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A Conceptual Framework on Green Supply Chain Management Practices

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Abstract

Rapid worldwide industrialization has contributed led to the extensive damage caused to the environment and is increasing at a fast pace in the recent years, industrial wastes of various forms have damaged and the environment and made it irreversible with ozone depletion and Antarctic icebergs melt. The after effects of this deterioration have created pressure from all stake holders towards manufacturers on their cleaner production responsibilities in India making Green supply chain management a vital development in the area of research in management. Since this area of research is new to Indian context the research proposes a conceptual model for GSCM practices based on extensive literature review and practices related to this area.

Keywords: GSCM, Green practices, Inbound Green practices, Outbound Green practices, Green design, Green Manufacturing, Reverse Logistics.

1. Background

Increasing scarcity of resources, building awareness among consumers, stringent laws that are more environment conscious and the natural impact on the environment are posing real challenge to Indian companies today.(Vachon and Klassen, (2006); Srivastava, (2007)). Another major business strategy of the century posing challenges to today's business is creating an integrated organization. Supply chain management, which was once considered only for the upstream supply chain has now evolved to the entire supply chain. Using this strategic weapon and new technologies dynamic business organisations are made possible. Hence lately environmental management in the supply chain is posing major challenge and has gained increasing attention among researchers and managers. (Jonathan et al.,(2007)). Environmental management in supply chain has been implemented across the world by many companies (Krut & Karasin(1999),Rao (2002), Gemi (2004)) and is otherwise known as Green supply chain management which includes product design, materials and supply, manufacturing, final product delivery to consumer and reverse logistics.

Recent globalization poses that this concept is of high significance to the Indian industries as the majority of the world's manufacturing will be carried out in Asia, making India an integrated part of the Global supply chain. (US-AEP (1999)). But this tremendous growth opportunity to the country also brings equal environmental challenges (Rao, (2002)). Hence Indian companies are forced to invest in the "greening" of the supply chain which can in turn save resources, eliminate waste and increase productivity. (Porter and Van Der Linde, (1995)). The 'greening' here refers to everything that is ecologically thought (Svensson, (2007)). Mudgal et al. (2009)) also refers that "greening the supply chain is considered as a process of integration of the environmental values into supply chain". This leads us to the simple definition of green supply chain management (GSCM) by adding "green" to the supply chain management practices. It can be defined as "green procurement+ green manufacturing+ green distribution+ reverse logistics" (Sekshan et al, (2010),Sarkis(1995)). The ultimate purpose is to eliminate or minimize waste (energy, emissions, and chemical/hazardous, solid wastes) along the supply chain. (Hervani et al (2005)).GSCM has been quoted by many researchers as an emerging approach to balance both economic and environmental performance of organisations (Zhu & Sarkis (2004)).

Other definition found in literature are, according to Srivastava (2007) the definition of GSCM is: "the integration of environmental thinking in managing the supply chain, including product design, source and material selection, manufacturing processes, final product delivery to consumers and management of the product at the end of its life". Patrick Penfield of the Whiteman School of Management extends the definition of Green

Supply Chain Management (GSCM) to sustainability as "the process of using environmentally friendly inputs and transforming these inputs into outputs that can be reclaimed and re-used at the end of their lifecycle thus creating a sustainable supply chain." The definitions and explanations by various researchers on this issue lead us to a common platform with varied groupings of practices in GSCM.

2. Need for the study

Today's enterprises have established global networks of suppliers to take advantage of various characteristics to build their competitive advantage. This poses a major challenge to the supply chain managers to balance at low costs and innovate to substantiate both environmental & economic sustainability. (Pagell (2004)). Green supply chain management (GSCM) has emerged to help managers balance these competitive requirements (Narasimhan and Carter (1998)). Environmental practices in SCM pose inherent complexity due to multiple stakeholders, uncertain implications and international presence and have been a challenging field for researchers. Research is very important to support the development of management practices to turn the entire supply chain into a green supply chain. GSCM research so far can be considered ad hoc, fragmented and partial. Therefore, more integrative contributions are needed, especially in the dissemination of best practices.

