



# Sustainable Supply Chain Management: Evolution, Directions and Digitalization

Dr. Poonam Mittal<sup>1</sup>, Dr. Mamta<sup>2</sup>

<sup>1</sup>Associate Professor, Dr. Bhim Rao Ambedkar College, University of Delhi.

<sup>2</sup>Associate Professor, Dr. Bhim Rao Ambedkar College, University of Delhi.

## **ABSTRACT:**

*A first-order supply chain is characterized by the use of non-renewable and non-recyclable materials, whereas sustainable supply chain management is characterized by the use of renewable and recyclable resources.*

*The convergence of supply chains and sustainability are taken into account. As a result, the emphasis on environmental management and operations shifts from local optimization of environmental aspects to consideration of the entire supply chain throughout product manufacturing, consumption, customer service, and post-disposal disposition. This is an important and timely topic that reflects growing concerns about sustainability, whether driven by existing legislation, public interest, or competitive potential. The objective of this paper is to outline the various facets of sustainable supply chain management.*

*As a result, sustainable development is a fertile ground for an academic study that has the potential to influence future government policy, existing manufacturing processes, and the identification of new business models. This paper provides context for a better understanding of current trends in this diverse topic that intersects with operations management, as well as the research opportunities and difficulties it presents.*

**Keywords:** Supply Chain Management, Sustainability, SSCM.

## **SECTION 1: INTRODUCTION AND REVIEW OF LITERATURE**

The concept of supply chain management (SCM) has been gaining importance since the early 1980s (1). The SCM approach is derived from the fact of dependence between the levels in the channels from the point of origin to the point of consumption (2). Usually, in SCM, point of origin refers to suppliers or manufacturers while point of consumption refers to consumers, customers or end-users. A supply chain through which a commodity, product or service is marketed (2). The connection between sustainability and supply chains is a vital next step following recent investigations into operations and the environment and operations and sustainability (3).

While the supply chain management concept has made significant contributions in the areas of environmental operations, policy and strategy, and consumer product management. It is important to address the systemic issues of supply chain sustainability, and environmental management. It takes into account both the stability and the supply network. The diversity of areas in which it explores sustainability problems and consequences demonstrates its multidisciplinary character. Finally, this paper explored the emerging field of sustainable supply chain research.

Although Christopher devised the term supply chain management, it still has considerable similarities with the concept of logistics (strategic logistics) created by the ideas of the French school of thought. The difference, if any, is that supply chain management involves a clear and mutual search for alliances and collaborations with shared risks and benefits among players. According to Harland(1996), the number of enterprises engaged in logistics operations differentiates supply chain management. A supply chain includes decision-makers, resources, information and/or processes, and all parties involved in executing client orders.

In addition, supply chain management is also referred to as controlling supply chain operations, resources, information, and money in such a way as to maximize the profitability or surpluses of the supply chain, which is the difference between the revenue generated from customer orders and all costs incurred by the supply chain. The ability to conduct business with the long-term objective of economic, environmental, and social welfare is characterized as business sustainability. We are now prepared to present a unified definition of sustainable supply chain management as the management of supply network operations, resources, information, and money in order to maximize supply chain profitability while reducing the environmental effect.

Reviews of the literature on Sustainable Supply Chain Management definitions suggest that Sustainable Supply Chain Management is the voluntary integration of social, economic, and environmental considerations with key inter-organizational business systems to create a coordinated supply chain to effectively manage the material, information, and capital flows associated with the procurement, production,

and distribution of products or services to meet short and long term profitability, stakeholder requirements, and competitiveness.

The study examines the literature on sustainable supply chain and management before developing a framework for sustainable supply management. Much of the research on sustainable supply chains is considered part of Corporate Social Responsibility (CSR), with little or no acknowledgement of the interrelationships between themes such as environment, diversity, and sustainability as an independent strategy. Human rights, philanthropy, and security are, in reality, components of broader, more comprehensive ideas of CSR and sustainability as they pertain to supply chain management (4).

