Sustainability in Supply Chain Management: An Overview

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In recent times, sustainable business development has become the key focus area for companies because of the increased competitiveness and market globalization. Organizations are under pressure to reduce the cost of products and improve the services to the customers. The number of organizations integrating sustainability in supply chain is increasing in order to improve their market positions over their competitors and increase their profitability. Incorporating sustainability in supply chain has become a challenge for the company because of several issues like environment protection, restriction in natural resources' usage, abiding by government policies, disposal of the product at end-of-life, providing efficient and effective product or service, etc. It has become indispensable to include these key features in the existing supply chain. Realizing the importance of sustainability in a supply chain, the present paper aims to offer an understanding of the current trends in sustainable supply chain management and the challenges it faces over its implementation.

Introduction

Business organizations have realized that focusing on internal efficiencies and processes is not sufficient enough to exist and progress in the globalized market today. Firms need to take advantage of Supply Chain (SC) capabilities and resources to bring products and services to the market faster, at the lowest possible cost, with the appropriate product and service features and the best overall value (Gunasekaran *et al*., 2001). Thus SC approach is critical for any organization's ability to compete effectively in today's global and dynamic environment.

Enhancing organizational sustainability is a long-term process which needs internal, social and environmental effort. However, these efforts are not being adequately pursued in many cases due to inadequate knowledge about their benefits and lack of motivation (Ageron *et al*., 2012). Sustainability in today's business environment is of great importance for long-term success of companies, their economy, profits and profitability. Governments have begun to pass laws that mandate carbon emission reductions. Carbon dioxide, methane and nitrous oxide are the primary Greenhouse Gases (GHGs) which trap the heat in the earth's atmosphere thus contributing to the rise in global temperature (Gupta and

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Desai, 2011). Organizations are realizing the need to take immediate action the way in which the earth resources are used. The use of the non-renewable resources should be decreased as it takes millions of years to produce these resources, and the use of non-renewable resources like coal, minerals, methane, etc., has adverse effect on the environment. There is a need for the companies to be extremely careful of the use of raw materials, fuels, etc., and consider environment protection as their responsibility. Legislation, customer demand, eco-labeling programs and ISO 14000 are some of the motivating factors for a company or organization to become more environmentally responsible (Bras, 1997).

Over the past decade, government and both profit and non-profit organizations are giving significant attention to social, environmental and corporate responsibility for sustainable business and development (Ageron *et al.,* 2012). The reputation and performance of the firm is highly influenced due to interdependency of the units in the supply chain which otherwise has led the firms to recognize that their own activities are impacted because of social, ethical and environmental forces (Keating *et al.*, 2008). In their entire supply chain, companies are asked to consider the environmental and social problems also (Seuring and Muller, 2008). According to Zailani *et al*. (2012), manufacturing firms considering the sustainability concept in their purchasing should procure from suppliers having certification and having Environmental Management System (EMS). Suppliers supplying raw materials that are recyclable or reusable and easily disposable, result in competitive advantage over their competitors. The society expects a better social, environmental and economic viability and hence companies have started ensuring that people get proper remuneration for their work and the environment is not damaged from what they are producing. It is the responsibility of the company to protect human rights and labor involved, protect the environment and also maintain the profitability.

There is an increasing concern for companies of all sizes and across a wide range of industries to manage supply chain in a sustainable manner (Seuring, 2012). People prefer to work in an organization having an eco-friendly environment, proper remuneration for work and no discrimination during promotion, i.e., an organization focusing on all the three dimensions of sustainability. Hence, sustainability helps an organization hire talented employees who can understand, pay attention to organizational behavior towards the environment and tackle the issues impacting environment in the supply chain efficiently (Buyukozkan and Berkol, 2011). Incorporating sustainability in supply chain management results in significant benefits like customer satisfaction, supplier innovation capacity, quality, trust, supply risk management, whereas some common benefits it encompasses are optimal inventory, flexibility, supply chain cost and supply lead time (Ageron *et al.*, 2012). From the above discussion, it is clear that sustainability in supply chain aims to provide all the stakeholders that are involved in bringing the products and providing services to the market a long-term growth.

There are many definitions of supply chain management. Monczka *et al.* (1998) defined supply chain management as a concept "whose primary objective is to integrate and manage the sourcing, flow, and control of materials using a total systems perspective across multiple functions and multiple tiers of suppliers". Mentzer *et al*. (2001) defined it as "the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole". Lambert *et al.* (2006) stated that it refers to ''the integration of key business processes from end-user through original suppliers, that provides products, services, and information that add value for customers and other stakeholders''.