3. Literature Review

3.1 Green Supply Chain Management (GSCM) Practices:

Green supply chain management (GSCM) is an emerging field that differentiates itself from the traditional supply chain perspective. The "quality revolution in the late 1980's and the supply chain revolution in the early 1990's" have evoked businesses to become environmentally conscious (Srivastava, (2007), Wu & Dann, (1995)). Supply chain management has been viewed earlier as a process in which materials are made into final products. (Beamon, (1999)). In this process companies extract and exploit natural resources in various forms (Srivastava, (2007)) making it more related to the environment. This exploitation and damage caused to the environment can be prevented or reduced by making the concept of supply chain green. Adding the 'green' concept to the 'supply chain' concept opens up a new paradigm, the GSCM, with a direct relation to the environment. These two paradigms were mostly considered to be in head-on collision with each other (Srivastava, (2007)). A study by Schaper (2002)18 quotes that "green" supply chain management though a newly evolved concept has developed forty years ago. Kelle and Silver's (1989) article was the first to quote on Green supply chain. Later studies have modified the concept of GSCM according to their nature of study across the supply chain or partly on a functional area of the supply chain.

The key practices worth noting from the previous research work are the concepts of green design, green operations, reverse logistics, waste management and green manufacturing (Guide & Srivastava, (1998); Srivastava, (2007)). The environmental laws and CSR practices and ISO 14000 certifications have improved the environmental practices in many Indian companies. But the question lies if the same has been extended to the supply chain.It is important to integrate the these practices into the entire supply chain to achieve a sustainable supply chain and create competitive advantage (Zhu et al., (2008), Linton et al., (2007)). Critics also argue that improvements are not likely to occur outside the boundaries of the organizations with EMS. However, some research works suggests that the organizational capabilities required to adopt an EMS may facilitate GSCM implementation. Consequently, EMS adopters may have a greater propensity to expand their focus to forming a Green SCM. (Darnall et.,(2009)23.The green supply chain management practices hence includes all the supply chain activities, from green purchasing and integrate complete product life cycle, through manufacturer till the customer, and closing the loop with reverse logistics (Zhu et al., (2008)).

The extensive review of literature and some findings of the deductive research undertaken on GSCM practices shows varied approaches as discussed below; Stephan (2007) conceptualized GSCM practices into two environmental collaboration & environmental monitoring. Messelbeck and Whaley (1999) considers the environmental effects of the researching,developing, manufacturing, storing, transporting, using and disposing of the product. Many researchers have identified four kinds of GSCM practices, including internal environmental management, external environmental management, investment recovery and eco-design (Zhu et al., (2007)) and later adopted Ninlawan et al.,(2010). Most of the research work on GSCM practices are fragments of a part of the Porter's value chain model. Emmet and Sood(2010) have classified GSCM practices as Green procurement and supply, Green production, Green packaging, Green marketing, Green Logistics and Supply loop.

This descriptive work is an attempt to create a framework of the GSCM practices across four major functions-purchasing(Ninlaw(2010),Sanjeevkumar(2012),and in-bound logistics(manish(2011),design and production(ninlaw(2010),toke(2010),Sanjeevkumar(2012)30,Sarbjit singh(2010),Halme et al(2002), distribution and out-bound logistics(toke (2010))34 and reverse logistics(toke (2010),Sreevatsa,(2007) tonanont,(2008)). A number of integrative issues that may affect each of these functional areas are justified with two more supportive components:- management practices (Lippmann 1999), US –AEP(1999), Evans and Johns (2005)3,Handfield et al(2005) and customer cooperation (Zhu et al.,(2010), Ninlawan et al.,(2010)). As this is a relatively new field, a number of debates have emerged, within and between functions. Since most of the literature on green supply chain management has been descriptive, anecdotal, and/or prescriptive they have only investigated certain links of the whole supply chain. Academic journals have only begun to address these issues by early 1990's, but with only a few empirical studies, which have been exploratory, the amount of generalizable knowledge and theory development in this area is almost negligible. Based on review of various literatures on GSCM this research work has proposed a framework on GSCM practices across the four major components of supply chain adding management practices and customer cooperation as supportive practices.