Managers sometimes miss opportunities to learn from the successes and failures of environmental efforts because they do not know how to apply this information to future projects in other parts of their business in other areas of sustainability, such as diversity and safety concerns, and so on (4). They incorporate management literature on social responsibility and use a hierarchy of economic, legal, ethical, and discretionary responsibility to place standalone supply chain management activities within the context of discretionary activities and thus social responsibility. (Murphy, 2003) also includes stand-alone actions within the umbrella of social responsibility, emphasizing the need to "seek socially positive consequences in addition to economically profitable ones." Both of these studies included environmental and social initiatives under the umbrella of social responsibility. Despite the inclusion of economic responsibility by these and other social responsibility researchers, much of the existing literature in the field of "logistics social responsibility" has operationalized the environmental and/or social dimensions of CSR without explicitly accounting for economic performance. Managers in the industry have frequently considered social responsibility as just that, an obligation, which did not always result in financial benefits (6). (Carter, 2008) incorporates complementary theoretical bases to introduce a theoretical framework of sustainability as it is applied to the supply chain, a concept which they refer to as Sustainable Supply Chain Management.

At the core of this conceptualization is the triple bottom line: the intersection of environmental, social, and economic performance (8). This is a parsimonious and potentially powerful means of conveying what sustainability means for an organization. Rather than suggesting that firms identify and engage in social and environmental activities, which will hopefully help, or at least not harm, economic performance, the triple bottom line explicitly directs managers to identify those activities, which improve economic performance and dictate the avoidance of social and environmental activities, which fall outside of this intersection.

(Carter and Rogers 2008) suggest that engaging in sustainability, and Sustainable Supply Chain Management, in particular, is not discretionary, but rather a requirement. Sustainable Supply Chain Management involves the long-run improvement of an organization's economic bottom line and helps managers to answer the question of, "What is it that we need to do, not just to survive, but to thrive, and not just one year, three years, or five years from now, but in ten years, 20 years, and beyond?" Again, this

is a salient conceptualization that can begin to allow managers to take tangible actions. (Mentzer, 2001) explained SCM as the systemic, strategic coordination of traditional business processes and techniques across various business functions inside a specific firm and between businesses within the supply chain, with the goal of increasing the long-term performance of individual enterprises and the supply chain as a whole. While few studies expressly address supply management sustainability challenges, this research seeks to explore the aspects that will affect SSM through the construction of a theoretical framework and empirical investigation.

## **SECTION 2:**

### **OBJECTIVES:**

The objective of this paper is to outline the various facets, significance and digitalization of sustainable supply chain management. This paper provides context for a better understanding of current trends in this diverse topic that intersects with operations management, as well as the research opportunities and difficulties it presents.

## **SECTION 3:**

### **SIGNIFICANCE AND DIGITALIZATION OF SSC (10)**

#### **1. Reduced environmental impact**

There is a common misconception that reducing the environmental impact of a business comes at a cost. In fact, it can lead to big savings. By reducing waste and increasing the efficiency of buildings, vehicles and machinery, returns can be easily seen.

#### **2. Improve continuity of supply**

The supply chain should be diversified to avoid over-reliance on a single link. There have been many cases over the years of suppliers being unable to fulfil a service or product, which has then had knock-on effects for other businesses.

Having multiple suppliers in different parts of the world can help improve the continuity of products or services, preventing costly downtime and reputation damage.

In 2011, a harsh monsoon season (that was attributed to climate change) in Thailand caused global prices of hard drives to rise. Two of the world's largest hard drive manufacturers were overly reliant on their Thai suppliers who found themselves unable to fulfil orders, leading to delays, shortages and steep costs.

### 3. Protecting against reputational damage

With information readily available online, the supply chain also affects brand reputation. It's important to protect reputation to enhance business growth.

Ensure strategy for sustainability enhances the lives of every worker throughout the chain. This includes ensuring fair working conditions, and pay and minimizing environmental impact. Workers should not be subjected to unnecessary risk.

Apple has fallen foul of this with the working conditions of their Chinese factory coming under scrutiny. There were concerns their new cheaper iPhone was being produced under illegal and abusive conditions.

Between 2016 and 2018, the tech brand lost 27 places, from 2nd to 29th, in the Reputational Quotient Poll, which will have had detrimental effects on their profits. The report from Apple shows they've had the worst-performing quarter since 2016, losing market share in China and Japan.

### 4. Potential for new partnerships

A business with a sustainable supply chain is also an attractive prospect for other companies looking to partner with it. The environmental credentials of a business will likely align with the values of another brand. In turn, this opens up potential partnership opportunities.

