

Sustainability in Supply Chain Management of Textile and Apparel Industry

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Abstract

During globalization, cost-effective manufacturing, distribution, and a complete supply chain have been redesigned. The breaking of geographical barriers, ease of offshore manufacturing, and urge of industrialization in so-called developing countries and the evolvement of the concept of industrial equilibrium paved the path of the global supply chain. In any industrial process, many activities are there - starting from raw material sourcing to finished goods packing, which is called the elements of operation, the establishment of the plant, machinery, technology, arrangement of the workforce, strategy, policymaking called management/administration, allocation of fund for fixed capital and to manage the day to day expenses (working capital) called finance, activities like distribution, networking, sales, the establishment of marketing channel, development of customer base as a part of marketing process together form a supply chain management.

Now, the global supply chain is two types regarding on-ground application: i) the nineteenth-century model, i.e., the supply chain under one roof and ii) the model with no geographical bar, i.e., the supply chain activities are distributed as per the best and effective (cost as well as ease) performance-based available location. For example, in the clothing and textile industries, the production base for big retail bulk selling items has been shifted from West Europe to East Europe to China, Bangladesh, Vietnam, Myanmar, Cambodia, and India. Still, sales and distribution are mainly in Europe. However, boutique type customized products are still manufactured in consumer locations, which may not be cost-effective, but there is an ease of handling according to the customer's need.

Again, in operation, the supply chain is multi-country based, e.g., clothing factories are in Bangladesh (cutting, stitching, sewing, inspection and packing), raw materials coming from China and India, and interestingly even in raw material, the first derivative may come from Europe / China. The second derivative is manufactured in India and China. The multi-locational supply chain is due to the most effective performance of the various elements/activities of the supply chain.

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1. Introduction

The supply chain is an essential evil as it has to manage / control/trade-off between three factors of contemporary business, i.e., globalization, competition and sustainability. Globalization is 'anything and everything in everywhere', which means complete access to every product and service in every corner of civilized society. Competition is the survival of the fittest in the business environment, i.e., who wants to survive in a competitive business environment do something unique or offer products or services with the best value for money. Sustainability is the line of control to protect nature and natural life and the livelihood of human beings from the black hole of globalization and absolute competition in the contemporary business environment.

As such, all the elements of human civilization have been built on compromising earth's natural balance; however, that had been done at a slow pace, and the impact was also in the low-key. However, since the last two centuries, the rate of civilization has been fast. Due to the evolving concept of globalization in the previous six to eight decades, the entire world is facing its impact through environmental change, sudden and unprecedented

natural calamity, global warming, shortage of drinking water in many parts of the world, and an alarming indication of many lowlands of human habitats are gradually sinking underwater.

Sustainability issues are in many value chains in the textile and apparel industry. The sustainability factors are associated with natural fibre, i.e., cotton, regenerated cellulose, i.e., viscose or manufactured fibre like Polyester. Table 1 shows a quick understanding of sustainability issues and solutions to a certain degree.

Table 1: Sustainability issues and possible solutions

Fibre	Sustainability issue	Possible solution
Cotton	Excess consumption of groundwater, usage of chemical fertilizer spoils the farmland.	BCI cotton (Better cotton initiative, i.e., cotton farming with less water and chemical fertilizer) Organic cotton (farming of cotton with non-genetically modified plants and without any usage of synthetic pesticides) Recycled cotton
Viscose	They are cutting trees to collect the wood pulp.	Eco viscose, i.e., plantation of trees in the proportion of cutting trees.
Polyester	Non-biodegradable fibre.	Use of recycled polyester (from PET bottles converted into polyester fibre).

Big Hi Street retailers like M&S, NEXT, H&M, and global departmental stores like TESCO and Wall-Mart are buying sustainable products as a commitment to society. Many NGOs, nature protecting organizations and awareness among customers are vital for the corporate / conglomerate/brands / big chain retailers to adopt sustainability as their core objective as part of top-line and bottom-line growth.

Another dimension of sustainability in connection with the supply chain is CSR (corporate social responsibility). When the essential elements of the supply chain are offshore manufacturing (low-cost manufacturing centre), the key focus area of CSR is to ensure the desired work condition, healthy and risk-free work atmosphere, safety and security in the workplace, implementation of country-specific labour law and minimum earning to manage expected/agreed livelihood by the workforce.

Sustainability is a continuous process, and more effective implementation of rules/regulations/laws is required, especially in developing countries that are the world's popular / desired manufacturing hub.

