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GREEN SUPPLY CHAIN PRACTICES IN THE INDIAN MANUFACTURING SECTOR: AN EXPLORATORY STUDY

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***Abstract*— Green Supply Chain Management (GSCM) is one of the recent buzz world in the industrial enterprises in India for the enhancing the capabilities of their supply chain management through sustainability. Industries are more interested in profit making due to sustainable supply chain activities rather than to save environment. Thus in this research, we aim to study the various activities involved in the supply chain processes of the various Indian manufacturing industries & finds how much eco-friendly they are in their logistics as well as supply chain activities by taking into account from the procurement of the raw material to the transportation of the end product. This study will serve the purpose of metering the performance of the Indian industry which includes both small scale as well large scale industrial houses. The major six activities of the supply chain; namely green 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 study, 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.**

***Index Terms*— GSCM, Green Procurement, Green Manufacturing, Green Warehousing, Green Distribution, Green Packaging, Green Transportation.**

I. INTRODUCTION

An environmentally conscious supply chain, also called a sustainable 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 economic development" was the key concept of the 2012 earth summit in rio de janerio, brazil as governments and international organizations committed themselves to take action to protect the environment as an 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 economic growth, with improvements in health, working conditions, and sustainability. In particular, organizations were called upon to exercise leadership in the promotion of environmentally friendly 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 their 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 several approaches for implementing green supply chain management practices. 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 which indicates that these enterprises would emphasize on supplier management performance in implementing green supply chain management [17].

Fengfei zhou in 2009 study on the implementation of green supply chain management in textile enterprises in which the author recognizes green supply chain management as 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 [7].

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.

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 through supplier's development programs 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 achieve what any individual organization on its own could not possibly achieve i.e. minimized waste, minimized environmental impact while assuring maximized consumer satisfaction, and good profits. As consumers have become more aware of environmental issues, such as global warming, they have started asking questions about the products they are purchasing. Nowadays, organizations face queries from the customers 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.

Few organizations around the globe have been able to convert the consumer's interest in Green issues into increased profits. A number of projects within organizations have shown that there is a 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. 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 in the supply chain may be concerned about their own carbon footprint and should try to reduce this, irrespective of the impact on upstream and downstream supply chain. There may be focus on end-to-end supply chain costs but due to limitations of information sharing, the costs are far from optimized in most cases.

II. METHODOLOGY

A survey questionnaire was designed with four main factors affecting the sustainability in the 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 and discuss the sustainability performance of various manufacturing sectors within the supply chain activities in order to create awareness towards Green future. More than 102 respondents of different industries has taken part in this research study covering Small, and Medium Enterprises of the Punjab state in India.

III. FINDINGS AND RESULTS

From multiple manufacturing SMEs with a total of more than 102 respondents taken interest in the study. Respondents to the survey came from a variety of industry sectors which includes Small and Medium Manufacturing Enterprises. Major Categories covered during this study are Auto Parts Manufacturers, Tools Manufacturers, Industrial Equipment's/ Machinery Manufacturers & Pipe fitting Manufacturers

Green Procurement Initiatives: Reducing paper in contract and auditing suppliers were the least commonly implemented initiatives i.e. 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.