Sainsbury is an example, the company partnered with vets to support its dairy farmers, teaching them how to find and deal with common health problems. This has led to each of the 55,000 cows producing 140 litres of milk more than the national average. Healthier cows mean happier cows, which leads to fewer cows being required to fulfil demand.

### 5. Win more business

A sustainable supply chain can land more business as one proves its green credentials. Businesses can further support this through internationally recognised standards, such as ISO 14001. Often a requirement in business tenders, ISO 14001 is a management system that helps identify gaps in the business where green efficiency savings can be made.

If a business reviews its supply chain and can make changes, the rewards are plentiful. Taking positive action can lead to big savings and better margins, along with reducing the damage we are doing to the planet.

## Different Standards of Sustainable Supply Chain Management

Over the last two decades, environmental issues of supply chain management have been the primary focus of study. Of course, the environment is an important component of the triple bottom line, and it has been in the news due to climate change and rising energy prices. To some extent, both scholars and management have used

the terms "sustainability" and "environment" interchangeably. However, as opinions converge, we are now seeing a more consistent understanding and implementation of the phrase sustainability as the triple bottom line.

The United Nations General Assembly created the United Nations Conference on Environment and Development (UNCED) in December 1992, and the Commission on Sustainable Development (CSD) was formed to guarantee that the conference's follow-up is efficiently established. The goal of the Commission on Sustainable Development (CSD) in terms of sustainable development is to make indicators of sustainable development at the national or country-level available to decision-makers for policy formation and sustainable development initiatives. The Commission defines/creates techniques and frameworks for stakeholders (Commission on Sustainable Development, 2002). The effort is a follow-up to the Brundtland report on sustainable development from the Earth Summit, and it focuses on the four elements of sustainability: social, environmental, economic, and institutional.

This visual interface, created in 1998, is used to present and report on a country's performance in terms of sustainability. The indicator focuses on a country's progress toward sustainable development and hence reports using a graphical display. Furthermore, the dashboard, which is separated into four dials, reports on the many characteristics of sustainability. Using the dashboard, a country's performance may be simply seen on a single platform, making it simple to make inferences about a country's efforts/success (Dashboard Sustainability).

**The Global Reporting Initiative (GRI):** The Global Reporting Initiative (GRI) provides a framework for organizations to disclose and incorporate their sustainability performance. It identifies and assists society stakeholders in understanding corporate activities for holistic development. GRI focuses on the triple bottom line idea, as envisioned by Elkington et al 1997, by balancing the complicated linkages between present economic, environmental, and social demands in a way that does not jeopardize future needs.

**The Triple Bottom Line Index (TBL):** The Triple Bottom Line Indicator is a composite index that measures an organization's sustainability performance. The indicator computes the total of economic growth or wealth creation, environmental improvement, and equitable wealth distribution while taking social wellbeing into account (Elkington 1998).

**The Dow Jones Sustainability Index (DJSI):** The Dow Jones Sustainability Index tracks the performance of the top 10% of organizations in terms of corporate sustainability activities and practices (Jones, 2005). According to the index, sustainability or sustainable development is a long-term strategy for increasing shareholder value. Organizations should produce long-term value for shareholders by seizing opportunities and managing risks connected with economic, environmental, and social developments.

**ISO-14000:** ISO 14000 standards are primarily concerned with environmental issues and their management in various organizations. It is a collection of principles and a framework for guiding and measuring the outcomes

of an organization's operations and practices. Other ISO14000 family standards, on the other hand, are frameworks with a focus on specific environmental features such as life cycle analysis, communication, and auditing of environmental management systems (ISO 14000).

(Gopal and Thakkar 2012) conclude from their research that the supply chain should have some of the following qualities.

1. Supply chain management metrics must be capable of dealing with both long and short product life cycles.
2. Metrics for supply chain management should take into account push, pull, and push-pull supply chains.
3. The supply chain metrics system/model should be mathematically sound.
4. Supply chain management indicators should be sector-neutral, allowing them to be cross-functionally applicable across sectors.
- 5 Metrics for supply chain management should also include measurements for continual improvement.
6. In the current network era, supply chain management metrics should be customized for complicated supply chain networks.
7. Supply chain management metrics should be flexible in order to assist organizations in understanding and responding to the quickly changing value addition curve.
8. To handle various supply chain collaborations and partnerships, supply chain management metrics should have defined KPIs.
9. The competitive climate necessitates empirical measurements and case study methods to supply chain measurement.
10. Supply chain management metrics could also assist organizations in categorizing indicators depending on long and short-term supply chain strategy.

