

Elements of Green Supply Chain Management

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Abstract-The purpose of the paper was to highlight the elements of green supply chain. Green Supply Chain Management (GSCM) has received more attention in the last few years in academia and industries. Adoption of environmental management practices is essential in every industry to fulfil the requirement of environmental regulations and customer demands. The findings of the paper confirm that firms need to implement green supply chain elements as a continuous process to achieve sustainability in the supply chain processes. The study concludes that firms need to enhance the levels of implementing green supply chain practices in managing their operations. GSCM is a remarkable concept to increase environmental performance and reduce environmental impacts.

Keywords-Green supply chain management(GSCM), supply chain management(SCM), Reverse logistics, Green manufacturing, Green operations, Green procurement.

I. INTRODUCTION

Green Supply Chain Management (GSCM) has emerged as new management strategy for automobile organizations to become more environmental friendly, cost effective and competitive. The study focuses on green supply chain management practices in Automotive Industry in India. With the rise of environmental awareness, regulations in various countries become stricter, which consequently results in environmental pressures. With the economics developing rapidly, negative externalities (e.g., emission of carbon dioxide or the use of hazardous substances) in the process of manufacturing have significantly impacted the environment and ecology. Countries therefore become more aware of environmental issues and sustainable development and have formulated various environmental directives to restrain firms' negative impacts on the environment[2]. Green supply chain management can be defined as integrating environmental thinking into supply-chain management, including product design, material sourcing and selection, manufacturing processes, delivery of the final product as well as end-of-life management of the product after its useful life. According to [11], GSCM's scope ranges from reactive monitoring of general environmental management programs to more proactive practices implemented through various Rs (Reduce, Reuse, Rework, Refurbish, Reclaim, Recycle, Remanufacture, Reverse logistics, etc.). Over recent years, the globalization of the economy, environmental awareness of stakeholders, and pressures exerted by governments through legislation and environmental regulations, have motivated companies to adopt positive changes like GSCM practices in the operations of supply chains[4].

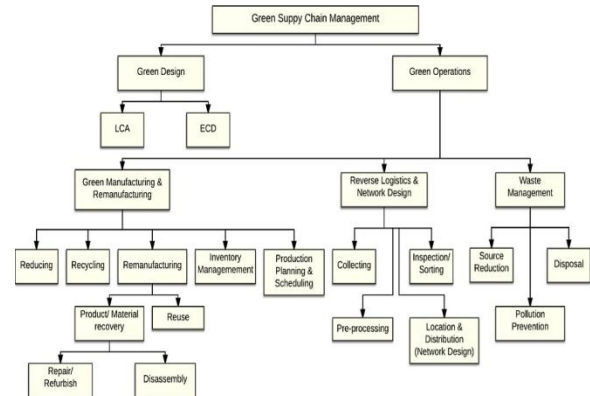


Fig.1 Classification of GSCM practices in Automobile Industry (Srivastava, 2007)

II. ELEMENTS OF GSCM

A. Green Procurement

Green procurement is defined as an environmental purchasing consisting of involvement in activities that include the reduction, reuse and recycling of materials in the process of purchasing. Besides green procurement 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 in a multinational investigation identified key factors for green purchasing including providing design specification to suppliers that include environmental requirements for purchased items, cooperation with suppliers for environmental objectives, environmental audits for supplier's internal management, and suppliers' ISO14001 certification.

B. Green Design

Green design has been used extensively in the literature to denote designing products with certain environmental considerations. It is the systematic consideration of design issues associated with environmental safety and health over the full product life cycle during new production and process development. Its scope encompasses many disciplines, including environmental risk management, product safety, occupational health and safety, pollution prevention, resource conservation and waste management. A common approach is to replace a potentially hazardous material or process by one that appears less problematic. This seemingly reasonable action can sometimes be undesirable if it results in the rapid depletion of a potentially scarce resource or increased extraction of other environmentally problematic materials.