Sustainability is an integral part of supply chain management and an attempt to incorporate it using the triple bottom line concept in the existing supply chain practices leads to study Sustainable Supply Chain Management (SSCM). SSCM can be defined in a number of ways, of which few definitions are discussed in order to have a better understanding of sustainability with regard to supply chain. Sikdar (2003) defined sustainability as "a wise balance among economic development, environmental stewardship, and social equity" (Teuteberg and Wittstruck, 2010). Carter and Rogers (2008) defined SSCM as ''the strategic, transparent integration and achievement of an organization's social, environmental and economic goals in the systemic coordination of key inter-organizational business processes for improving the long-term economic performance of the individual and its supply chain'' (Olga, 2012). Seuring and Muller (2008) defined SSCM as "the management of material, information and capital flows as well as cooperation among companies along the supply chain while taking goals from all three dimensions of sustainable development, i.e., economic, environmental and social, into account which are derived from customer and stakeholder requirements". Gupta and Desai (2011) defined sustainable supply chain as "a set of managerial practices that includes all of the following: (i) environmental impact as an imperative; (ii) consideration of all stages across the entire value chain for each product; and (iii) a multidisciplinary perspective encompassing the entire product life cycle". From the above definitions, sustainable supply chain management can be understood as maintaining a balance among social responsibility, environmental stewardship and economic viability along the entire supply chain, improving the long-term economic performance of an individual and the company and also meeting the customers' need competitively throughout the life cycle of goods and services. There are many differences between traditional supply chain and sustainable supply chain, brought out by different authors. Significant among them are social, environmental and economic issues considered in sustainable supply chain. Table 1 gives the key differences between the traditional supply chain and SSCM.

In recent years, a number of special issues on sustainability and SSCM have been brought out by *Journal of Operations Management, International Journal of Production*

Table 1: Key Differences Between Traditional Supply Chain Management and Sustainable Supply Chain Management

Traditional Supply Chain Management	Sustainable Supply Chain Management
Focus is only on elements connecting from the point of origin to the point of consumption (i.e., from supplier to consumer).	Social, environmental and economic issues are also considered along the supply chain.
Purchasing does not consider the environmental issues.	Incorporates green purchasing strategies and environmental purchasing.
Significance to marketing of product or service to protect the environment is not given.	Green marketing, environmental marketing and environmental marketing management of the product or service.
ISO certification is not an integral part.	Includes ISO-14000 certification.
Reverse logistics is not an integral part of the supply chain.	Reverse logistics is an integral part of the supply chain.
Importance to reducing the waste during manufacturing is not given.	Emphasizes on reduction of waste during manufacturing.

Source: Svensson (2007)

Economics, Journal of Supply Chain Management, Supply Chain Management: An International Journal and *Journal of Cleaner Production,* with the subject thus becoming the area of focus for academia and practitioners (Ageron *et al*., 2012).

Based on the above premises, the present study on SSCM has the following multifold objectives:

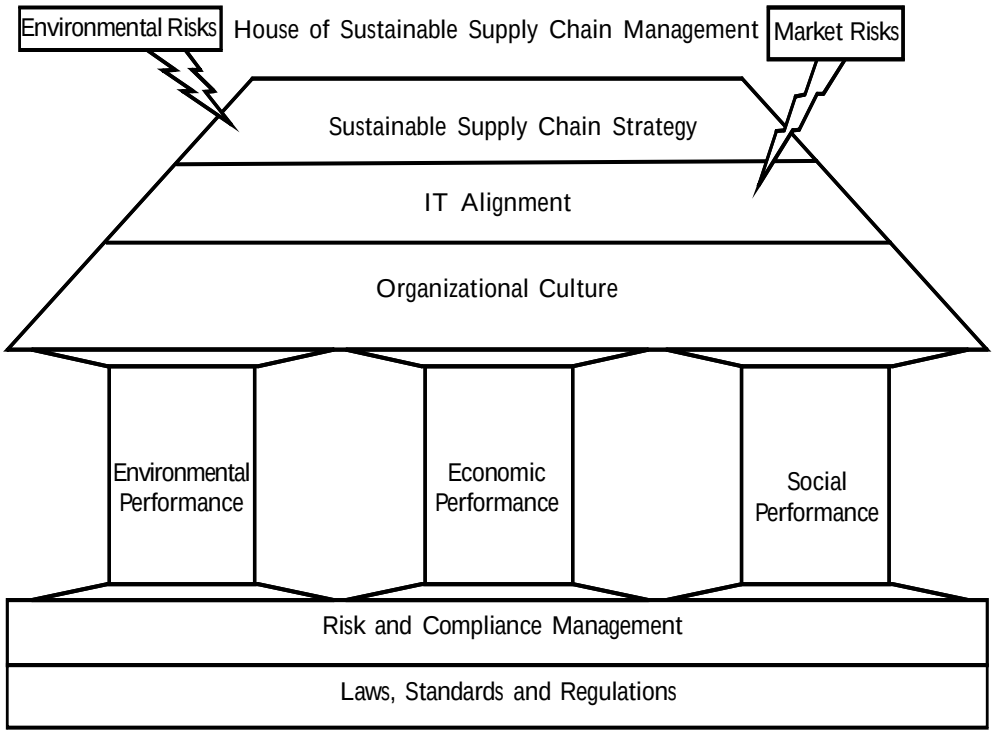
- To create a platform for researchers by carrying out an in-depth review of literature on SSCM.
- To study the need for sustainable supply chain management and its integration.
- To study the enablers and barriers of SSCM.

