

# A STUDY ON GREEN SUPPLY CHAIN MANAGEMENT INITIATIVES IN SMES OF THE PUNE REGION

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## ABSTRACT

*Green Supply Chain Management (GSCM) is a new concept for improving the capability of the supply chain through sustainability. Manufacturers are more concerned with profit-making rather than saving the environment. However, it is important to balance between profitability and saving the environment. The paper is aimed at studying the various activities of the supply chain processes in selected small and medium-scale industries of the Pune Region. and it tries to find how eco-friendly they are in their logistics as well as supply chain activities. This study addresses the major activities of the green supply chain; namely green procurement, green manufacturing, green warehousing, green distribution, green packaging, and green transportation. Through the literature review, the various environmental factors affecting the manufacturing sector were identified and discussed. A questionnaire is designed with factors affecting the sustainable supply chain and was used for the survey. The data analysis is carried out to find the sustainability performance of various manufacturing activities toward a green future. The result analysis indicates that green initiatives have started but need acceleration to a higher level.*

**Keywords:** *Green Supply Chain Management; Green Supply Chain Performance; Green Business Strategy; Sustainable Manufacturing; Sustainable Supply Chain*

## INTRODUCTION

Supply Chain Management (SCM) consists of all the parties involved, directly or indirectly, in fulfilling a customer's need. It includes not only the manufacturer and suppliers but also transporters, warehouses, retailers, and even customers themselves [1]. Green Supply Chain Management (GSCM) is an integration of environmental thinking into the supply chain [2]. GSCM is one of the latest industrial buzzwords; implementing the green concept in supply chain management, which intern will help industries to focus on environmental issues. Environmental concern has become a remarkably prevalent concern for governments, societies, and business houses. Business organizations and the transportation sector are considered to be the source of most of the environmental problems such as global warming, ozone depletion, solid waste, and air pollution. The common view that arises to mind when the thought of green is the basic step of recycling, reusing, and reducing. There are many opportunities for companies to contribute to going green. For the purpose of this study, the focus is on the supply chain. This study will address the major activities of the green supply chain as shown in Fig1; namely green procurement, green manufacturing, green warehousing, green distribution, green packaging, and green transportation. Green supply chain practices range from green purchasing to integrated supply chains flowing from

suppliers, to manufacturers, to customers, and to the reverse supply chain which is “closing the loop” (Zhu and Sarkis, 2003; Rao and Holt, 2005; Sarkis 2012).

In a conventional supply chain, the flow of materials and information is linearly moved from one end to the other and there is limited cooperation and visibility. In contrast, Green Supply Chain considers the environmental effects of all stages of the supply chain from the pulling out of raw materials to the final disposal of merchandise. Within the Green Supply Chain, all stage player induces other players to go Green and offer the essential information, support, and direction through supplier’s development programs. Environment aims and performance measurements are then integrated with financial and operational objectives. With this amalgamation, the Green Supply Chains will then accomplish what any individual organization on its own could not possibly accomplish i.e. reduced waste, and minimizing environmental impact while promising maximized consumer satisfaction, and good profits.

