

Current Scenario of Green Supply Chain and logistics Management practices in the Indian Industries: A survey study

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ABSTRACT: - Green Supply Chain Management (GSCM) is one of the recent innovations for the enhancement of capabilities of Supply Chain Management. In this research, we aim to study the various activities of the Supply Chain processes of the various Indian Manufacturing Industries i.e. both SME's {Small Manufacturing Enterprises} & Large Scale Industries & finds how much eco-friendly they are (i.e. how much % of the green factor are involved in their supply chain activities from the procurement of the raw material to the transportation of the final product) for the purpose of metering the performance of the manufacturing sectors has been studied. The major six activities of the supply chain; namely Green Sourcing & Procurement, Green Manufacturing, Green Warehousing, Green Distribution, Green Packaging, Green Transportation are being covered throughout the research. From these above process activities we measured the performance of the various Indian manufacturing industries with the help of various crucial performance indicators & their sub-indicator's.

The research outcome based on the survey in this research paper identifies the important results that are causes impact on the environment caused by the manufacturing sectors based upon the appropriate methodology we applied for research purpose. In this research paper, we discussed the various environment factors affecting in the manufacturing sectors while greening the supply chain as identified from the literature review. A survey questionnaire designed with four main factors affecting the sustainable supply chain further having various Indicators & Sub-Indicators. This survey questionnaire was being filled by the various multiple manufacturing sectors in order to find out the sustainability performance of various manufacturing sectors towards Green future.

Keywords: *Green Supply Chain management (GSCM)* ; Green Sourcing & Procurement , Green Manufacturing , Green Warehousing , Green Distribution, Green Packaging ,Green Transportation,

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I. Introduction & Literature review

An environmentally conscious supply chain, also called a green supply chain, is a new concept appearing in recent literatures. Although this environmental issue has been realized very important for business, its introduction to supply chain management has only been developed recently. The literature about environmentally conscious supply chain is very limited. "Sustainable Development" was the key concept of the 1992 Earth Summit in Rio, as governments and international organizations committed themselves to take action to protect the environment as in integral part of long-term economic development. Environmentally-responsible consumption and production is seen as an essential part of the strategy to improve environmental quality, reduce poverty and bring about economic growth, with resultant improvements in health, working conditions, and sustainability, and is today's highlighted Agenda. In particular, organizations were called upon to exercise leadership in the promotion of environmentally sound goods and services.

Qinghua Zhu in 2006 studied Green supply chain management: pressures, practices and performance within the Chinese automobile industry in which they observed that Increasing pressures from a variety of directions have caused the Chinese automobile supply chain managers to consider and initiate implementation of green supply chain management (GSCM) practices to improve both their economic and environmental performance. Expanding on some earlier work investigating general GSCM practices in China, authors explores the GSCM pressures/drivers (motivators), initiatives and performance of the automotive supply chain using an empirical analysis of 89 automotive enterprises within China [5].

Chung-Hsiao in 2008 studied the Green supply chain management in the electronic industry in which they mentioned that there are various approaches for implementing green supply chain management practices has been proposed and recognized in previous literatures according to the author, but there is yet no investigation that identified the reliability and validity of such approaches particularly in electronic industry. Author used the fuzzy analytic hierarchy process method to prioritize the relative importance of four dimensions and twenty approaches among nine enterprises in electronic industry. The findings indicate that these enterprises would emphasize on supplier management performance in the crucial role of implementing green supply chain management [17].

Fengfei Zhou in 2009 Study on the Implementation of Green Supply Chain Management in Textile Enterprises in which according to the author The green supply chain management is a sort of modern management mode which could comprehensively consider the environmental influence and resource utilization efficiency in the whole supply chain and how to implement the green supply chain management in special industrial operation at present has become into one of hotspot problems [7].

In another study Ninlawan & Tossapol in 2010 works on the Implementation of Green Supply Chain Management Practices in Electronics Industry in which they aims to survey current green activities in computer parts' manufacturers in Thailand to evaluate green supply chain management and they survey current green activities in computer parts' manufacturers in Thailand, 11 manufacturers are case studies who provide in-depth interview about green procurement, green manufacturing, green distribution, and/or reverse logistics. To evaluate green supply chain management, the questionnaire related to investigate GSCM practices, measure GSCM performance, and explore GSCM pressure/ driver within Thai electronics industry is used to obtain survey results. Then suggestions to develop GSCM in electronics industry are presented in the end [18].