5. Conceptual Framework Proposed

The framework proposed is based on the extensive review of literature to enable practitioners, managers and researchers to get the complete perspective of Green supply chain management practices. A deductive approach was used to develop the model on green supply chain management practices which is discussed in detail below

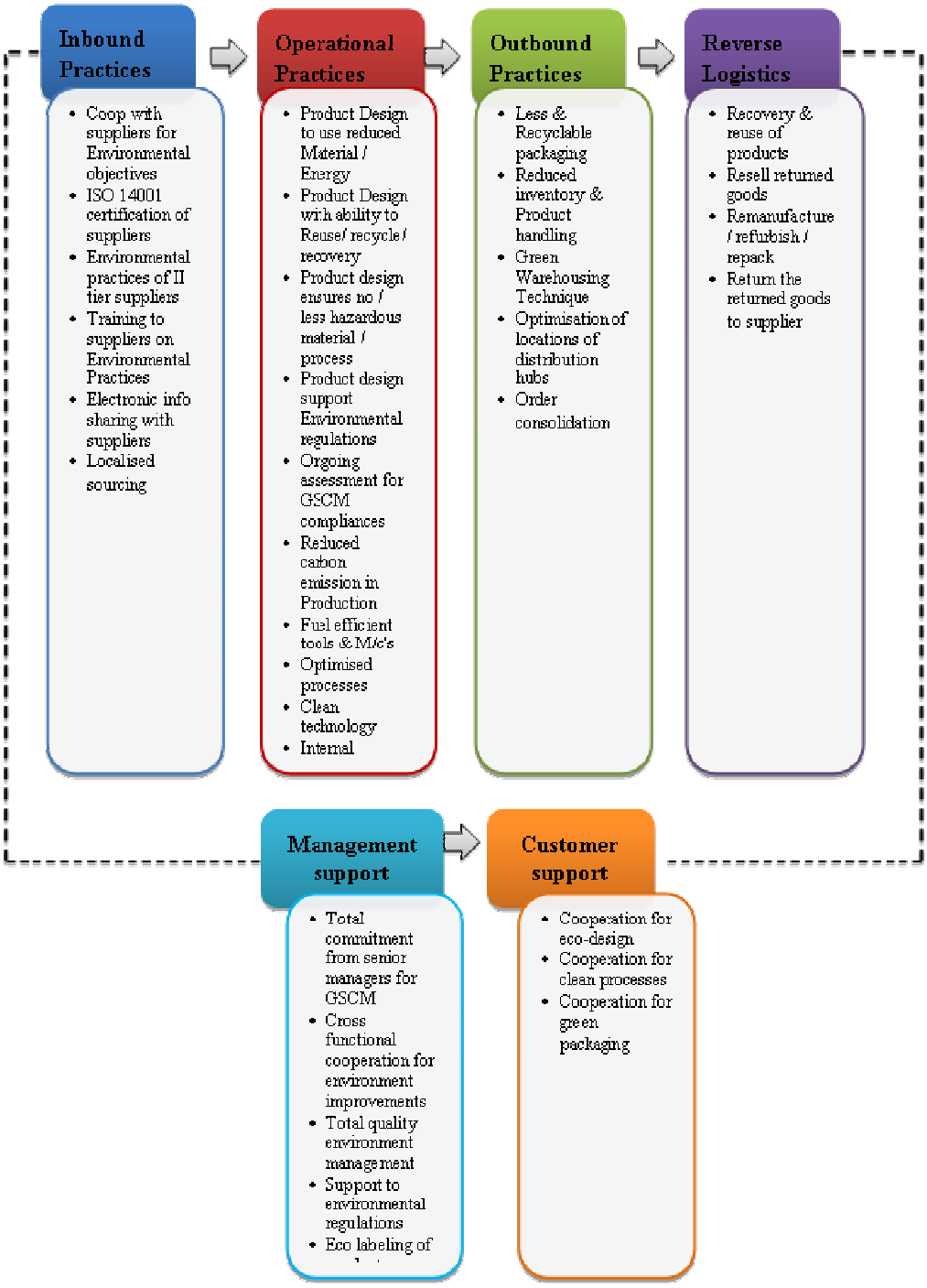

Fig 1: Framework for GSCM practices

5.1 Green Inbound Practices:

The purchasing function involves the acquisition of materials from suppliers to meet the needs of the producer. Purchasing includes vendor selection, material selection, outsourcing, negotiation, buying, and delivery scheduling, inventory and materials management. Various research works has been undertaken on the innovation and creation of the concept of Green in purchasing procurement /supplier and inbound logistics. (Green et al., (1996), Handfield et al., (2005), Yuang & Kielkiewicz (2001), Narasimhan & Carter (1998)).