The paper has been organized as follows: (1) Definitions of supply chain management and sustainable supply chain management and its characteristics; (2) Reasons to go for sustainability in supply chain management; (3) Integration of sustainability with supply chain management; (4) Sustainability in Green Supply Chain Management (GSCM); (5) Some of the most cited framework measuring performance of sustainable supply chain management; (6) Barriers to sustainable supply chain management; (7) Discussion on the managerial implications; and (8) Results and conclusion.

Reasons for Incorporating Sustainability in Supply Chain Management

There is a need for incorporating sustainability in supply chain management to protect the environment and maintain the reputation in the market, be it manufacturer or service provider. Sustainability helps a company maintain its profitability and also fulfill its responsibility to protect the human rights, thus delivering on its social responsibility. In order to have sustainability in the supply chain management, the idea of "triple bottom line" was developed by Elkington (2004), which indicates that the balance between the environmental, social and economic dimensions is necessary to achieve sustainability (Bouzon *et al.*, 2012). In view of this, Teuteberg and Wittstruck (2010) proposed a "House of Sustainable Supply Chain" (Figure 1) where the triple bottom line acts as a pillar for the building with risk and compliance management forming the foundation of the building, while the starting points of implementing sustainable practices are laws, standards and regulations.

Figure 1: House of SSCM



Source: Teuteberg and Wittstruck (2010)

For successful implementation of sustainable supply chain, significant attention is being paid by researchers to the triple bottom line (environment, social and economic aspects), the importance of which is discussed in detail to have sustainability in supply chain.

Environment Responsibility and Government Pressure

To protect consumers, the government has set up regulations in relation to environment which can be achieved by reducing production of harmful goods or by products as well as industries that use and/or consume harmful goods (Polonsky, 1994; Azevedo *et al*., 2011; and Deif, 2011). Transportation in the supply chain has also considerable effect on environment as it is also one of the main sources of NO_x and SO_2 gas emission in the environment (Dekker *et al.*, 2012). Companies are under pressure from the government, as many laws have been implemented that would result in hefty penalty on the company if it is polluting the atmosphere by any means. Emission of carbon into the environment is depleting the ozone layer due to which the temperature of the earth is continuously rising which is a cause for great concern in the world. In the supply chain, reducing the use of fossil fuels could result in reduction of carbon emission in the environment. As a result of industrial revolution, in the last 150 years the concentration of carbon dioxide has increased by 30% and the concentration of methane has almost doubled (Gupta and Desai, 2011). Global warming and depletion of natural, non-renewable resources and increasing industrial activities from developed and emerging economies have become the rising concern for government institutions as well as profit and non-profit organizations. This has forced stakeholders to focus on sustainable business development (Ageron *et al*., 2012). Winkler (2011) suggests that for wastage reduction and waste avoidance, different companies should work together from the developmental to end-of-life stages of a product life cycle. This provides cost efficiency while the customer needs are satisfied. There is a demand from the society for better environment (i.e., clean air, water and soil) as well.

Corporate Social Responsibility

Corporate Social Responsibility (CSR) has a significant influence on supply chain management (Cruz, 2009). CSR means fair treatment to the workforce and setting up the supply chain such that it does not damage the environment. Keating *et al*. (2008) explained CSR in a way that an organizational philosophy should be such that its profit-making activities should have minimum social impact. CSR results in generating specific standards and codes that bring in standardized procedures and organized behaviors, thereby causing the enterprise to operate according to the principles of efficiency and effectiveness and also increasing its overall productivity (Tencati *et al.*, 2010). CSR is limited not only to its moral responsibility towards the society but also to its corporate actions or behavior towards the employees working in the organization (Svensson, 2009).

Protecting human rights is the responsibility of the company. International labor standards have been set up according to which a worker should be provided with a safe and healthy working environment, proper compensation should be paid for their work;

child labor and forced labor should be avoided; there should be no discrimination during recruitment and promotion; etc. Due attention needs to be paid by the company that the labor conditions do not fall below the international standards and national regulatory requirement, failing which it may lead to serious human rights abuses. If the employee of the company is not satisfied or proper care is not taken, it results in decrease in their work efficiency, thereby affecting the productivity of the company. According to Tang and Zhou (2012), corporates or organizations generate waste and emissions (solid waste, toxic waste, air pollution and water pollution) during production activities which is dangerous to the planet. They suggest that corporates need to take into account the environmental factors (consume less natural resources, dispose of fewer wastes, generate fewer greenhouse gases) in their decision-making and daily operations to minimize the negative impact on the planet.