Robert & Benjamin in 2010 Introducing Green Transportation Costs in Supply Chain Modeling in which they thinks that Escalating environmental concerns with prevalent transportation modes has lead to an increased interest in the adoption of "green", sustainable practices in the area of supply chain management. As a part of an overall green supply chain strategy, the amount of carbon emissions resulting from the transportation element of a supply chain is a growing concern for supply chain managers and corporate executives alike. In which authors tries to review methods for quantifying carbon emissions and estimating the cost of going green in a select set of supply chain optimization models [19].

It is not surprising that GSCM finds its definition in the supply chain management. Adding the green component to supply chain management involves addressing the influence and relationships of supply chain management to the natural environment.

$$\text{GSCM} = \text{Green purchasing} + \text{Green manufacturing/materials management} + \text{Green Distribution} / \text{marketing} + \text{Reverse logistics}.$$

II. Traditional versus Green Supply Chains

In a traditional supply chain, the flow of materials and information is linear and from one end to the other. There is a limited collaboration and visibility. Each supply chain partner has limited information regarding, for example, the carbon footprint and greenhouse gas emission of the other partners. Hence, each player may be concerned about his own footprint and may try to reduce this, irrespective of the impact on upstream and downstream supply chain. There may be some focus on end-to-end supply chain costs but due to limitations of information sharing, the costs are far from optimized in most cases.

An example follows in Figure 1-1 self constructed. In contrast, Green Supply Chains consider the environmental effects of all processes of supply chain from the extraction of raw materials to the final disposal of goods. Within the Green Supply Chain each player motivates other players to go Green and provides the necessary information, support, and guidance, for example, through supplier's development programmes or customer support. Environment objectives and performance measurement are then integrated with financial and operational objectives.

With this integration, the Green Supply Chains then will strive to achieve what any individual organization on its own could not possibly achieve: minimized waste, minimized environmental impact while assuring maximized

consumer satisfaction, and healthy profits. As consumers have become more aware of environmental issues, such as global warming, they have now started asking questions about the products they are purchasing. Nowadays, organizations routinely face queries about how Green their manufacturing processes and supply chain are, how wide the carbon footprint is, how wasteful their packaging is, and how they will recycle.