A sustainable supply chain is one that fully integrates ethical and environmentally responsible practices into a competitive and successful model. End-to-end supply chain transparency is critical; sustainability initiatives must extend from raw materials sourcing, to last-mile logistics, and even to product returns and recycling processes (12).

## Digital transformation in the supply chain

Digitalization allows companies to meet and exceed sustainability benchmarks while also innovating and growing their businesses.

**Artificial intelligence:** AI technologies allow for the curation and analysis of multiple, disparate data sets across the supply chain. A particularly powerful benefit that AI brings to the sustainable supply chain is the capacity for synchronicity and collaborative shipping. This means tracking the status and location of packages to take real-time advantage of opportunities to combine shipments or utilize less resource-heavy logistics if time permits.

**Machine learning:** As an application of AI, machine learning uses Big Data to help systems and connected devices adapt in real-time – to discover patterns, learn from experience, and automate agile and responsive workflows. For supply chain managers, the operational optimization measures that come out of this process can significantly reduce waste and energy usage.

**Robots and automated things:** Online shopping has risen by over 149% since the start of 2020. With many customers expecting fast or next-day delivery, we are pushing the existing capacity of warehousing and last-mile logistics provision to its breaking point. Electronic drones and inventory management robots are examples of automated things that can be optimized with intelligent automation to improve workflow efficiency, optimize energy, and save on fossil fuel usage in the logistics network.

**Additive manufacturing:** Also known as 3D printing, additive manufacturing allows companies to maintain virtual inventories and manufacture stock on demand. The ability to manufacture on-site and on-demand eliminates fossil fuel usage and other resources used in overseas shipping and packing. It also has the potential to use recycled plastics from within the supply chain loop as the base material for 3D manufacturing.

**Industrial Internet of Things (IIoT):** When connected devices and machines within a business are fitted with unique identifiers and the ability to send and receive digital data, they become part of an IIoT network. Asset intelligence in a sustainable supply chain can help to optimize machine performance and automate maintenance to reduce energy usage and eliminate redundancies in workflows.

**Blockchain:** In sustainable supply chains, blockchain is particularly useful in its ability to act as a single source of truth. Through the use of sensors, products and materials can be accurately tracked back to their source to remove any speculation as to their provenance, quality, and handling – at any stage across the supply chain.

**Sensors:** RFID (Radio Frequency Identification) devices and other small, inexpensive sensors can easily be fitted to products and raw materials – at their source or anywhere along the supply chain. When partners and suppliers comply with mandatory sensor attachment, an unprecedented level of transparency is achieved.

**Modern databases and Enterprise Resource Planning:** The best sustainability solutions run on in-memory databases and ERP systems that can manage Big Data and diverse, complex processes. The technologies and automated components of a sustainable supply chain are dependent upon predictive and advanced analytics as well as on the real-time insights made possible by these modern, centralized business systems.

And with the proper use of digital solutions, enterprises can achieve an increase in profits by optimizing production and other economic processes, increasing labour productivity, attracting new consumers, etc. Ultimately, this allows the organization to make any decisions based on more information, taking a better position in any external circumstances (Rogetzer et al., 2019)

Several researchers claim that this revolution will have an enormous impact on every aspect of the economy. Sustainability is no exception to that, especially when we consider its triple bottom line (i.e., economic, social, and environmental). In particular, experts agree that digitalization will increase the importance of the external industrial ecosystem and supply chain collaboration. Potential changes encompass all supply chain areas, from supplier management to distribution, warehousing, and transportation. Firms are using sensors to capture all kinds of data in supply chains with low human intervention, efficiently sharing information through wireless communication networks and cloud computing and analyzing it using big data and artificial intelligence algorithms. Simulation techniques, such as digital twins and augmented reality, are being used to develop new products and produce customized products using 3D printers and cyber-physical production systems. (14)

#### **SECTION 4: CONCLUSION**

Businesses are grappling with concerns of sustainable development and sustainability, which are related to resource availability and changing dynamics. Natural resource availability is decreasing, demand patterns are shifting, and business dynamics are changing. In this scenario, maintaining economic success in the framework of environmental responsibility and social stewardship becomes more prudent. Organizations must concentrate on business processes and initiatives to produce long-term stakeholder value in their goods and services.