C. Green Operations and Reverse Logistics

Green operations relate to all aspects related to product manufacture/remanufacture, usage, handling, logistics and waste management once the design has been finalized. Some of the key challenges of GSCM such as integrating remanufacturing with internal operations, understanding the



effects of competition among remanufacturers, integrating product design, product take-back and supply chain incentives, integrating remanufacturing and reverse logistics with supply chain design in this define reverse logistics as 'the process of planning, implementing, and controlling the efficient, cost-effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal. Reverse logistics activities differ from those of traditional logistics. Reverse logistics networks have some generic characteristics related to the coordination requirement of two markets, supply uncertainty, returns disposition decisions, postponement and speculation. 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 characteristics of the product. Better packaging, along with rearranged loading patterns, can reduce materials usage, increase space utilization in the warehouse and in the trailer, and reduce the amount of handling required.

D. Green Manufacturing and Remanufacturing-

Green manufacturing is defined as production processes which use inputs with relatively low environmental impacts, which are highly efficient, and which generate little or no waste or pollution. Green manufacturing can lead to lower raw material costs, production efficiency gains, reduced environmental and occupational safety expenses, and improved corporate image. Green manufacturing aims to reduce the ecological burden by using appropriate material and technologies, while remanufacturing refers to an industrial process in which worn-out products are restored to like-new condition. Remanufacturing is defined as recycling-integrated manufacturing. Industries that apply remanufacturing typically include automobiles, electronics and tyres. Product recovery refers to the broad set of activities designed to reclaim value from a product at the end of its useful life.

E. Waste Management

Waste management can be said as the reduction of perilous waste which is generated as a by-product of the production process and operations and subsequently treated, arranged or disposed off. Waste reduction can be done at source or prevention of pollution at every step of the organization's procedures. Waste management helps to prevent the formation of waste rather than managing it after it is generated. Effective waste management needs to focus on 'preventing' pollution at the source in products as well as manufacturing processes rather than 'removing' it after it has been created. Firms can control waste through efficient usage of water instead of having to wait until the waste has accumulated. In addition, disposal cost, especially for equipment has always been a compelling problem and has led to green consciousness. Firms need to ensure that they utilise whole life costing when procuring equipment, by taking disposal measure and costs into account.

III. LITERATURE REVIEW

GSCM is the term refers to integrating environmental thinking into supply chain management including product design, material sourcing and selection, manufacturing processes, delivery of the final products to the customers and end of life management of product to the consumers after its useful life. In this type of system, innovation and policies in supply chain respond to the need for a more

sustainable environment. The objective of the GSCM is win-win strategy to benefit the environment as well as the overall performance of the company. Most of the companies are keen to implement GSCM and it has become a future goal for many companies. GSCM mainly includes green design, green sourcing, green manufacturing, green transport and reverse logistics[11].

Green supply chain (GSC), is also called environmentally conscious supply chain (ECSC) or environmentally supply chain (ESC), which has its roots in both environment management and supply chain management literature. Adding the 'green' component to supply chain management involves addressing the influence and relationships between supply chain management and the natural environment. The conceptual framework for the study was developed based on the framework of green supply chain management by [3] who postulate Green supply chain management elements as involving green procurement, green manufacturing, green operations and reverse logistics and finally waste management as independent variables.

Green Design about taking into account systematically issues related to environmental safety and health over the product life cycle with a potential to be reused or recycled at end-of-life[5]. Eco-design process includes the following green practices:

- Design of products to reduce material/energy consumption during production and product use.
- Design of products for (3Rs) reuse, recycle, and recovery of material and component parts.
- Design of products to avoid the use of hazardous materials.

Green distribution process is defined as the integration of environmental issues into packaging, transportation and logistics activities[10].