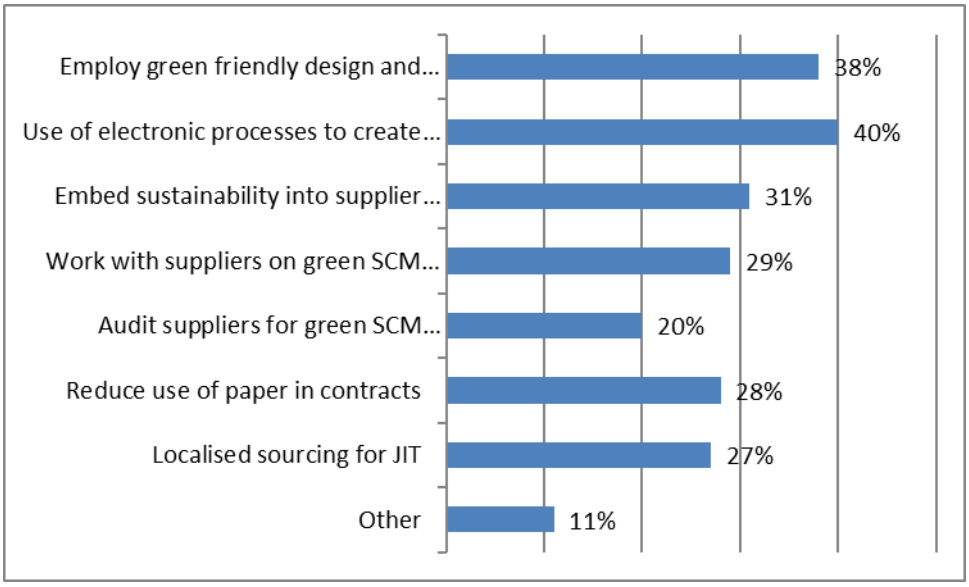

Figure 1: Green procurement initiatives

Green Manufacturing Initiatives: Applying carbon off-setting was a distant priority. Carbon offsetting is a relatively new 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.

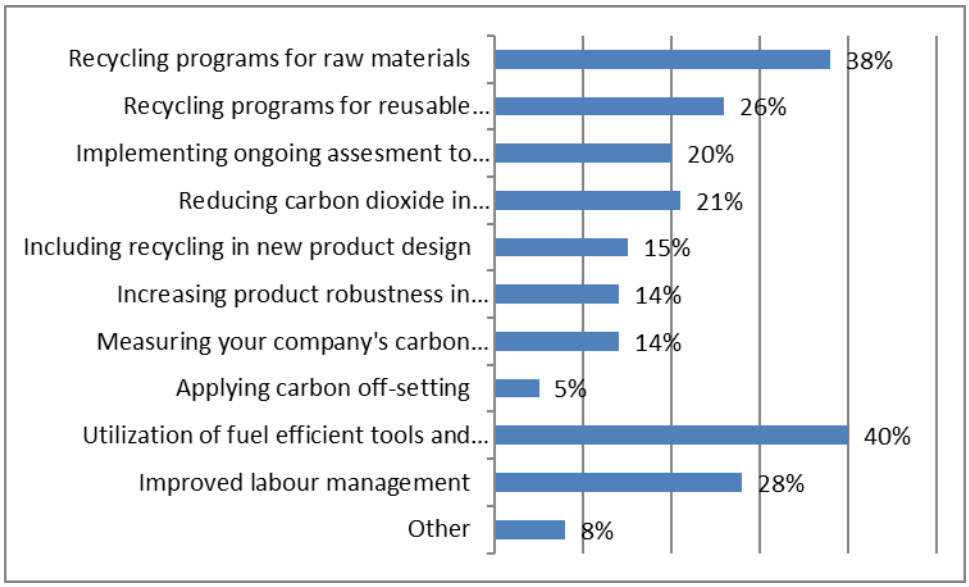

Figure 2: Green production initiatives

Green Warehousing and Distribution 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 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. [22%] companies report that they have optimized the location of their distribution hubs. While these types of initiatives show direct cost but efficiency benefits too, the up-front cost associated with these activities

may be the reason why more companies have not adopted them.

Green Transportation 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.