Profitability and Corporate Image

In the long run, no supply chain can exist without economic success (Seuring and Muller, 2008). Customers, through increasing the demand for a product, put pressure on the companies for better quality and environment-friendly product at lowest possible cost. Companies' becoming environment-friendly helps to reduce the cost because while going for eco-friendly product they reduce the input resources and at the end develop better quality product which creates new business and also generates revenue (Nidumolu *et al*., 2009). According to Handfield and Nichols (1999), if the entire sequence of steps involved in the production of a product, be it goods or service, is optimized, the greatest value can be produced at the lowest possible cost.

Organizations should set up effective Supply Chain Coordination (SCC) as increased sales, improved customer service, efficient product development efforts, and low manufacturing costs are some of its benefits (Kanda and Deshmukh, 2008). Supplying the product at low cost and better quality develops a trust in the consumer and the ensuing satisfaction results in profitability for the company particularly in difficult economic times. Daniel (2007) reveals that in order to strengthen brand names or differentiate their products, 60% firms have adopted sustainable practices. Inclusion of flexibility measures makes the business more responsive. According to Das (2011), organizations intending to respond to emerging business opportunities must include supply flexibility, product mix flexibility, and customer service level flexibility in their business plan. Due to increasing competition in the market, one who supplies the good or service at the lowest possible cost with better quality will emerge successful in the market.

Ageron *et al.* (2012) were of the view that apart from the social, environmental and economic responsibility, external and internal factors also influence the companies to incorporate sustainable supply chain. They stated that the external factors include regulatory requirements, business nature and stakeholders' action, while internal factors include vision of top management, demand of customer and suppliers' sustainable initiatives. Hence, sustainability in supply chain is a need for both manufacturing and service organizations to survive in a competitive market and carry the business ahead in

a positive way. According to Linton *et al.* (2007), the relation between sustainability and supply chain management is such that "it is critical to move forward to the systemic issues that exist at the intersection of sustainability, environmental management and supply chains". The summary of various enablers for sustainability in supply chain management is shown in Table 2.

Table 2: Enablers for Sustainability in Supply Chain

S. No.	Enablers	Sub-Enablers
1.	Corporate Social Responsibility	Economic responsibility
		Public responsibility
		Social responsiveness
		Integration into the corporate policy
		Manufacturing quality product at low cost
2.	Incorporating Reverse Logistic Practices	Reducing solid waste
		Waste elimination strategies
		Reducing toxic gas emissions into the environment
		Reuse/Recycle the product at the end of life
		Use of biodegradable raw material
		Reducing the use of harmful raw materials
3.	Top Management Commitment	Sharing the information
		Training education of purchasing employees and suppliers
		Evaluating supplier certification
		Adopting new manufacturing technologies
		Innovation
		Trust among the members of supply chain
		Customer satisfaction
4.	Coordination Along the Supply Chain	
5.	Green Purchasing	Suppliers ISO 14000 certification
		Providing information to supplier about environmental issues
		Supplier-buyer cooperation for environment-friendly raw material
		Eco-friendly packaging
		Reducing carbon footprints
6.	Regulations	Environmental policy
		Government regulations
7.	Motivation	Competitiveness
		Legitimation
		Ecological responsibility
8.	Incorporating Flexibility in Supply Chain	

