

# Sustainable Supply Chain Management: Literature Review, Trends, and Framework

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## Abstract

Sustainability concept has been introduced to many fields including management, technology, and supply chain. These days, companies have established different environmental strategies into their strategies to improve their environmental and business operations. One environmental strategy that has been applied in organizations is in supply chain management (SCM) activities. Sustainable Supply Chain Management (SSCM) is an important strategy that supports organizations in improving the overall performance. This research provides a quick review of literature review related to SSCM. The literature review showed that SSCM strategies effects are still unclear and may cause positive or negative economic performance. Therefore, the researcher provides a comprehensive definition for the SSCM. Also, the advantages and barriers for SSCM have been discussed in this research to clarify some of the ambiguity in this field. In addition, the overview for each activity in SSCM has been provided. The importance of technology systems in this field has been shown. Moreover, the subsequence of SSCM activities over the past twenty years has been clarified and summarized. Finally, a framework that helps managers developing SSCM has been introduced.

**Keywords:** *Sustainable Supply Chain, Technology Management, SSCM trends, SSCM framework, Manufacturing.*

## 1. Introduction

In recent years, sustainability concept has been introduced to many fields including management, technology, and supply chain (SC). Hansmann and Claudia [27] and Liang and Chang [17] assert that implementing environmental strategies create new opportunities for organizations. Corporate social responsibility has been replaced by environment business regulations on organizations' agenda [1]. These days, companies have established different environmental strategies into their strategies to improve their environmental and business operations. One environmental strategy has been applied in organizations is in supply chain management (SCM) activities. Sustainable Supply Chain Management (SSCM) is an important

strategy that supports organizations in achieving advantages over their competitors and in improving the overall performance. Wagner, Schaltegger, and Wehrmeyer [41] believe that SSCM strategies' effects are still unclear and may cause positive or negative economic performance. Therefore, the advantages and barriers for SSCM have been discussed in this research to clarify some of this ambiguity. Also, a SSCM frame work has been introduced. Finally, the sequence of SSCM activities over the past years has been clarified.

## 2. SSCM Definition and Activities

The most accepted definition for SSCM is that the process of managing the SCM activities with consideration for environmental, economical and social issues for enhancing the long-term economic goals of individual organization and its supply chains [14][16][23][18].

The SSCM activities that have been discussed in the literature review are summarized in figure1. A brief review has been provided for each activity as it is related to sustainability concept.



Fig. 1 SSCM activities.

### 2.1 Sustainable Design and Packaging:

The first activity in implementing SSCM is developing sustainable design strategies for the product and for the package. This activity also includes designing products in a way that could be recycled or remanufactured. Navin-Chandra [34] was the first researcher to explain the need for a sustainable design to eliminate the impact of product waste [2]. Baojuan [3] asserts that sustainable design has an important impact on resources and environment. He believes that "It would optimize the relevant designing factors, besides the functions, quality, development cycling,

and costs [3].” Sustainable design will lead to achieve a successful recycling process. Also, it helps organizations to earn customers’ respect, save money and lead to better products [4]. In the middle of the 90’s, interest in implementing environmental packaging, choosing suitable raw materials according to environmental standard, and attention for recycling were observed [42] [45]. Baojuan [3] believes that sustainable packaging can be achieved by using sustainable design to reduce package materials.

## 2.2 Sustainable Production:

Production is the second activity that is important in developing SSCM. Environmental production can be achieved by using clean production method, new technology, and reducing raw materials and resources to reach low input, high output and low pollution [3]. Lean manufacturing or the Just-in-time technique is the first production strategy that achieved environmental goals or named as environmental production ([25]; [30]; [35]; [34] [44]; [14]. Srivastava [39] asserts that “lean manufacturing is an important consideration in reducing the environmental impact of the production phase”. Liang & Chang [17] believe that lean production is helpful in improving environmental performance of manufacturers through activities such as waste reduction and minimizing hazardous wastes. King & Lenox [31] affirm that “lean production leads to improvements in environmental implementation and it assists organizations in reducing the marginal cost of pollution. Rothenberg, PiI, & Maxwell [38] identify that lean plants aim to minimize waste products and buffers in environmental technology and management. Recycling is another production activity that helps in developing SSCM. Baojuan [3] confirms that recycling helps organizations to improve the environmental image in front of their customers. Sustainable products lead to achieve sustainable in recycling for the products and some parts. Another activity of implanting sustainable production is reverse logistics [2], which is accepting products for remanufacturing and recycling purposes [24] [22]. Economic factors such as reducing production costs also helped organizations to adopt reverse logistics [5].

## 2.3 Sustainable Marketing:

Marketing is a very important activity in developing and implementing SSCM. To achieve sustainable marketing, organizations “should keep biological balance, and pay more attention to environmental protection” [3]. Rao [37] believes that management of wastes in sustainable marketing can lead to cost savings and enhanced competitiveness. In addition, it helps organizations enhance their relationship with customers, suppliers, and other partners.