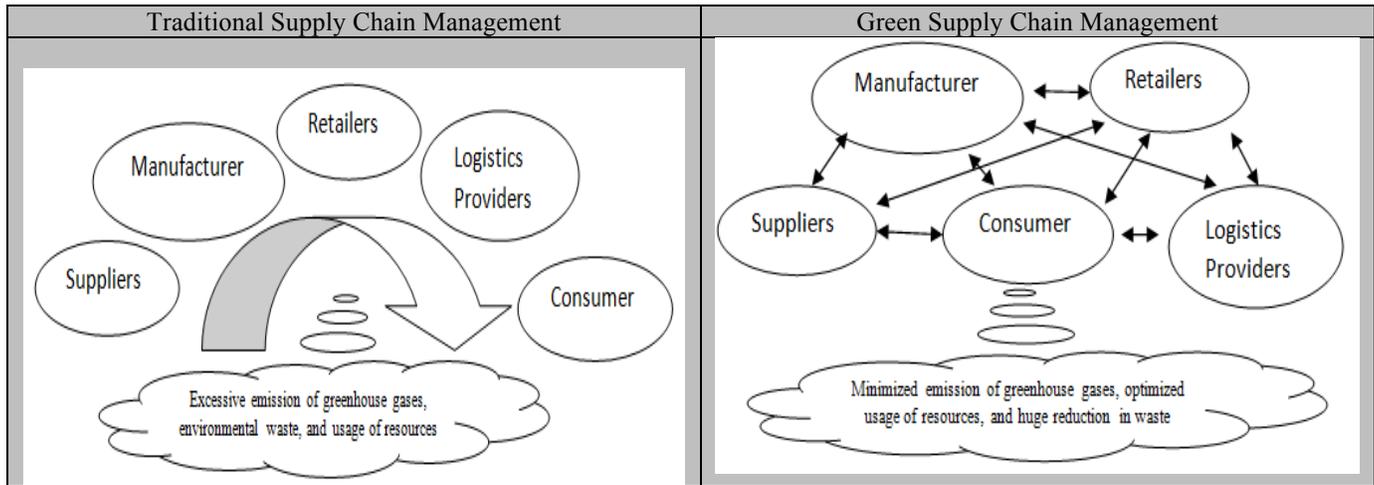


Figure 1-1 Traditional Supply Chain Management vs. Green Supply Chain Management

Some organizations have been able to convert the public's interest in Green issues into increased profits. A number of projects within organizations have shown that there is a clear link between improved environmental performance and financial gains. Organizations that have looked to their supply chain have discovered areas where operational and environmental improvements can produce profits. For example, General Motors was reported to reduce disposal costs by \$12 million by establishing a reusable container programme with their suppliers. While the motivation for this project may have been a desire to reduce costs, GM found that the environmental cleanup that resulted was actually a very marketable message for the public and policy makers.

III. Methodology:- A survey questionnaire designed with four main factors affecting the sustainable supply chain further having various Indicators & Sub-Indicators. This survey questionnaire was being filled by the various multiple manufacturing sectors in order to find out the sustainability performance of various manufacturing sectors towards Green future. More than 100 respondents has enthusiastically taken part in this research study covering Micro, Small, and Medium, Large Enterprises

IV. Important Findings & Results:-

Sample target of the 100 various multiple manufacturing industries with a total of more 200 respondents, out of which 35 % of respondents indicates them self as a top priority of the organisation & rest of the percentage value are like supervisors & various other's co-workers of the manufacturing unit. We collect the data from all forms of the sectors like micro & small scale are of [45%] and [55%] are from the medium and large scale enterprises [both government and private oriented manufacturing unit].

Respondents to the survey came from a variety of industry sectors {Micro, Small, and Medium, Large Enterprises}. Major Categories we covered are Railway's locomotive Manufacturer's , & Auto Parts Manuf.[25%], Hand Tools & Cutting Tools Manuf.[30%], Industrial Equipments (Agro ,Electrical & Safety) ,Machinery, Components/ Parts Manuf.,[27%] & various Others Manuf.,{ Like Food Products & Beverages Manuf., Paint manuf., Pipe manuf., Paper, Rubber & Plastic products manuf., Soap & chemical manuf., Packaging products manuf. [18%] ;

1. Green sourcing & procurement focused initiatives: - Reducing paper in contract and auditing suppliers were the least commonly implemented initiatives (both cited by less than a 3rd of respondents). The indicators here are positive and suggest that as technology improves and supply chains become more efficient, green practices will become more prevalent. 40% of companies Use electronic processes to create efficiencies in sourcing & procurement. Graph 1-2 is shown below

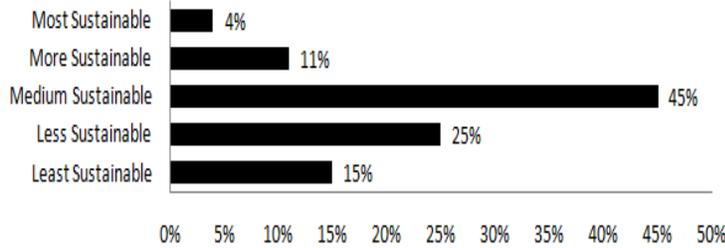
2. Green productions & manufacturing focused initiatives: - Applying carbon off-setting was a distant priority. Carbon offsetting is a relatively new and abstract concept which will take time to adopt. Other green production and manufacturing initiatives that Indian manufacturing companies are implementing include the introduction of “returnable and reusable” packaging, reducing the usage of solvent based chemicals and choosing compliant factory and supplier partners. Graph 1-3 is shown below

3. Green warehousing & distribution focused initiatives: - Most companies seem to be quite advanced in the implementation of green warehousing and distribution initiatives, most likely because these initiatives often also mean added efficiency. Companies appear to be most ahead in green practices in their inventory reduction and product handling [53%] have already implemented initiatives; and their ability to consolidate orders [44%] have already implemented these initiatives; and usage of reusable containers and storage equipment , where [57%] have already implemented these initiatives. When it comes to reducing energy consumption through the use of solar panels or green roofing options, surprisingly [14 %] of companies have already adopted such initiatives. Similarly around [22%] of companies report that they have already optimized the location of their distribution hubs. While these types of initiatives show direct cost and efficiency benefits, the up-front cost associated with them may be why more companies have not adopted them. Graph 1-4 is shown below