Green procurement can be defined as environmental purchasing activities that include the reduction, reuse and recycling of materials in the process of purchasing. It is a solution for environmentally concerned and economically conservative business, and a concept of acquiring a selection of products and services that

minimizes environmental impact (Salam, 2008). The study considers the purchasing functions relevant to Green SCM, identified from the extensive review of literature.

Seksan et al., (2010), Zsidisin and Hendrick (1998), Zhu and Cote (2002), Hu and Hsu(2010), Ninlawan et al.,(2010) identifies GSCM practices such as Cooperation with suppliers for environmental objectives, Environmental audit for suppliers' internal management(Handfield et al.,(2005),Yuang & Kielkiewicz (2001),Zhu et al.,(2005), Suppliers' ISO14000 certification(Walton et al., (1998)), Second-tier supplier environmentally friendly practice evaluation(Walton et al (1998)), supplier training (GEMI (2004)). Green purchasing hence focuses on the inbound supply chain of the organisations. (Zhu and Cote (2004)).

The major issue in inbound GSCM practices and the controversy that commonly arises is the use of just-in-time (JIT) practice common in today's manufacturing industries. This practice is meant to reduce inventory, eliminating costs and waste, which in turn reduces the necessary overhead and resource consumption needed to manage inventory. Thus, JIT is an environmentally sound practice. But it also rises a controversy that less amount of inventory also means more number of delivery and small batches production. Thus raising fuel consumption and traffic congestion (McIntyre et al., (1998), Penman(1994), Sarkis (1995), Wu and Dunn(1995). Tradeoffs show that some of these issues are mitigated with practices as on-site suppliers or close proximity for JIT. Another factor related to JIT and supplier management is that fewer suppliers are usually used in a JIT environment. This means better forecasting and fuller loads could be planned. Freight consolidations, transport mode selection (Wu & Dunn (1995)) and other "tradeoffs" and issues in in-bound logistics.

5.2 Green Operational practices:

The internal supply chain of the organization that is with the factory premises is considered as the green operations in the study. The two major Supply chain activities inside the walls of the organization are the Design and Production. Green design and Green manufacturing are two important aspects of GSCM that has been extensively researched and quoted in various studies.

5.3 Green Design:

Green design is an important sub-attribute to Green supply chain management. It is about designing a product or a service with environmental awareness. As a result of the Rio Summit on the Environment in 1992 the growing pressures calls for firms to green their design. Several literatures have extensively quoted on Green Design. (US – AEP (1999), Rao (2002), Yuang & Kielkiewicz (2001), Zhu et al., (2005), Lewis et al.,(2001), Hu and Hsu(2010)). The first green design literature came from Navin-Chandra's (1991), Ashley (1993); Allenby and Richards (1994) and Zhang, Kuo, Lu and Huang (1997) have used the context and have attempted to expand the framework of green design. Life-cycle analysis was an example of a framework that was a contribution of the work on green design. (Arena, Mastellone and Perugini (2003), Beamon (1999) and De RonPenev (1995), Srivastava (2007),Gungor and Gupta (1999), Ninlawan et al.,(2010)). In Indian context many companies have started adapting to the Green design or eco design of their product / services.

Green design is also quoted as design for the environment / for disassembly and product life cycle assessment, specifically to consider environmental aspects in the products design. The product life cycle assessment is described as a process of analyzing and evaluating the consequences of material and energy flows of a product in relation to the environment in all phases of its life: extraction and processing of raw materials, production, transport and distribution, use, re-manufacturing, recycling and final disposal. (Srivastava (2007), Jonathan et al., (2007),Rebitzer et al (2004)). Eco-design as it is commonly quoted as is a helpful, emerging tool to improve companies' environmental performance and help organizations close the supply chain loop by addressing product functionality and simultaneously minimizing life-cycle environmental impacts. The success of eco-design requires cooperation throughout the supply chain. (Zhu et al., (2006), Ninlawan et al.,(2010))