## 2.3 Sustainable Transportation:

Sustainable transportation is another important element in developing effective SSCM. Many factors including fuel sources, type of transport, infrastructure, and operational and management practices should be considered in developing environmentally-friendly transportation systems. Kam, Christopherson, Walker, & Smyrniotis [29] believe that these factors and the dynamics that connect them, “determine the environmental impact generated in the transportation logistics phase of the supply chain.”

## 2.4 Sustainable Purchasing:

Developing SSCM requires implementing sustainable purchasing strategies. Liang & Chang [17] confirm that sustainable purchasing leads to reducing waste and hazardous materials by using environmental raw materials. Also, sustainable purchasing plays a significant role in SSCM because it assists organizations in reducing the source of pollution and waste by using strategies such as recycling, scrapping, dumping, or sorting and using biodegradable packaging [6].

## 3. Environmental Management System (EMS)

Technology has simplified the complexity of environmental management problems and helped in making environmental decisions. One new technology that helped in making environmental decisions in SSCM is EMS, which is an information system that can be used for improving environmental and business performance [7]. EMS affects each activity in SSCM and organizations can use EMS to reduce environmental harms with less effort and short time [8]. Florida & Davison [7] summarize the EMSs advantages by managing environmental risk, helping organizations in achieving their environmental goals, commitment to environmental improvement, improving business performance, and improved community relations. EMS will lead to effective implementation for SSCM because the simplicity in sharing information with different parties including employees, suppliers, distributors, customers, and government agencies. Also, it helps in creating reports that helps in the assessment and monitoring processes. Different technological innovations such as database techniques helped EMS to be more effective in managing SSCM activities. The most recent technology that has been used in SSCM is Radio Frequency Identification (RFID). RFID helped in “improving the environmental health of the world and the financial health of the retail giant and its suppliers... reducing unnecessary truck deliveries ...and reducing customers' trips to stores for items that were out of stock during their initial visit” [9]. More advanced wireless

technologies, advanced decision Support Systems and Artificial Inelegant will be more effective in the future of SSCM.

#### 4. The Importance of SSCM

Integrating environmental practice in SCM activities will help organizations achieving many advantages. Many researchers explore the advantages of the SSCM. Hock & Erasmus [28] Liang & Chang [17], Carter & Easton [19], and Carter and Rogers [23] believe that applying SSCM will help in reducing environmental risks, pollution, and improving environmental performance. Also, Hock & Erasmus [28], Liang & Chang [17], Carter & Easton [19], and Carter & Rogers [23] assert that by applying SSCM, organizations will achieve marketing advantages, improve corporate image and organizational reputation. Cost reduction is another important advantage for implementing SSCM [36][14][19]. In addition, Farahani, Asgari, & Davarzani [14] believe that it is important to integrate suppliers in a participative decision-making process, and protecting brand reputation and addressing corporate social responsibility. Carter & Easton, [19] summarize the benefits of using SSCM by reducing packaging through using more effective design for reuse and recycling, lowering health and safety costs, reducing turnover and workforce costs due to safer warehousing and transport, improving product quality, and lowering disposal costs. Certain environmental and social initiatives help organization in having the closest relationship to consumers [10] by sponsoring environmental activities and providing grants for local environmental projects and activities [7].

#### 5. Barriers for implementing SSCM

Implementing SSCM strategy faces a number of difficulties. Many studies have explored these barriers. Min & Galle [6], Hines & Johns [13], and Farahani, Asgari, & Davarzani [14] believe that the high cost of environmental programs is the main difficulty in developing SSCM. Also, uneconomical recycling and uneconomical re-use, and lack of management commitment and human resource affect developing SSCM strategies [6] [13]; [14]; [7]. In addition, lack of awareness (buyers and suppliers), deficient company-wide environmental standards or auditing programs and lack of state and federal regulations are also other important barriers for implementing SSCM [6]. Hines & Johns [13] and Farahani, Asgari, & Davarzani [14] believe that high competition and fluctuating market demand affects negatively on SSCM development. Also, Farahani, Asgari,

& Davarzani [14] assert that short term strategies are not helpful in developing SSCM. Bastakis, Buhalis, & Butler [20] (p.5) and Buhalis [21] confirm that low profit margins and inability to reduce suppliers' prices also affect the SSCM development.

#### 6. Findings

There are two findings that have been extracted from reviewing random number of literature review studies. The first one summarizes the sequence of developing SSCM strategies over the past twenty years. The second one is a framework that assists managers in developing SSCM strategies in their organizations.