Thus, green distribution practices are presented:

- Green packaging: the use of environmentally friendly materials and recycled packaging with improved packaging designs and techniques help companies to reduce waste and costs.
- Green transportation and logistics: the consolidation of orders and route optimization are energy saving ways and methods to reduce CO2 emissions.

GSCM is a concerted effort across the enterprise and is more than simply implementing some ecological practices, but rather a coherent approach for improving environmental and organizational performance of all levels of management[13]. Green supply Chain management (GSCM) = Green Purchasing[11] + Eco-Design [5] + Green Manufacturing + Green Distribution[10] + Reverse Logistic[9]. [11] defined GSCM as integrating environmental considerations into SCM including product and service design, procurement, manufacturing processes, distribution, and end-of-life management of the product to achieve sustainable competitive advantage. L'Oreal, HP, IBM, GE, and Dell have all taken the term "green" as an important value for their business and adopted of new energysaving technologies in order to improve good public image or "green image". BMW, Pepsi-Cola, and Kodak have implemented reverse logistic process for economic benefits.

Reverse logistics activities differ from those of traditional logistics. Reverse logistics networks have some generic characteristics related to the coordination requirement of two markets, supply uncertainty, returns disposition

decisions, postponement and speculation. 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 characteristics of the product. Better packaging, along with rearranged loading patterns, can reduce materials usage, increase space utilization in the warehouse and in the trailer, and reduce the amount of handling required[1].

Green manufacturing is defined as production processes which use inputs with relatively low environmental impacts, which are highly efficient, and which generate little or no waste or pollution. Green manufacturing can lead to lower raw material costs, production efficiency gains, reduced environmental and occupational safety expenses, and improved corporate image. Green manufacturing aims to reduce the ecological burden by using appropriate material and technologies, while remanufacturing refers to an industrial process in which worn-out products are restored to like-new condition[6].

Different authors have provided several definitions of GP and have used different terminologies, such as environmental procurement or purchasing. Furthermore, while the notion of “green purchasing” or “GP” is circulating, nobody has outlined it in depth and specified the notion of “greenness” as related to suppliers[8]. Two types of driving factors for the adoption of green procurement is categorized based on internal and external factors. Internal driving factors, according to some previous studies, are concerned with organizational factors, while external factors are driven by some variables such as regulation, customers, competition, and society [12]. Green operations relate to all aspects related to product manufacture/remanufacture, usage, handling, logistics and waste management on the design has been finalized[6]. Some of the key challenges of GSCM such as integrating remanufacturing with internal operations, understanding the effects of competition among remanufacturers, integrating product design, product take-back and supply chain incentives, integrating remanufacturing and reverse logistics with supply chain design are posed in this area.

IV. CONCLUSION

It is important for organisations to consider moving towards Green Supply Chain Management (GSCM). It is not a fad: it is becoming a necessity. Implementing GSCM best practices has the potential to provide financial benefits (such as increased revenue, reduced costs, improved asset utilisation, and enhanced customer service); environmental benefits (such as reduced waste, increased energy efficiencies, reduced air and water emissions, and reduced fuel consumption); and social benefits (such as reduced community impacts, minimised traffic congestion through improved transportation management, and better health and safety). It can also enhance a company’s brand and reputation. Once companies gain the proper motivation and

start looking at greening of their supply chains in earnest, supply chain managers will need to focus on three areas of relevance for them:

A. Greener product and Green packaging:

Designers will need to use the maximum amount of environmentally-safe product components, and finished goods and packaging will need to be more biodegradable and minimally harmful to the environment.

B. Supply network compliance:

It will become imperative for companies to do an audit of their suppliers and their suppliers’ suppliers to ensure every firm - both local and global - that has an impact on their products is complying with green guidelines.

C. Reverse logistics:

When government will start imposing increased regulations on recycling, up-cycling etc., supply chain systems will have to accommodate products being returned for recycling or disposal at end-of-product life. This will require a truly closed-loop supply chain, where goods have to return to the supply chain to be broken down and properly disposed of.

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