2. Challenges of maintaining sustainability

Since sustainability is the crucial thing associated with globalization, uncontrolled industrialization in many locations, the unprecedented growth of human civilization, over-dependence of technology on human life vis-a-vis destruction of natural resources, global warming, and disappear of natural balance, so the supply chain must comply with the sustainable aspects of industrial process/activities irrespective of geographical locations.

Theoretically, everything is perfect and accurate and as per the stated rules and regulations to the agreed action plan for a sustainable supply chain, but on the ground reality, it may not be followed as per strict guidelines in many geographical locations by compromising the long-term irreversible spoiling of natural balance for short term and immediate human comfort. The adverse environmental effects have forced the industries to adopt a green supply chain. This green supply chain management is still in its inception and has not been widely accepted in the textile industry. Tumpa et al. reported and analyzed the main obstacles in adopting green supply chain management practices. The most critical barrier is low demand from customers, financial constraints, and a lack of government regulations in implementing green supply chain initiatives [1].

3. Sustainable supply chain and corporate social responsibility

Supply chain sustainability is becoming more widely recognized as an essential part of corporate social responsibility. Combating corruption makes excellent business sense and is the right thing to do when managing supply chains' social, environmental, and economic implications. On the other hand, supply chains are made up

of constantly changing markets and relationships. Based on the United Nations Global Compact principles, a few benchmarks have been established and actual initiatives that businesses can take to make progress to negotiate this rugged terrain. Supply chain sustainability is all about managing environmental, social, and economic implications while fostering good governance practices throughout the lifecycles of goods and services. [2]. On the other hand, supply chains are made up of constantly changing markets and relationships. Researchers have devised a strategy for navigating this challenging environment. [3-5].

Academic (experimental and application-based) discussion on the synthesis of sustainability and supply chain management has been growing in the last decade. However, an integrated social and economic sustainability performance measurement in supply chains is an emerging avenue in the sustainable supply chain management discourse. Researchers studied socially sustainable practices' effect on financial performances in supply chains through a structured questionnaire. A conceptual framework and the data were analyzed using Partial Least Square Structural Equation Modelling. They observed that the practices conducted by apparel manufacturers ensuring the social sustainability of the human factor inside the company (Internally Influencing Social Sustainability Practices-ISSP) and in society (Externally Influencing Social Sustainability Practices-ESSP) create a positive impact on the economic performance. However, the effect produced by ISSP was higher than the ESSP [6].

The discussions on sustainability in supply chains are embedded in the Triple Bottom Line (TBL) concept [7] and how the best sustainability performance emerges at the consolidation point of the three dimensions [8]. More importantly, the debate on whether economic benefits can be gained via environmental and social sustainability is an ongoing discussion about SCM [9]. Some researchers also studied the holistic perspective of sustainability to comprehend the economic consequences of sustainability practices [10].

4. Green supply chain

Green supply chain management is a sort of modern management tool which could comprehensively consider the environmental influence and resource utilization efficiency in the whole supply chain [11]. Implementing green supply chain management in industrial operation has become one of the hotspot problems. The adverse environmental effects have forced the industries to adopt a green supply chain. The rapid digitization of endeavour, or Industry 4.0, is trending in supply chain management. The opportunities surrounding digitization have made it possible for supply chains to access, store and process a large amount of data both from within a firm and externally. One application is intelligent devices that record and share data to identify opportunities using learning algorithms [12]. Digitization also allows demand information to be shared directly with actuators in manufacturing plants, leading to shorter changeover time and enhanced service levels. While the amount of data made available through digitization has enabled supply chain benefits, there still exist challenges regarding the rapid digitization of the field. Therein lies opportunities for researchers to leverage the growing amount of data through knowledge management to cultivate valuable information for organizations. Comparisons are conducted on two measurements (prevalence and growth) to determine significant differences between the scholarly publications and practitioner (news and video) media to compare scholarly vs practitioner activity utilizing textual data and google trends data from 2010 to 2018 [13].

5. Environmental aspects in sustainable supply chain

Sustainability has got much interest in supply chain management and has been the subject of research to meet environmental and corporate needs; current academics and practitioners pay considerable attention to environmental issues [14]. When implementing environmentally sound practices, businesses face new obstacles and opportunities [15]. Sustainability is a global issue [16].