Integration of Sustainability with Supply Chain Management

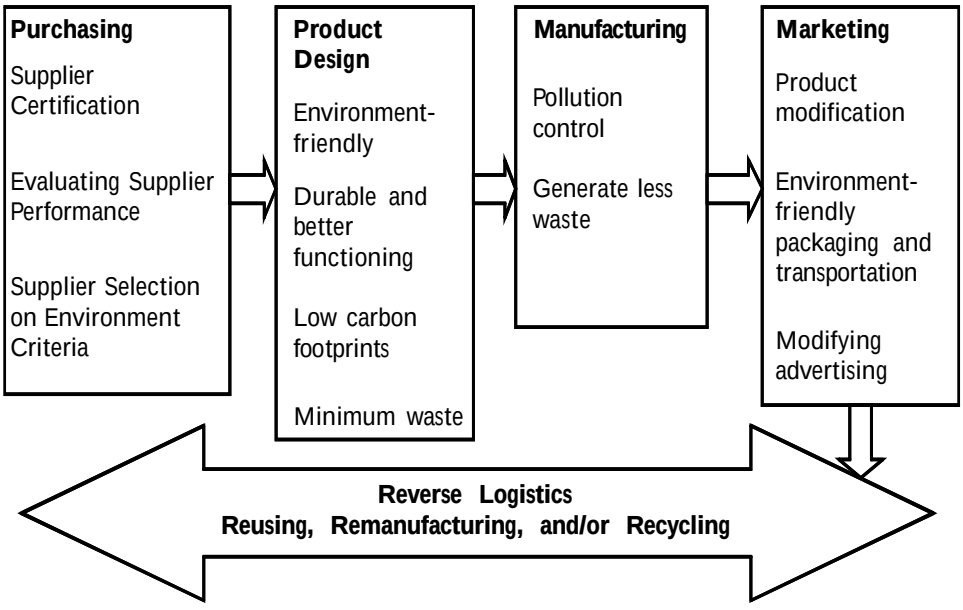
Developing a product from initial processing of raw material and converting it into finished product to deliver it to the customer is supply chain management, during which quality, cost, schedule and user requirements are kept in mind, whereas the traditional focus is on design, manufacturing and maintenance (de Brito and van der Laan, 2010). According to Linton *et al.* (2007), issues that exist beyond the core of supply chain management such as product design, manufacturing by-products, by-products produced during product use, product life extension, product end-of-life and recovery processes at end-of-life must also be integrated to have sustainability. To integrate sustainability management into business organization, international standards and guidelines (like ISO 14000, Social Accountability (SA) 8000, ISO 26000, etc.) exist. According to Lee and Saen (2012), when it comes to the implementation of these standards and guidelines, there are some suggestions and recommendations on how sustainability management can be integrated with the company's goal and activities. Integrating supplier with the supply chain is a vital issue specially when critical materials have to be procured and the organization is focusing on sustainability factors (Bai and Sarkis, 2010). It is critical for the firms to identify the needs of each strategy, and to integrate sustainability into the supply chain strategy, new capabilities need to be developed (Wu *et al.*, 2014).

Green Supply Chain Management

In a supply chain management considering the 'green' component is indicating the effects and relationship of supply chain management to the natural environment. At every stage of product life cycle, environmental impacts occur (Wu *et al*., 2011). Protecting the environment, safeguarding the natural resources and reducing carbon footprints by managing the flow of materials along different phases like during supply, production and distribution form the wider strategy of green supply chain. Green supply chain is also impacted by the supplier as the raw material purchased is either recyclable/usable or not, and hence supplier having ISO 14000 should be preferred with an expectation that the environmental risks associated with these suppliers are lessened (Sarkis, 2003). Cost, quality or flexibility of the supply chain is affected when a decision is made to buy greener product from suppliers (Dey and Cheffi, 2012). Selection of supplier is an important strategic decision making when thinking of sustainability. Financial performance of the organization improves if it incorporates strategic purchasing in its supply chain (Large and Thomsen, 2011). Reducing waste and packaging material, compliance with ISO 14000, lean management, eco-design, production facilities, clean programs, product life cycle costing or assessment, reducing transportation cost and remanufacturing are some of the other environmental issues in the supply chain (Ageron *et al*., 2012). According to Beamon (1999), an organization must follow the basic principles established by ISO 14,000 and procedures should be developed that focus on operational analysis, continuous improvement, measurement and objectives to achieve GSCM.

According to Zhu *et al.* (2008), depleting resources and serious environmental problems are the two main pressures on Chinese manufacturers to enhance their environmental and logistics performance along with economic gains, due to which GSCM is becoming an emerging management approach. Green practices like green purchasing, green design, green manufacturing and green marketing exist throughout the supply chain as well as at the end of product life, referred to as 'Re's' of reduction, reuse, remanufacturing and recycling (Hervani *et al.*, 2005). To reduce the negative impact on environment, firms producing electrical consumer products are trying to reuse, remanufacture and recycle the used products (Paul *et al.*, 2014). To achieve complete GSCM, closed loop supply chain can be very useful (Zhu *et al.,* 2008). Solid waste management processes such as Closed Loop Supply Chain Management (CLSCM) application result in significant reduction in CO_2 emissions, thereby reducing the GHG effect and global warming (Olugu and Wong, 2012). GSCM involves all areas of the SC from green purchasing to reverse logistics. Thus, managing the environment and closed-loop supply chain is included in the GSCM. In a study carried out by Azevedo *et al.* (2011), who performed cross-case analysis on five companies, all the five companies considered 'reverse logistics' to be extremely important for a supply chain. Hervani *et al.* (2005) defined GSCM as the sum of green purchasing, green manufacturing/ materials management, green distribution/marketing and reverse logistics. The green activities at various links of supply chain are shown in Figure 2.

Figure 2: Green Activities at Supply Chain Links



Source: Hervani et al. *(2005); and Large and Thomsen (2011)*

Performance Measures of Sustainable Supply Chain Management

Performance measurement systems make an important contribution towards decision making in supply chains (Kurien and Qureshi, 2012). It also helps in organizational change and improvement (Tangen, 2005). Even though the authors have discussed the performance measurement of sustainability in supply chain and the performance measurement of green supply chains, it is observed from literature that there are no broadly accepted standards for measuring the total environmental footprint of a supply chain. It is also seen that increasing number of supply chains are incorporating green performance measurements in their performance measurement systems.