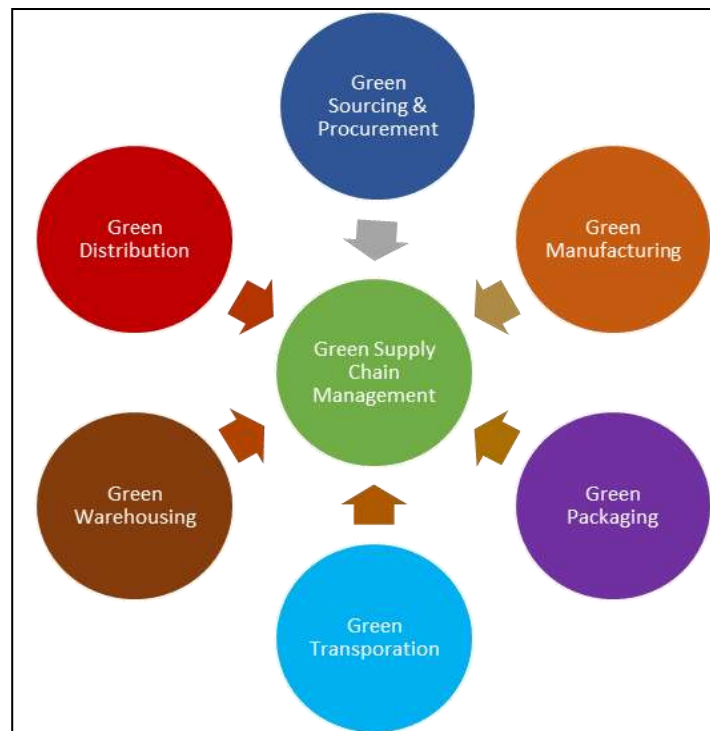


Fig. 1: Major activities of the green supply chain

## LITERATURE REVIEW

Purba Rao, and Diane Holt (2005) [6] explore to identify potential linkages between green supply chain management, as a program for environmental enrichment, economic performance, and competitiveness amongst the South East Asian companies. For this purpose, they develop a conceptual model from literature sources and collect data using a questionnaire from a sample of leading edge ISO14001 certified companies in South East Asia followed by structural equation

modeling. They conclude that greening the different phases of the supply chain leads to an integrated green supply chain, which ultimately leads to competitiveness and economic performance.

Sang M. Lee, et. al. (2012) [7] investigate green supply chain management (GSCM) practices and their correlation with organizational performance. Explores the effect of GSCM practices on the performance of small and medium scale enterprises, the three organizational variables (employee satisfaction, operational efficiency, and relational efficiency) are as moderators. Data is collected from 223 SMEs in the electronics industry of Korea. The reliability, validity, and goodness-of-fit of the research model were tested by widely accepted statistical tools. The hypotheses relating to GSCM practice implementation and business performance were tested using structural equation modeling. However, significant indirect relationships were found between GSCM practice implementation and business performance.

Su-Yol Lee, (2008) [8] describe what facilitates small and medium-sized suppliers require in order to participate in green supply chain initiatives. The author examines buyers' green supply chain management practices, government involvement, and internal readiness of the suppliers themselves, as possible drivers. Through an e-mail survey, the research framework and hypotheses were examined in South Korean small and medium-sized suppliers. Data is empirically assessed through factor analysis and Cronbach- alpha test. To test the hypotheses for the drivers of suppliers' willingness to participate in green supply chain initiatives, hierarchical linear regression was adopted. The study reveals that buyer environmental requirements and support were positively connected to their suppliers' willingness to take part in green supply chain initiatives.

Maria et. al. (2012), [9] aim to present a structure of dimensions, which are important concerning environmental measurement in supply chain management. The author also aims to present, how environmental performance measurements can be a success by applying these dimensions. Literature regarding logistics management and performance measurement is coupled with theories regarding environmental logistics and green supply chain management. A framework is developed and a case study based on a reverse supply chain is used to illustrate the framework. The paper outlines important aspects to consider in the design of environmental performance measurements in supply chain management and identifies shortcomings in existing research. The case presents successful examples of how environmental performance measurements can be applied across managerial levels.

## **ELEMENTS OF GREEN SUPPLY CHAIN**

### ***A. Green Sourcing and Procurement***

The role of procurement is to obtain a supply of raw materials in order to produce a product or service. Purchasing includes the selection of a vendor, selection of material, outsourcing, negotiation, delivery planning, stocking, material management etc. Green procurement is defined as a set of supply-side practices utilized by an organization to effectively select suppliers based on their environmental competence (Thoo Ai Chin, Huam Hon Tat, and Zuraidah Sulaiman 2015) [2].