6. Handloom and handicrafts - a natural, sustainable supply chain

Handlooms and handicrafts are among the most important cottage industries in the country, providing livelihood to most rural India. As an inherent nature of this activity, it follows a sustainable supply chain model. Several handloom sectors in India are weaving with natural fibres such as cotton, silk, and wool. Most of the villages in India are directly or indirectly dependent on their bread and butter in the handloom and handicraft sector. This sector proudly carries the traditional beauty associated with India's precious heritage. Shrivastava carried out the study to understand the existing supply chain, gain insight through a diagnostic analysis of the environment,

specific realities prevailing, resources available, and map the aspects of the handloom industry. The study and its outcomes aim to bring forth strengths, weaknesses, opportunities, and threats. Interested agencies and Government sectors can use this SWOT to provide or facilitate necessary aids that can bring about positive changes in the lives of the weaver. The study on handicrafts is one of the potential segments for accomplishing sustainable development for better conservation of resources and its moving towards sustainability [17].

As mentioned, any localized industries –handicraft or handloom are sustainable supply chains. This supply chain provides opportunities to local skills and expertise convertible in unique products or services without disturbing natural balance or compromising any form of human livelihood. With the introduction of Trade-Related Aspects of Intellectual Property Rights (TRIPS) under the WTO, GIs have emerged as an essential intellectual asset that not only protects the consumer's interest in high-quality products but also results in specific benefits to localized producers through enhanced economic returns and protection of traditional knowledge or know-how. Thus, GIs have become an essential legal and financial tool for rural development and protecting traditional knowledge.

The introduction of intellectual property rights (IPR) under the WTO regime demonstrates that the decision-making process at an international level affects millions of livelihoods across the globe. This has made governments introduce new laws and legislation, such as enacting the Geographical Indications Act of India in 1999. The inclusion of Geographical Indications (GIs) under the Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement of WTO has been acclaimed by developing countries for its potential to boost rural development, create wealth and protect traditional knowledge. The premium consumers are willing to pay for the GI registered product is inextricably linked to the quality. This calls for a thorough re-organization of the supply chain to adhere to quality and ensure that the revenue arising out of GI is distributed equally along the supply chain. This necessitates strengthening linkages between stakeholders at all levels to foster trust and facilitate access to the market through a sustainable supply chain. The critical challenges in implementing GIs, a key component of IPR, in the traditional livelihood sector, such as handloom weaving in India, have been reported [18].

7. Supply chain management in the textiles and apparel sector

The clothing sector is characterized by short product life cycles, high variability, unpredictable and variable demand, many inventory items, low predictability, impulse buying, high product range, long and inelastic procurement processes and a complicated supply chain. Therefore, the sector can be defined in lean retailing terms, indicating retailers' agility against demands. The rapid renewal of products and satisfying the needs (delivery times, accurate and exact orders) are the absolute requirements of lean retailers within the clothing industry. In sustainable supply chain management (SSCM) research, the motives for apparel firms to employ dedicated certification schemes as sustainability practices have gotten little attention. As a result, it is critical to comprehend the many rationales for establishing certification schemes that have evolved in the past, as they significantly impact the overall effectiveness of sustainability. However, there is a big gap between laid down principles of certifications and on-ground implementation of the same. Oelze et al. did the research work to breeze this gap. Their research methodology was based on an in-depth comparative case study with five managers of three clothing sector companies. The approach was qualitative to find out their motivations for implementing a certification scheme to achieve a sustainable supply chain in the clothing and apparel sector. It explains how strategic objectives, marketing considerations, and information about sustainability features influence certification in the apparel industry. The study also found that certification schemes can help clothing companies improve their marketing and competitiveness and raise knowledge about sustainability in the textile and apparel supply chain [19].

The importance of sustainable supply chain management in the textile industry is because enterprises operating in the textile and clothing industry are particularly exposed to social and environmental problems in the entire supply chain. The expansion of textile production and consumption has contributed to increasing pollution, water shortages, fossil fuel and raw material depletion, and climate change [20]. It should be emphasized that the issue of sustainable supply chain management, due to its inherent complexity, requires continuous analysis of the situation of internal and external decision-making and is burdened with greater or lesser risk concerning the choice of strategy and resource allocation. Therefore, supply chain management should be supported by various instruments to streamline organizational structures and processes [21].

Textile and apparel products face a significant challenge to earn foreign exchange through export. The simple management mode of 'purchase to export' or the production and management mode of 'vertical integration' have made the textile and apparel industry lack activity, innovation ability, and international competition. Under this background, the idea of 'horizontal integration' begins to rise, and supply chain management increasingly prevails as the representative of this idea. Green supply chain management has gradually become the new concept for the sustainable development of enterprises [11].