4. Green transportation focused initiatives: - Manufacturing Companies in India are also fairly well advanced in the types of green transportation focused initiatives they have adopted. Similar to their production and warehousing initiatives, there is a crossover between implementation of green and levels of efficiency. Almost half of companies surveyed are already periodically services of the vehicles at service stations along reducing empty miles, truck idle time and increasing cube utilization to create efficiency. Adoption of more sophisticated green transportation measures which have less direct relation to efficiency and cost savings are not in wide practice. These more advanced green transportation measure such as using more aerodynamic trucks [9%] and more alternative fuel powered trucks are all adopted by [11%] or less of companies. Graph 1-5 is shown below

5. Overall Performance Analysis of the Indian Manufacturing Sector

Category	Comments
Least Sustainable	Manufacturing sectors/Industries which face maximum challenges in maintaining their environment in the coming years
Less Sustainable	Manufacturing sectors/Industries likely to experience increasing environmental problems unless appropriate
Most Sustainable	Manufacturing sectors/Industries that are most likely to remain sustainable



■ Manufacturing sectors/Industries Performance Status

Graph 1-1 Various Indian Manufacturing sectors/Industries Performance Status



Overall Status of performance result summary of manufacturing sectors of India

1. 15 % out of 100 survey industries lies in the lagging category towards the sustainability capability

2. 25 % out of 100 survey industries i.e. $\frac{1}{4}$ ratio lies slightly above the lagging sectors category towards the sustainability capability
3. 45 % out of 100 survey industries lies i.e. nearly half the ratio lies in the middle range category towards the sustainability capability
4. Results of 11 % out of 100 survey industries very much better than the middle range lies in the slightly above performer category towards the sustainability
5. Only 4 % out of 100 survey industries lies in the leading category towards the sustainability capability

Summary of the finding for the GSCM performance for manufacturing sectors of India

6. [40%] of Indian manufacturing sectors Use electronic processes to create efficiencies in sourcing and procurement
7. Cost and complexity are perceived as the biggest barriers to implementing Green SCM, which highlights the need for cost effective and easy to implement solutions.
8. Brand building is one of the top incentives for green SCM, highlighting the importance of public perception of how companies operate.
9. Recycling of raw materials and component parts are the top green manufacturing and production focused initiatives
10. Adoption of green practices is highest in those areas of the supply chain where there is a direct relation to cost savings and efficiency, for example in inventory reduction, recycling of raw materials.
11. Almost a third of respondents are not collaborating with their extended supply chain on green practices.
12. 64 % of companies are not using e-tools extensively to support their supply chain operations, suggesting an opportunity to explore greater usage of electronic tools to facilitate green practices among the other half.

Most of the Indian manufacturing small and medium enterprises like cutting & hand tools & auto parts & spare parts & industrial equipments and machinery manufacturer & various other products manufacturer are seem to be quite advanced in the implementation of green warehousing and distribution initiatives, most likely because these initiatives often also mean added efficiency. Those enterprises appear to be most ahead in green practices in their inventory reduction and product handling [53%] have already implemented initiatives; and their ability to consolidate orders [44%] have already implemented these initiatives; and usage of reusable containers and storage equipment , where [57%] have already implemented these initiatives.

When it comes to reducing energy consumption through the use of solar panels or green roofing options, surprisingly [14%] of companies have already adopted such initiatives. Similarly around [22%] of companies report that they have already optimized the location of their distribution hubs. While these types of initiatives show direct cost and efficiency benefits, the up-front cost associated with them may be why more companies have not adopted them.

IV. Future Scope for Further Research

As like above techniques and methods we can developed more quantitative techniques to measure the performance & we can also calculate the carbon emissions of any particular process , product or any organizations etc by simple mathematical calculations work . we can also take any particular case study of any bigger organization to do more work efficiently in cast effective and cost benefit way towards green supply chain future . In summary, those organizations that wish to start on Green Supply Chain projects must ask some fundamental questions. The answers will then help to illuminate their way towards innovation, profitability and sustainability.

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