Green procurement involves buying goods and services that are less harmful to human health and the environment than competing products that serve the same purpose (Hokey Min William P. Galle, (2001)). It also means the participation of the purchasing department in the practical use, reuse, and preservation of resources that occur in supply chain activity. One of the most important but more difficult groups in a supply chain is the small-scale supplier. Research has shown that small-scale companies do not attach as much importance to the management of an environmental problem as large companies. Indeed, small and medium-sized ventures that contribute in green procurement present major barriers for producers (Sarkis, 1995). General research on corporate earnings and environmental awareness shows that large companies tend to be more thoughtful of the environment (Hokey Min William P. Galle, (2001)). The procurement or purchasing decision will impact the green supply chain through the purchase of materials that are either recyclable or reusable, or have already been recycled (Joseph Sarkis 2003) [5].

### **B. *Green Manufacturing***

Green manufacturing can be defined as reducing the environmental pressure by using appropriate technology and materials (Nunes et al, 2010). [12] The main goal of green manufacturing is to save energy via new technologies or by supplying greener source of energy and increase the production efficiency via new processes (Anoop A.T., et al, 2013) [3]. The phrase sustainable manufacturing is sometimes used carelessly to describe the actions related to characterizing and reducing the environmental impacts of manufacturing. Sustainability, however, implies a great deal more than the simple act of analyzing and modifying the environmental performance of manufacturing processes and systems [4]. Green manufacturing makes use of renewable energy, recycled materials as possible.

### **C. *Green Packaging***

It is not only the product that is produced and sold that leaves a carbon footprint, but also the packaging. Green packaging or environmentally friendly packaging is one which is easily recycled, and safe for individuals and the environment. By studying the waste container, one can easily get an impression of how much unnecessary packaging will get from the products consumed every day. Packaging is a large part of the operational life cycle, and because of that there are several ways of making the supply chain greener by making changes to the packaging process. This often goes hand in hand with product design, while designing products one should consider efficient packaging in mind, which can make improvements that will reduce the environmental impact of the product throughout the supply chain. Also, by using environmentally friendly material for packaging one can develop greener solutions.

Another part of packaging is labeling, that's Ecolabels. Ecolabels are seals of approval given to products that are deemed to have fewer impacts on the environment than functionally or competitively to similar products. This function is a visible proof for the others, saying which environmental requirements the products fulfill.

#### ***D. Green Warehousing***

Green warehousing is a relatively new approach which implements greening into warehouses and distribution centers. There are many elements that you can implement in a warehouse, but in short, each element which reduces energy consumptions or material usage/ waste is a greening element. The warehouse is the perfect place to start reducing, reusing and recycling.

#### ***E. Green Distribution and Transportation***

Distribution and transportation operations are also important operational characteristics that will affect the green supply chain. A number of choices including distribution outlet locations, mode of transportation, control systems, and just-in-time policies, will not only influence the forward logistics network, but also the reverse logistics network. [5] According to Al-Odeh and Smallwood (2012), factors like: fuel, modes of transport, infrastructure, and operational practices are important factors to consider in developing green transportation. Green Transport is sometimes known as Sustainable Transport is any form of transport that does not use or rely on declining natural resources. Instead, it relies on renewable or regenerated energy rather than fossil fuels that have a finite life expectancy. A green vehicle, or clean vehicle, or eco-friendly vehicle or environmentally-friendly vehicle is a vehicle that produces less harmful impacts to the environment than comparable conventional internal combustion engine vehicles running on gasoline or diesel.

## **FINDINGS AND RESULTS**

The survey was designed with six factors affecting the green supply chain was conducted in the small and medium manufacturing industries of Pune region in order to find out the sustainability performance of these industries towards green future.