Government laws, worldwide rivalry, and customer knowledge of sustainable products pressure industries to implement environmental measures. As a result, businesses are compelled to adopt sustainable practices to improve their environment rather than economic performance. The Sustainable Supply Chain Management (SSCM) system is a concept that ensures that existing supply chains follow environmentally friendly practices. India's industries are no different from those in other emerging countries. In this regard, Ali et al. reported the implementation of SSCM into Indian textile industries to grab post-WTO agreement of enormous market opportunities. There are numerous enablers for converting SSCM to TSCM, but these enablers do not guarantee that the system will have the same impact in different industries or countries; where SSCM is implemented, the system will vary depending on culture and local restrictions. As a result, enterprises must first identify significant enablers to adopt SSCM. The researchers claim that Interpretive Structural Modelling can find the influential enablers for SSCM (ISM). According to the ISM data, the enablers dominate the industry's activities, including acceptance of safety standards, green practices, community economic well-being, health and safety issues, and employment stability. This study demonstrates that from a safety standpoint [22].

Since the last decade, researchers and academics have done numerous studies on the sustainability of global supply chain models; however, socially related aspects are still neglected in many of those studies. Researchers had done a study to enrich the discussion by providing social issues in sustainable supply chain management (SSCM) in the field of textile/apparel sector and propose a comprehensive map that integrates the latest findings on socially related practices in the textile/apparel industry with the dominant conceptualization to reveal potential research areas in the field. The results show an ongoing lack of investigation regarding the social dimension of the triple bottom line in SSCM. Findings indicate that a company's internal orientation assists in sustainable supply chain management practices. Nevertheless, suppliers also face or even create considerable barriers in improving their social performance, which calls for more empirical research and qualitative or quantitative survey methods, especially at the suppliers located in developing countries [23].

Textile and garment firms such as M&M&S, NEXT, ZARA, H&M, Patagonia, and The North Face prioritize sustainability in their supply chains. They have taken a multi-pronged approach to improve their long-term supply chain management levels. Sustainable product strategy, investment, performance evaluation, corporate social responsibility, and environmental management system adoption are some factors that contribute to sustainable supply chain management development in the textile and apparel industries. Sustainability challenges in the textile and garment sector have gotten much attention because it is one of the most polluting industries on the planet. Sustainability in textile and clothing supply chains is complex due to geographically vast and complicated global manufacturing networks and the simultaneous cost and lead time pressures. Transforming raw materials into finished clothing has significant environmental and social repercussions, including air and water pollution and human resource exploitation, especially when production is outsourced to low-cost countries. In addition to financial success, the triple bottom line idea advises businesses to consider social and environmental performance in their operations.

Furthermore, there is evidence that some consumers are prepared to pay extra for sustainable textile and garment products as their awareness of sustainability grows. Apparel companies across all market levels, such as fast-fashion brand H&M, outdoor wear brand Patagonia, and luxury brand Louis Vuitton, have implemented various approaches to improve the level of sustainability in their supply chain management to meet stakeholders' increasing expectations and reduce the risk of the negative social and environmental periphery. To improve the textile and apparel supply chain, it is necessary to be more sustainable. Product returns, low-carbon supply chains, corporate social responsibility, sustainable design operations, and sustainable competition are only topics and innovations studied in academic literature. However, many other concerns linked to sustainable supply chain management in today's global textiles and clothing sector have yet to be thoroughly investigated [24].

The examination of implementing ISO standards can provide new insight into their quality and environmental management benefits. These insights can be more impactful in manufacturing sectors, especially textiles, as it is known for its environmental degradation and questionable supply chain practices. This exploratory study investigates the extent to which organizations that implement either ISO 9001 or 14001 standards impact sustainable supply chain management (SSCM). Researchers used several measures to identify the time of impacts of examined standardized management systems on improvements in different processes of SSCM. Their contributions to the field include finding that quality management systems support environmental processes,

relationships with stakeholders, functions within the supply chain, and SSCM. Other findings include implementing environmental management system standards that impact the rationalization of different methods. Raut et al. recognized that the textile sector significantly influences socio-economic and ecological dimensions of sustainability. The textile industry consumes significant resources, pollutes the environment during production and delivery, and generates substantial amounts of waste, of which only a small part is recycled [25]. Researchers have claimed that the textile industry is essential for improving sustainable supply chain management (SSCM). Therefore, continuous improvement of SSCM is a priority for enterprises operating in manufacturing industries because of opportunities to enhance an image and the growing environmental awareness of potential consumers [26, 27].