The ISO 14031 (1999) "Environmental Management—Environmental Performance Evaluation—Guidelines" give guidance on the design and use of environmental performance evaluation, and on identification and selection of environmental performance indicators. This framework divides environmental performance indicators into three classifications: (i) Management performance indicators; (ii) Operational performance indicators; and (iii) Environmental condition indicators. Shang *et al.* (2010) conducted a study to identify the taxonomy of sustainability and firm performance. This study identified, on the basis of a factor analysis, six GSCM dimensions and 37 performance measure attributes. Supply Chain Operations Reference (SCOR) model is a process reference model developed by the management consulting firm PRTM and endorsed by the Supply Chain Council (SCC) as the cross-industry performance measurement tool for supply chain management (Huan *et al*., 2004). Green SCOR is an integral part of eighth version of SCOR model (Baumann and Genoulaz, 2014). Green SCOR integrates environment best practices and metrics into the entire supply chain planning process. It also enables a systematic study of the supply chain to unearth opportunities for making the supply chain greener. Green SCOR identifies five environmental metrics that can be measured across the supply chain. The Green SCOR metrics are carbon emissions, air pollutant emissions, liquid waste generated, solid waste generated and the percent of solid waste that is recycled. When applied within the SCOR framework, these metrics allow for targeted data collection that ultimately makes it easier to create a total view of an organization's internal and supply chain-wide environmental performance.

Barriers to Sustainable Supply Chain Management

Literature indicates many barriers to the implementation of sustainability practices in supply chain. These include the costs associated with such practices, the lack of legitimacy to implement such practices, poor commitment from suppliers, etc. Resistance to change always exists in organizations.

Several academic studies have indicated that financial considerations remain the principal barrier (Ageron *et al.*, 2012; and Vasilenko and Arbaciuskas, 2012). Moreover, additional challenges arise when one considers that sustainability is something relatively new for companies; it requires increased dependence between supply chain partners, and

it is difficult to distribute the costs and the benefits between partners. Lack of qualified personnel, lack of information, lack of awareness about environmental problems, resistance to make changes in the production process, supply chain collaboration, etc. are some of the non-financial barriers to implement sustainability in supply chain management (Gimenez *et al*., 2012; and Vasilenko and Arbaciuskas, 2012).

Anti-Environment Paradigms

Beamon (2005) describes two different, but related, commonly-held anti-environment paradigms as the cause of reluctance to care for the environment. The first is, crisis-oriented environmental management, i.e., having a belief that environmental management hampers business performance. Therefore, businesses should not cooperate with the government or anyone else who detracts from the purpose of business to make money. The second is, cost-oriented environmental management, i.e., an organization's belief that those environmental regulations are part of the cost of doing business and nothing more.

Resistance from Various Sources

Including sustainability in the supply chain is to look beyond the existing supply chain and involving issues like quality product and service, better technology or processes which result in less wastage. It also involves evaluating suppliers' and distributors' performance, human resource management, eco-friendly product design and manufacturing, cost, finance, etc., which means changes in the existing supply chain to achieve the desired goals. However, changes in the organization have always faced resistance. According to Ageron *et al.* (2012), some of the factors that offer resistance to implementation of sustainability in the supply chain are:

- Top Management and Finance: Weak top management leads to failure in improvement in the supply chain. Top management may better understand the role of finance/accounting in the supply chain but not in a position to know what would be the impact of improving the technical requirements of the product. Moreover, improving the standards of the product will increase the cost of the product and hence create financial burden on the organization which is one of the reasons restricting top management from implementing sustainability in supply chain. Finance is identified as one of the principal barriers for implementation of sustainable supply chain by most of the companies due to two major concerns: difficulty in evaluating the return on investment and difficulty in distributing the costs and benefits between the partners (Ageron *et al.*, 2012). Supplier in the supply chain needs to be educated about the social and environmental impact of the product and supply eco-friendly raw materials and develop a green supply which also adds to the cost. Training and human resource development should be the practices of the firm to be competitive in market, and new technologies and developments should not be seen as financial burden on the organization (Gowen and Tallon, 2002).

- Lack of Knowledge and Expertise: A clear understanding of the sustainable supply chain management is a must which will help in better connectivity of the supply chain members. Knowledge and ability possessed by humans play a critical role in supply chain organization and its performance (Estampe *et al.,* 2013). Often the organization may not have experts, and also inadequate knowledge about the benefits of incorporating sustainability in supply chain management restricts it implementation.
- Culture and Human Resources: Members in the supply chain should work in coordination in order to achieve the mission (objectives) defined by the organization and should abide by the cultural values. Company culture includes company mission, values, ethics, goals, and work environment. Members of the organization are the ones who contribute to sustainability in the supply chain and to what extent sustainability is implemented largely depends on the culture of the organization. If the members in the supply chain have distinguished beliefs, values and working ways, different parts of the organization will pull in different directions which ultimately will reduce the effectiveness of an organization. Human resource department should educate the members of the supply chain about the company's culture for successful implementation of sustainability in supply chain management.