The questionnaire on green sourcing and procurement consists of six questions that intended to test how sourcing and procurement practices support green initiatives. Eight questions on Green manufacturing was intended to address the internal factors of manufacturing system with reference to environment. Five questions on packaging were to know how green are the packaging. Warehousing questions were planned to study use of nature and reduction of inventory. Green distribution and Transportation questions aims appraise the use of environmentally friendly vehicles. The survey was carried out thorough personal visit and Google survey. A total of 65 industries responded to questionnaire.

#### ***A. Green Sourcing and Procurement***

With the objective of how green sourcing and procurement is practiced in industry, questions were put to know, are they guiding their suppliers for environmental protection, to reduce the use of paper, encourage for recycled materials, use of green packaging and to know the distance of location of the supplier. In general, to study do they guide suppliers through green procurement

policy or not.

From table-1 it is learnt that among 65 respondents 58% of manufacturing industries were actively guiding the suppliers for environmental protection goals. 66 % have reduced the use of paper in procurements by using electronic process to create efficiency. 80% of the responding manufacturing industries have suppliers located within 100 Km. 82% of manufacturing industries insists on suppliers to use green packaging and they have environment policy guidelines for suppliers. From the analysis it is known that 63.1% of responding manufacturing industries gave preference for recycled materials during procurement.

Table:1 Responses on green sourcing and procurement

<i>Sl. No</i>	<i>Question</i>	<i>Yes</i>	<i>No</i>
1	<i>Does your organization actively guide with the suppliers for environmental protection goals?</i>	38	27
2	<i>Do you reduce the use of paper in procurements by using electronic process to create efficiency</i>	43	22
3	<i>Are your suppliers located within 100kms from manufacturing plant?</i>	52	13
4	<i>Your organization always makes demands on suppliers to use green packaging</i>	53	12
5	<i>Does your organization have environment policy guidelines for suppliers?</i>	53	12
6	<i>Do you give preference for recycled materials during procurement?</i>	40	25

## **B. Green Manufacturing**

Green manufacturing questions were intended to study the extent of use of natural resources, reduction of toxic and hazardous materials in manufacturing, optimization of manufacturing processes, use of renewable sources, use of efficient tools, elimination of waste and disposal of waste.

From table -2 the responses shows that only 6% of the responding manufacturing industries were consuming very low, 14% low, 58% medium, 19% high, and 3% very high level of natural resources like wood, coal, oil, water, steel etc. 11% have least importance (very low & low) on reducing toxic and hazardous materials in manufacturing processes and 50% have medium importance. 6% of the industries have very high importance for optimization of manufacturing processes, 30% consider high importance, 50% medium importance, 9% have low importance.

Table:2 Responses on Green Manufacturing

Sl. No	Indicate the extent to which your organization is/has	Very Low	Low	Medium	High	Very High
1	Consuming natural resource like wood, coal, oil, water, Steel etc.	6%	14%	58%	19%	3%
2	Focusing on reduction of toxic and hazardous materials in manufacturing processes	2%	9%	50%	30%	9%
3	Optimized manufacturing processes	0%	9%	49%	36%	6%
4	Using recycled water (if any water consumption)	3%	19%	23%	47%	8%
5	Using renewable energy source like wind, solar, and biomass	14%	27%	41%	12%	6%
6	Focusing on the reduction of waste in manufacturing processes	0%	19%	27%	48%	6%
7	Using fuel/power efficient tools and machine	2%	14%	48%	33%	3%
8	Mixing industrial waste having chemical composition while disposal	14%	41%	34%	11%	0%

### C. Green Packaging

Questions on green packaging were deliberate to learn organization policy for environmentally friendly packaging, such as biodegradability, economic aspect in selecting packaging and recyclability.

The data in table-3 shows that, 67.2% of the responding manufacturing industries were using biodegradable packaging. However, 44% were considering every time packaging as an economic issue. About 53% were occasionally encouraging the packaging made of recyclable materials. 47% were occasionally encouraging disposal in an environmentally responsible way of packaging. 58% of the responding manufacturing industries were occasionally collaborates with suppliers to use less packaging materials.