The emphasis on ecological activities means that some customers care for the environment when making these decisions. For many reasons, consumers are an essential stakeholder, and an industry that can quickly respond to changing customer trends can gain a competitive advantage. Based on the literature, some of the most important trends shaping entire markets are digitization, globalization, and care for environmental protection. According to Moorhouse and Moorhouse, all stakeholders in the textile sector should be involved in activities aligned with sustainable development. Today sustainability is not a fad or new idea but increasingly a business model. Although this approach requires tremendous effort and resources, remaining on the sidelines of such activities may soon damage a firm's image and weaken its market position. It can be concluded that organizations operating in the textile industry, and manufacturing in general, must look for solutions to improve the functioning of the supply chain in crucial aspects of their business, including quality environment management and innovation management. Although companies in the textile industry have implemented many practices to improve SSCM, the literature lacks research on the impact of standardized management standards on SSCM in this industry [28]. ISO standards can help this industry sector and other manufacturers. They enable a firm to design, produce effectively and deliver quality products and services with fewer environmental impacts. The combination of quality management in ISO 9001 and environmental management in the ISO 14001 standards can meet changing customer needs by including more top-management involvement in and measuring manufacturing practices. Despite widespread acceptance, implementing these standards and their benefits still provide new insights as impacts across all industry sectors and countries are not uniform. One way to improve SSCM can be to implement the requirements of standardized management systems. While several studies are dealing with the impact of the ISO 14001 standard on sustainable business management and some discuss its effect on SSCM, there is a lack of research into implementing the requirements of ISO 14001 in the textile industry [29].

Various research papers have looked into the proper definition of concordance in the perceived hurdles and enablers for sustainable Supply chain management (SSCM) policy implementation. However, a distinct focus on the textile sector has gotten little attention in the past. However, it has been discovered that it impacts how companies approach sustainable supply chain management improvements within that industry. Researchers conducted an in-depth comparative case study analysis based on 23 interviews with ten textile industry executives from ten companies. The findings show that certain types of collaboration can help to create a successful SSCM and reduce policy implementation hurdles. When addressing external barriers and enablers, the width and depth of a collaborative management approach for an efficient internal SSCM differ from industry cooperation and buyer-supplier collaboration. The balance between attaining competitive advantage and acting sustainable while meeting the demands of many stakeholders to retain reputation, legitimacy, and credibility is a significant problem for enterprises working in global textile supply chains. Essential stakeholders such as regulators, consumers, shareholders, the media, and non-governmental organizations pose a substantial risk to a company's reputation (NGOs).

Furthermore, focal firms are typically held liable for their vendors. However, social and environmental challenges, such as uneven and poor product quality or supply chain interruptions, pose an operational risk. As a result, supply chain sustainability challenges may result in a drop in financial performance or a loss of competitiveness. Supplier evaluation impacts this risk-oriented strategic approach to managing sustainability throughout supply chain processes. In contrast, a focus on supplier development aims to establish a business case from sustainable supply chain policy implementation. According to prior research, organizations' strategic approaches focus on controlling supply chains to generate sustainable products or managing the supplier base to reduce risks and ensure performance. As a result, current research has focused on sustainable supply chain management (SSCM). SSCM combines the concepts of supply chain management and sustainability, and it encompasses all of a company's efforts to improve the supply chain's sustainability. SSCM is defined as "the management of material, information, and capital flows, as well as cooperation among companies along the supply chain, while taking into account goals derived from customer and stakeholder requirements in all three dimensions of sustainable development, i.e., economic, environmental, and social." Previous research has looked at the obstacles and enablers of sustainable supply chain management. Diabat et al. found that the enablers for SSCM are sector and cultural context-specific enablers and correlate [30]. Textile companies have been found to employ a CoC (code of conduct) to verify a supplier's compliance with established sustainability requirements, set specific sustainability criteria for suppliers, and decrease reputational and operational risk through monitoring and self or third-party auditing. The textile industry's social supply chain policy includes working conditions, salaries, and housing and homeworker circumstances. Due to the intricacy of the textile supply chain, it has been determined that the SSCM strategy should be implemented at the sub-tier supplier level [31].

8. Conclusions

Sustainability in the supply chain is a newly practised concept in the globalized business of consumable products and services; however, it is gradually becoming a must-consider element in any corporate or organized business environment. Sustainability can be implemented in two ways i) promoting localized development or traditionally available crafts, clothing, or any form of consumable items or services that are naturally sustainable and ii) multi-locational ample supply chain-based conglomerate/corporation should ensure every point of offshore manufacturing or outsourcing within the exact geographical location must comply with the rules and regulations of accomplishing sustainable practices. Overall, all good practices to meet sustainable criteria need the extra buck to sustain the sustainable practices. Needless to say, that extra buck is to be shared by the final consumer. So, consumer awareness is one of the driving forces for moving all stakeholders to implement sustainable practices in their supply chains.

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