5.4 Green Manufacturing:

Green manufacturing is defined as production processes using inputs with relatively low environmental impacts, which are highly efficient, and that generate little or no waste or pollution. (Atlas and Florida (1998)). It helps to lower raw material costs, production efficiency gains, reduced environmental and occupational safety expenses, and improved corporate image. This has been a well-researched area. Many studies have been done on environmentally conscious manufacturing (Florida (1996), Gupta (1995), Klassen and McClaughlin (1996), Sarkis(1995). Clean production,the common name for green manufacturing is the main component of organizational sustainability (Halme et al., (2002)). Green Manufacturing concept was first conceptualized in the

research work of Crainic, Gendreau and Dejax (1993). The concept of green manufacturing were then developed further by Van Der Laan and Salomon (1997); Guide and Srivastava (1998), White et al., (2003), Ninlawan et al.,(2010), Srikanta(2012). Many extensive reviews exist on GSCM, particularly in the late 1990's on green production (Bras & McIntosh (1999); Sarkis & Cordeiro(2001); Van derLaan, Salomon & Dekker(1996), Zhang et al. (1997)). Darnall, Jolley,Jason and Harnfield (2008) critique GSCM practices in production floor by saying that Environmental Management Systems (EMS) are making less progress in reducing environmental harms. This is very common controversy to quote GSCM as just a management philosophy and is not successful in practice. Some researchers have also suggested that Closed-loop manufacturing is one of the measures that can be used to improve the environmental performance of the internal supply chain. The philosophy of zero-emissions drives closed-loop manufacturing practice. It is a process of producing products with no negative environmental impact (Hasek(1997)) which in turn would improve the environmental performance of organization.

5.5 Green Outbound Practices:

Green distribution consists of green packaging and green logistics. Packaging characteristics such as size, shape, and materials have an impact on distribution because of their effect on the transport of the product. Better packaging, along with rearranged loading patterns, can reduce materials usage, increase space utilization in the warehouse and reduce the amount of handling required (Ho et al., (2009)). Seksan et al., (2010)) identified certain attributes of green packaging on an in-depth study. As purchasing and in-bound logistics focuses on managing the vendor-organization relationships of the supply chain, the distribution and out-bound logistics function is meant to address the organization-customer relationship issues. (Toke et al., (2010), Ninlawan et al.,(2010)).

The design of a logistics network and its planning are two of the more strategic issues facing logistics managers in this function. Many trade-off decisions need to be made with regard to the firm's market, customer, product and logistical resources. Logistics decisions include options such as direct shipping or hub-and-spoke, central warehouse or distributed network, intermodal or single mode, and third party services or private fleet. Some of the design and management criteria that support environmental planning in this area include fewer shipments, less handling, shorter movements, more direct routes, and better space utilization. But, each of these issues includes tradeoffs among delivery time, responsiveness, quality and cost, as well as environmental performance. (Toke et al.,(2010))

The green supply chain prescribes a reduction in the delivery frequency in order to reduce the carbon emission. This could be of conflict in today's highly agile and competitive market. However, this could be resolved not only through the reduction in delivery frequency but also using other strategies as proper selection of transportation modes, reducing geographic distances between entities and transport consolidation. (Helana & Machado (2008)). There is yet another major challenge in outbound practices, warehousing. Other than land use requirements, it generates more waste in the supply chain. These outbound logistic issues could be resolved by Freight consolidation which carried out to utilize the transport capacity more efficiently can help minimizing the environmental impact of the out bound system. (Wu et al., (1995))

5.6 Reverse Logistics:

Reverse Logistics is the opposite of traditional or forward logistics (Beamon(1999), Dowlatshahi (2000) and Carter and Ellram (1998) define reverse logistics as a process where a manufacturer accepts previously shipped products from the point for consumption for possible recycling and re-manufacturing. Dowlatshahi(2000).Thierryet al., (1995) reports that reverse logistics have been widely used in automobile industries such as BMW and General Motors. Other companies such as Hewlett Packard, Nokia etc., are also using reverse logistics as a supply chain process. This eventually helps firms become more competitive in their own industry (Srivastava (2007), Ninlawan et al.,(2010)).