Table :3 Responses on Green Packaging

Sl. No	Question	Never	Almost Never	Occasionally	Almost Every-time	Every-time
1	Do you view sustainable packaging as an economic issue?	3%	11%	39%	3%	44%
2	Your enterprise actively collaborates with the suppliers to use less packaging materials	4%	8%	58%	5%	25%
3	Does packing encourage disposal in an environmentally responsible way?	15%	11%	47%	16%	11%
4	How often you encourage the packaging made of recyclable materials?	1%	30%	53%	5%	11%

#### D. Green Warehousing

The intention here was to learn how best natural ventilation and lighting is used in the warehouse, use of reusable containers and reduction of inventory.

Data analysis in table-4 indicates that 85% of the responding manufacturing industries had strategy for reducing inventory and handling of the product. 43 % were using solar panels and green roofing option for reducing energy consumption. 69 % industries were using reusable container/ storage equipment. 97% of industries have better lighting and ventilation facility.

Table: 4 Responses on Green Warehousing

Sl. No	Question	Yes	No
1	Do you have better lighting and ventilation facility	63	2
2	Do you use any reusable container/ storage equipment	45	20
3	Do you use solar panels and green roofing option for reducing energy consumption	28	37
4	Do you have strategy for reducing inventory and handling of the product	55	10

#### E. Green Distribution and Transportation

The objective of study here is to identify the use of fuel-efficient vehicles for transportation, servicing the vehicles, speed management, optimization of routes, and order consolidation for transportation.

The analysis from table-5&6 indicates that 70% of responding manufacturing industries were implemented order consolidation. 80% were optimized location of distribution hubs/networks. 62% were following speed management policy for transport vehicles which helps to reduce fuel



consumption over a long distance. 45% of the responding manufacturing industries were using clean idle trucks. 65 % of them were actively collaborates with logistics providers for green logistics. 71.4% of responding manufacturing industries have highly efficient transportation facility. With respect to fuel efficient vehicles for transportation 41% prefer highly efficient vehicles, 1% prefer very highly efficient vehicles, 28% give least preference for fuel efficient vehicles. 47% of the respondents have optimized routes of transportation to medium extent 33% have highly optimized routes. Only 2% gave preference to very high extent. 18% have least bothered about optimization of routes. 50% of the responding manufacturing industries were often periodically ensures servicing of the vehicles at service station to a medium extent. 23%.

Table: 5 Responses on Green Distribution and Transportation

Sl. No	Question	Very Low	Low	Medium	High	Very High
1	How often you periodically ensure servicing the vehicles at service station	2%	19%	50%	23%	6%
2	Routes of transportation are optimized	1%	17%	47%	33%	2%
3	What is the extent of usage of new propulsion technologies like hybrid vehicles? power train, fuel cells and electric car for transportation	11%	23%	30%	31%	5%
4	What is the extent of usage of fuel-efficient vehicles for transportation	5%	23%	30%	41%	1%

Table: 6 Responses on Green Distribution and Transportation

Sl. No	Question	Yes	No
5	Does your transportation is highly efficient	45	20
6	Does your organization actively collaborate with logistics providers for green logistics?	42	23
7	Do you use clean idle trucks?	29	36
8	Whether you are following a speed management policy which helps to reduce fuel consumption over long distance?	40	25
9	Do you optimize location of distribution hubs/networks?	52	13
10	Do you implement order consolidation?	46	19

## CONCLUSION AND FUTURE SCOPE IN MEDIUM AND SMALL-SCALE INDUSTRIES

The paper provides an effective approach for the study on initiatives of green supply chain. The results inference show that the green initiatives have started in SME and are in progress. But they need to be accelerated to higher level. Further analysis can be done with a more structured questioner to determine exact extent of achievement. As the data was collected from the responses of the responder hence the accuracy of the data collected would be an area of worry.

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