Miscommunication or Insufficient Information

Effective communication is required for the success of sustainability in supply chain. If the demand of the product is increased in the market, the same should be communicated to the organization for increasing the supply of the product, as the organization may not be having much stock of finished goods since it increases the inventory and hence cost of storage. Companies and suppliers lack effective communication and understanding between them. Internal IT infrastructure should be developed by the company for setting up effective communication channels with the suppliers and audit services.

Supply Chain Collaboration

Triple bottom line is significantly impacted due to supply chain collaboration (Thomas and Griffin, 1996; and Gimenez *et al*., 2012). Cao and Zhang (2010) defined supply chain collaboration "as a partnership process where two or more autonomous firms work closely to plan and execute supply chain operations toward common goals and mutual benefits". To improve the CSR performance, firms have started identifying that working in collaboration with the supply chain partners plays a vital role and indicates that supply chain comprises interdependent units, and collaborating can influence the reputation and performance of each other (Keating *et al.,* 2008).

Unclear Objectives

Objectives should be clearly defined by the corporate in order to achieve sustainability in supply chain. Before defining the objectives, the companies should ask certain questions to itself such as:

- Whether the product designed generates minimum waste and satisfies customer needs;
- In designing sustainable product the quality is not compromised;
- Whether the firm possesses all the resources and is capable of responding to environmental threats and opportunities;
- Whether it has experts along the supply chain;
- How fast it can respond in case of increase in demand of the product; and
- Many a time, the organization is not clear about implementation techniques of sustainability in supply chain and by what means it will achieve it, and hence is not able to define the objectives clearly.

Supplier Human Skills

Suppliers should be aware of the sustainable issues in the supply chain. To achieve sustainability, buying firms are getting involved in supplier's internal environmental policy initiatives, e.g., eco-design programs, product recovery at the end-of-life for further recycling and recovery of wastes, and those suppliers which are not at par with purchasers' environmental requirement are even delisted (Olga, 2012). Policies related to environment and environmental management standards (like ISO 14001) need to be introduced by the suppliers to address the issues of corporate, social and environmental sustainability in their overall functioning. Suppliers should have experts in their system who provide training to upgrade the human skills for integrating sustainable issues in their strategy.

Lack of Production Facilities

Production process should be able to process certain eco-friendly material, integrate the reused or remanufactured components in the system and generate minimum waste. Innovation in manufacturing and new manufacturing technologies are important drivers for firms engaging in sustainable management; however, the initial investment for environmental manufacturing technologies significantly impacts its implementation (Schrettle *et al*., 2013).

Reverse Logistics

Collecting the product and bringing it for reuse, repair, remanufacturing, recycling and its disposal after its end-of-life is reverse logistics. In order to abide by the legal regulations and have economic and environmental sustainability, it is increasingly becoming important to reduce all types of waste generated from the production process and take suitable action to reuse or recycle the waste which otherwise is termed as waste management concept (Winkler, 2011). However, the timing of collection of the product at the end-of-life and maintaining efficient coordination between the consumer and the firm is of prime importance which creates hassle in its implementation.

Lack of Strategy

Continuous decrease in the fossil fuels and water, new regulations by the government and increasing concern to incorporate sustainability in supply chain force the corporate to develop various sustainable strategies. Companies should develop a strategy to assess the economic, social and environmental impacts associated with sustainability such as environmental management systems, pollution prevention, waste minimization, design for environment and clean technology programs (Buyukozkan and Berkol, 2011). Codes of conduct should be developed by the purchasing companies as part of improvement of supply chain management strategies. Strategic management includes three steps: defining strategic goals, strategic planning and implementing strategy and its evaluation; however, companies define their strategic goals and carry out the planning but often ignore their implementation and management (Jin and Bai, 2011).

Lack of Coordination or Coordination Complexity

Members of the supply chain should work as a part of integrated system for the improvement of overall supply chain performance and have sustainability. Working independently in the supply chain can enhance their individual position but not enhance the performance of the supply chain. Hence the word 'coordination' comes into light, and to improve the overall performance of the supply chain, the members of the supply chain may have to behave as a part of unified system and coordinate with each other effectively. Firms' supply chain performance is affected due to lack of coordination, and inaccuracy in forecasting, excessive inventory, inadequate customer service, inventory costs, time to market, response to order fulfillment, quality, customer focus and customer satisfaction are the consequences of lack of coordination (Kanda and Deshmukh, 2008). Coordination and integrating all the business operations along with sustainability considerations is the need of organizations in order to retain and strengthen their competitive advantage in the market (Buyukozkan and Berkol, 2011). Table 3 summarizes the barriers to sustainable supply chain.

