste and its negative effects on the environment, businesses should give top priority to implementing the circular economy’s reuse, reduce and recycling of materials. Investing in partnerships with suppliers, giving adequate instruction, and setting transparent sustainability criteria are some of the well-known strategies that companies should follow to overcome challenges such as supplier unwillingness and high initial expenses. For resilient and sustainable supply chain, customer awareness and demand for sustainable products play a crucial role. Few examples of strategic recommendations include incorporating sustainability into the core company plan, obtaining senior management support, and regularly monitoring and reporting on sustainability performance. Companies may reduce their negative environmental effects while also obtaining long-term financial and social benefits by implementing these methods and practices, which will eventually lead to a more resilient and sustainable supply chain.

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