An increasing number of organizations in Asia, Europe and North America engage in voluntary or mandatory end-of-life product management. Moreover, since developments in product take-back are driven by a mixture of environmental concerns and economic opportunities, the most promising corporate end-of-life strategies create both economic and environmental values (Geyer and Jackson(2004)).

GSCM and logistics efforts have caused organizations to consider closing the supply chain loop (Beamon (1999); Seuring (2004)). Kelle and Silver's (1989), Pohlen and Farris (1992); Stock (1998) and Tibbenand Limbke (2002), Carterand Ellram, (1998); Srivastava and Srivastava (2005); Shih (2001);Nagorney and Toyasaki (2005) and Min, Ko and Ko, (2006) have all provided conceptual studies on reverse logistics.

5.7 Support practices:

Industry has looked down at green as being optional. But if a company wants to maximise profit, being green is no longer an option. It has become a necessity due to inevitable influence of the environment. Becoming green is no more a fad; it is a change by itself which needs two major change agents to play a role to bring in a drastic change in the supply chain practices of the company as a whole or as an entity by itself. They are the market support from the customers and the internal management decision and support for implementation.

5.8 Management Support:

For successful adoption and implementation of any technology or change in an organization top management support is inevitable. (Hu and Hsu (2006),Ninlawan et al.,(2010)). Many such change management has failed due to the lack of Top management support. GSCM practices to be implemented in any organization involves time cost and resources (Murphy et al., (1996)), it is a strategic decision that has to be implemented with complete support from the top management (Lippmann (1999), Handfield et al.,(2005)). It is rather an initiative driven from top to bottom. Hence Total commitment from Senior Managers on GSCM makes the implementation of the practices possible in manufacturing companies. (Srikanta (2009), Hu and Hsu (2010)). Implementation of any environmental management system and GSCM practices in organisations involves not one particular department or session of an industry, it is mostly a cross functional activity (Yuang and Kielkiewwicz –Yuang(2001)) which makes the commitment from top management inevitable. Cross functional cooperation on environmental management on GSCM is vital for successful implementation of the practices. (Srikanta (2009)). TQEM (Total Quality Environment Management) is an outcome of making a TQM supported work floor green. It is very hard to define this concept like TQM, it is rather a management philosophy that drives an organization beyond TQM and which arises out of the support from the Top management. (Toke et al., (2010)).

5.9 Customer Cooperation:

Cooperation from customers is very important for a firm to invest on any strategic change in practices. (Zhu et al., (2008),Zhu et al.,(2010), Ninlawan et al.,(2010)). Environmental practices in the supply chain requires high cooperation from the customer and in today's customer driven market any change in organizational practices could be successful only if they are substantiated by good cooperation from the customers.(Karna and Heiskanen(1998), Sarkis(1999). GSCM practices require cooperation from customers on Eco-Design, Clean processes and Green packaging.

6. Discussion

The paper consolidates a framework for Green supply chain management practices for Indian manufacturing industry. The identification and consolidation of the practices would contribute to the better understanding and conceptualization of the GSCM as a whole and not just in fragments. The framework is a generalized format that can be modified to any supply chain. It offers a guideline for researchers to develop empirical studies that can explore the practices in real time. This acts as a framework for organisations to extend its environment management practices outside the walls of the organization. The framework can also be used by practicing managers to develop metrics to measure their position and understand their competitive advantages when analysed with the competition. Although the objective was accomplished, the paper has its own limitations. No statistical validation of the model was performed.

7. CONCLUSION

Global market demands and governmental pressures are driving businesses to become more sustainable. Hence Green supply chain management (GSCM) initiatives are the apt practices that can improve competitiveness and environmental performance leading to sustainability.

The subject launches a number of challenges for managers, academics and researchers. GSCM involves a paradigm shift in which the issue of sustainability is no longer seen as a source of costs, representing a potential source of competitive advantage for companies. Manufactures today are under pressure to adopt these strategies to create an environmental stance that is a driver for reduced costs and risks, increased revenues, and improved brand image. Organizations which have taken up the environmental position go beyond the basics of cutting waste and operating efficiently to adopt the strategy of Lean and Clean to be really green.

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