Table 3: Barriers to Sustainable Supply Chain

S. No.	Barriers	Reference
1.	Reverse Logistics	Min and Galle (1997)
2.	Government Regulations	Beamon (1999)
3.	Lack of strategy	Tallon and Gowen (2002)
4.	Corporate Culture	Tallon and Gowen (2002)
5.	Unclear Objectives	Tallon and Gowen (2002)
6.	Coordination Complexity/Effort	Seuring and Muller (2008)
7.	Top Management Commitment	Bullington and Bullington (2008)
8.	Supply Chain Collaboration	Naslund and Williamson (2010)
9.	Training	Uysal (2012)
10.	Inadequate Knowledge	Ageron *et al.* (2012)

Table 3 (Cont.)

S. No.	Barriers	Reference
11.	Financial Cost	Ageron *et al.* (2012)
12.	Green Investments	Ageron *et al.* (2012)
13.	Company Human Skills	Ageron *et al.* (2012)
14.	Supplier Human Skills	Ageron *et al*. (2012)
15.	Lack of Production Facilities	Ageron *et al.* (2012)
16.	Sustainable Procurement	Walker and Jones (2012)
17.	Organizational Size	Walker and Jones (2012)
18.	Insufficient/Miscommunication	

Managerial Implications in Sustainable Supply Chain Management

Klassen and Vereecke (2012) identified three managerial implications in terms of social issues related to supply chain. They are: (i) In order to retain the social and financial performance of the supply chain, the managers should continuously review the unrecognized risk associated with the supply chain base. This can be achieved by specific monitoring and collaborative initiatives; (ii) A senior and capable manager should lead in order to integrate the social issues along the supply chain. This will ensure quick response to the customer requirement, improving supplier quality, integrating marketing, logistics and operations; and (iii) The company should adopt standards or certification such as SA8000 in order to reduce the risk and have competitive advantage in the market.

Another area of managerial implications related to sustainability in a supply chain is supplier selection in a supply chain. According to Wong *et al.* (2012), suppliers having Environmental Management Capability (EMC), which means suppliers capable of producing components or parts that are composed of environment-friendly materials, and distributing in an environmentally conscious manner, should be selected for improvement in implementation of product stewardship. They also suggest that managers should source from suppliers who are ISO 14000 certified, conduct environmental evaluation of suppliers, reduce environmental impact in their manufacturing processes, provide ecological proof of their outputs, and communicate about their environmental management with trading partners.

Innovation is another area of managerial implication related to sustainability in supply chain. For successful implementation of new ideas, technologies, new systems or process, Research and Development (R&D) plays an important role. Organizations giving more importance to R&D generate positive reaction among the investors in implementing green supply chain projects (Bose and Pal, 2012). Hence, proper R&D infrastructure should be developed by the management to undertake green initiatives.

Conclusion and Suggestions

The study gives a broad understanding of the importance of and the barriers inhibiting adoption of sustainable supply chain management. Sustainability in supply chain has

considerable impact on the existing supply chain resulting in value addition to the organization and improvement in its market position. The results of the study can be summarized as follows:

- Certified supplier should be selected for the supply of raw material and the supplier should ensure that the raw material supplied does not impact the environment.
- Organizations should assume social and environmental responsibilities.
- Green product supply to the market strengthens the brand name of the organization.
- Greening the supply chain and reverse logistics reduce the cost of the product and protect the environment.
- Green manufacturing technologies should be adopted by the organization so that less emission occurs during the production process and also minimum resources are consumed, thereby ensuring less impact on the environment and reduction in cost.
- Transportation along the entire supply chain should be such that toxic emissions are less in the environment.
- Finance has great impact on sustainable supply chain implementation rather than non-financial issues.
- Waste reduction in the supply chain reduces the cost of the product and also its impact on the environment.
- The top management should have a clear vision about sustainable supply chain and should take initiatives on its implementation.
- Cutting the cost of manufacturing, improving the efficiency of the operations and distinguishing its product compared to other brands/products provides a competitive advantage in the market.
- Effective supply chain collaboration results in the elimination of excess inventory, increase in sales, improvement in customer service, product development and flexibility to meet the uncertain high demand of the customer for a particular product.

In this paper, the importance of sustainability in supply chain management has been discussed and analyzed. The study is based on related literature review. Sustainability in supply chains has received much attention over the past decade owing to the significant attention given by governments and non-governmental organizations to environmental, social and corporate responsibility. Supply chains are thus increasingly adopting sustainability practices. Measurement of sustainability is important to monitor its progress

and effectiveness. However, there are still many barriers to the implementation of sustainability in supply chains. ⌘

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