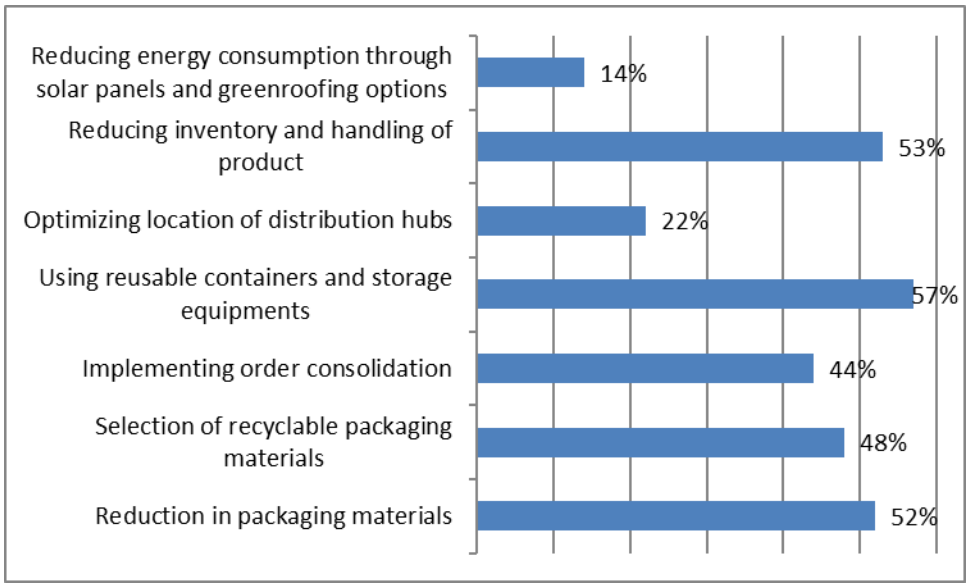

Figure 3: Green warehousing initiatives

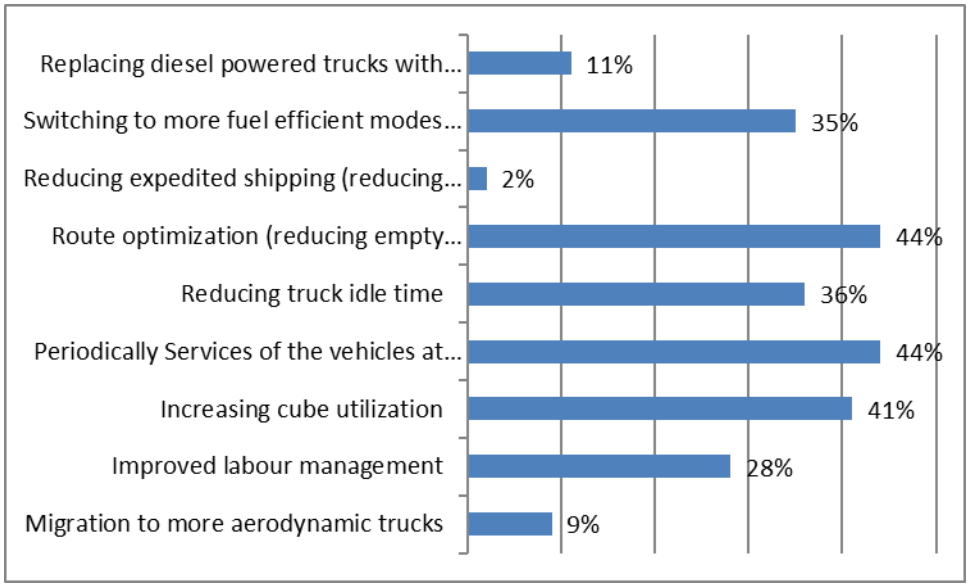

Figure 4: Green transportation initiatives

IV. Conclusion

More than one third [40%] of Indian manufacturing sectors use electronic processes to increase energy efficiencies in sourcing and procurement, reveals that new technologies when used in procurement reduces paper usage and hence are eco-friendly.

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.

Brand building is one of the top incentives for green SCM, highlighting the importance of public perception of how companies operate to develop green future.

Recycling of raw materials and reuse of component parts are the top green manufacturing and production focused initiatives, indicates that 3R's(Recycle ,Reuse, Recover) concept will popular among Indian manufactures.

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.

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.

Reducing energy consumption through the use of solar panels or green roofing options is a slow pace initiative, only [14%] of companies have adopted. The direct cost factor associated with these initiatives is the reason that more companies have not adopted them.

V. Limitations of the Study

Demographic Constraints: will be a main issue of concern. This is due to the reason that the data collection will be restricted to the Punjab state region.

Data Reliability: As the data will be collected from various sources the accuracy of the data collected would be an area of concern. It would be an uphill task to validate the data consistency of the collection of that data.

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