##### 6.1 The sequence of developing SSCM strategies in the literature review

Reviewing previous studies helped in understanding the stages of developing SSCM over the past twenty years. The starting point for SSCM is lean manufacturing that has helped in cutting costs and improving the production quality. Then, individual environmental responsibility with forcing from government regulations [11] [12] is the second stage of the SSCM activates. Sustainable design and using suitable material for packaging are the third stage of developing SSCM. Then, recycling, remanufacturing and reverse logistics have been developed in 1999. After that, more organized regulations and global activities helped in improving the customers' awareness. Customers' awareness put pressure on organizations to adopt sustainable strategies and it moved the SSCM to the next stages. This pressure forced organizations develop SSCM strategies to fulfill the consumer interest in the sustainability [46][33][40][14]. Organizations spent more efforts to meet their buyer's specifications. Then, organizations have developed assessing and monitoring procedures to achieve more effective SSCM. In addition, awareness seminars and education programs for employees, suppliers, vendors, and customers were given to improve the awareness level [13]. Improving quality is still important issue in developing SSCM [14]. The fast technology developments have played a significant role in improving the quality of implementing SSCM. Currently, RFID is the most recent strategy that has been used to implement effective SSCM in all of its activities. The following chart summarizes the sequence of developing SSCM over the past twenty years.

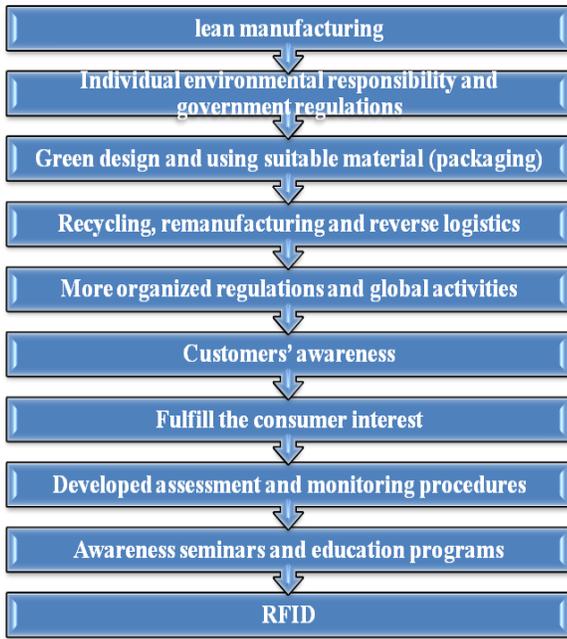


Fig. 2 Summary of the sequence of developing SSCM over the past twenty years.

## 6.2 SSCM Framework

The literature review showed that there is an evidence of an increasing interest in addressing sustainability strategies. Therefore, there is a need to collect and summarize the SSCM strategies that have been discussed in the literature review. These strategies are summarized in eleven steps SSCM framework that helps organizations in developing SSCM. First, government regulations help in motivating organizations to have the minimum level of developing environment friendly practices. Second, organizations should identify the business benefits of implementing sustainability initiatives and develop strategy that helps them in developing effective SSCM and engaging in sustainability process [32][19][23]. Establishing link between SSCM initiatives and increased economic performance will encourage organizations to be comfortable toward adopting SSCM [15]. Farahani, Asgari, & Davarzani [14] believe that SSCM requires development of trust between partners. Also, they believe that SSCM guidelines can support and drive industry practice to sustainable environment. Raising awareness among consumers and suppliers is important to achieve benefits of implementing SSCM. Organizations should involve their stakeholders in the process of developing SSCM because they play important role in making the success of the process [19]. Assessment and monitoring programs [14] will help organization in correcting their practices in achieving SSCM and help them to develop and update their plans. Developing environmental systems will

facilitate the process of monitoring their practice because it will help in generating automatic reports. Baojuan [3] asserts that enterprises should strengthen their SSCM management by using technology. Liang & Chang [17] affirm that companies should manage their suppliers' environmental performance to ensure that the materials and equipments supplied by them are environmentally-friendly and produced using environmentally-friendly processes. Also, they have to hold regular meetings with their suppliers to discuss their environment strategies, to explain the benefits of SSCM initiatives, to guide suppliers in development of environmental programs, to provide on-site recommendations and to assist them in the set up of their environmental programs [13][17]. Font, Tapper, Schwartz, & Komilaki [26] provide three conditions that are necessary for developing SSCM: long term partnership, fair pricing and a consistent volume of operations. Finally, Carter & Easton [19] and Carter and Rogers [23] believe that establishing environmental organizational culture, which includes high ethical standards and citizenship, will help in developing effective SSCM. Figure 2 summarizes the framework for developing SSCM.



Fig. 3 Summary of the framework for developing SSCM.

## 7. Conclusion

This research provides a quick review for literature review related to SSM. From reviewing a random sample of the available literature review, the researcher provides a comprehensive definition for the SSCM. Also, the advantages and barriers for SSCM have been discussed in this research to clarify some of the ambiguity in this field. In addition, overview for each activity in SSCM has been provided. The importance of technology systems in this field has been shown. Moreover, the subsequence of SSCM activities over the past twenty years has been clarified and summarized. Finally, a framework that helps managers developing SSCM has been introduced.

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