There are no established assessments or measuring tools to assess an organization's adoption of sustainable practices. In the midst of organizational attempts to embrace sustainability-based practices and strategies, supply chain management takes center stage since it encompasses the conversion of resources from raw material to completed products and the movement of material and energy along the whole value chain.

It is not yet clear the net impact of digitalization on sustainability, or how companies should redesign their supply chains and business models to better leverage such opportunities and avoid threats. On the one hand, firms can reap immense sustainability benefits from digitalization, such as through reduced waste and consumption of resources by streamlining supply chain processes and decentralizing production, improved worker safety through greater process autonomy, or acquiring better control of suppliers. However, there are also potential threats, for example, transparency and data security concerns, increased supply chain costs, rapid product obsolescence, the entrance of new types of industry competitors, or the complete redefinition of the typical roles and power in supply chains (14) Blockchain technology could be the answer to this threat.

#### **REFERENCES:**

- 1 . Oliver, R. Keith, and Michael D. Webber. 1982. "Supply-Chain Management: Logistics Catches up with Strategy." *Outlook* 5(1):42–47.
2. Snehota, Ivan, and Hakan Hakansson. 1995. "Developing Relationships in Business Networks."

- 3 . Kleindorfer, Paul R., Kalyan Singhal, and Luk N. Van Wassenhove. 2005. “Sustainable Operations Management.” *Production and Operations Management* 14(4):482–92.
4. Carter, Craig R., and Marianne M. Jennings. 2002. “Social Responsibility and Supply Chain Relationships.” *Transportation Research Part E: Logistics and Transportation Review* 38(1):37–52. doi: [https://doi.org/10.1016/S1366-5545\(01\)00008-4](https://doi.org/10.1016/S1366-5545(01)00008-4).
5. Murphy, Paul R., and Richard F. Poist. 2003. “Green Perspectives and Practices: A ‘Comparative Logistics’ Study.” *Supply Chain Management: An International Journal*.
6. Walley, Noah, and Bradley Whitehead. 1994. “It’s Not Easy Being Green.” *Reader in Business and the Environment* 36(81):4.
7. Carter, Craig R., and Dale S. Rogers. 2008. “A Framework of Sustainable Supply Chain Management: Moving toward New Theory.” *International Journal of Physical Distribution & Logistics Management*.
8. Elkington, John. 1998. “Accounting for the Triple Bottom Line.” *Measuring Business Excellence*.
- 9 . Mentzer, John T., William DeWitt, James S. Keebler, Soonhong Min, Nancy W. Nix, Carlo D. Smith, and Zach G. Zacharia. 2001. “Defining Supply Chain Management.” *Journal of Business Logistics* 22(2):1–25.
10. <https://www.cips.org/supply-management/opinion/2019/july/five-benefits-of-a-sustainable-supply-chain/>
- 11 . Gopal, PRC, and Jitesh Thakkar. 2012. “A Review on Supply Chain Performance Measures and Metrics: 2000-2011.” *International Journal of Productivity and Performance Management*.
12. <https://www.sap.com/insights/what-is-a-sustainable-supply-chain.html>
13. [https://www.researchgate.net/publication/328463598\\_Impact\\_of\\_Digitalization\\_on\\_Sustainable\\_Supply\\_Chains\\_Okonomische\\_und\\_soziologische\\_Perspektiven](https://www.researchgate.net/publication/328463598_Impact_of_Digitalization_on_Sustainable_Supply_Chains_Okonomische_und_soziologische_Perspektiven)
14. [https://www.mdpi.com/journal/sustainability/special\\_issues/digitalization\\_supply\\_chains](https://www.mdpi.com/journal/sustainability/special_issues/digitalization_supply_chains)
15. Yilmaz, Ayse Kucuk, and Triant Flouris. 2010. “Managing Corporate Sustainability: Risk Management Process Based Perspective.” *African Journal of Business Management* 4(2):162–71
16. [https://www.researchgate.net/publication/227763223\\_Supply\\_Chain\\_Management\\_Relations\\_Chains\\_and\\_Networks](https://www.researchgate.net/publication/227763223_Supply_Chain_Management_Relations_Chains_and_Networks)