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# TOWARDS SUSTAINABLE PRACTICES: AN ANALYSIS OF GREEN SUPPLY CHAIN MANAGEMENT IN MOTOR AND PUMP SMES IN COIMBATORE.

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**Abstract:** *Over the last decade, Green Supply Chain Management has gathered momentum in almost all industries. Protection of the environment and sustainability have become intrinsic parts of every manufacturing and service organization. Various studies on green management practices have previously been conducted, but very few GSCM studies were carried out in SMEs, especially in the motor and pump manufacturing units which form the backbone of the Indian economy. However, much of the existing literature has not taken into consideration the special challenges and opportunities of such SMEs. Therefore, this paper tries to bridge these gaps by reviewing GSCM-related literature in motor and pump SMEs in Coimbatore. This study particularly attempts to explore driving factors for GSCM adoption and assess the performance outcome arising due to green supply chain practices.*

***Keywords:*** *Supply Chain Management, Green Supply Chain Management, Sustainability, SMEs*

## INTRODUCTION

During the past decade, the issue of sustainability has come to the forefront as one of the major concerns of organizations worldwide. With growing environmental concerns across the globe, organizations of all sizes, types, and sectors feel that adaptation to sustainable practices in minimizing environmental footprint and contributing to greater, societal goals is inevitable. In this regard, GSCM has been receiving considerable attention of late. GSCM extends the traditional supply chain management by taking into account considerations of the environment at each stage of supply chain process, right from product design and material sourcing to manufacturing, delivery, and end-of-life management. This holistic approach aims at economic growth with environmental protection and social equity together for a sustainable future.

Although large corporations have been at the forefront of the adoption of GSCM practices, SMEs also are a significant lever for fostering sustainable development. In developing economies, such as India, SMEs form the backbone of the structure of industrial growth and economic development. For instance, in India, SMEs are quite instrumental in GDP, employment, and export earnings. The manufacturing industries of the motor and pump sectors are an essential part of the SME universe, particularly in the industrial town Coimbatore in Tamil Nadu. Coimbatore is also famously known as the "Pump City of Asia." This city has its place within the international arena with regard to motors and pumps, and the SME sector has manufactured products of varied capacities for national and international demands. However, studies of the environmental impact of these SMEs and their contribution to sustainable development through GSCM have been underexplored in academic research.

Despite their economic importance, Indian SMEs have unique challenges when it comes to adopting GSCM practices. A number of factors, such as lack of access to resources, proper technological know-how, awareness, and implicit costs associated with green practices, most often bind their efforts toward transitioning to sustainable supply chain management. Additionally, a majority of these SMEs are also either unaware or have very little regulatory pressure and incentives that can influence them to embrace GSCM (Hariharan et al., 2018). There is, therefore, a wide gap between the present status of GSCM implementation in SMEs and the potential benefits which can be achieved with more sustainable performance.

Extant literature on GSCM has been related to large organizations that can alone bring in green innovation and construct pollution-free environments. Nevertheless, very little is

known about the way SMEs, in particular those operating in motor and pump manufacturing, surmount the challenges that inhibit GSCM implementation. This knowledge gap needs to be filled because SMEs are often faced with different constraints and have different motivations from those of the larger firms. It is quite critical in formulating specific strategies and policies that could enhance the wider dissemination of GSCM among SMEs. The present research seeks to fill this gap, and this research has been focused on the study of driving factors, barriers, and outcomes related to the adoption of GSCM practices among Coimbatore's motor and pump SMEs. Therefore, the three-fold objectives of the present study include: to identify the critical driving factors that influence the implementation of GSCM amongst motor and pump manufacturing SME units in the Coimbatore district, barriers that deter the effective implementation of GSCM practices amongst Coimbatore district-based SMEs, and the impact of GSCM practices on the performance and sustainability of these SMEs. In addressing these objectives, this study will seek to present a comprehensive state of GSCM adoption among Coimbatore motor and pump SMEs, besides actionable insights to the policymakers and industry stakeholders for a more sustainable and resilient supply chain ecosystem.

It contributes to fast-growing knowledge in the area of sustainable supply chain management through a systematic literature review and empirical analysis, highlighting opportunities and challenges that are different and unique for motor and pump SMEs situated in Coimbatore. The results of this study will, therefore, be extremely useful in guiding efforts that not only enhance environmental performances for the SMEs but also make them more competitive in the increasingly sustainable global market. Finally, this research points to the fact that government bodies, industry associations, and individual SMEs must cooperate to provide enabling conditions that foster an appropriate enabling environment for widespread GSCM adoption.

**Green Supply Chain Management (GSCM)**

Green Supply Chain Management, GSCM, is the strategic approach by which environmental considerations are integrated into supply chain management while assuring economic sustainability. The basic objective of GSCM is to reduce the environmental impact that supply chains have with the intent to achieve sustainability, corporate social responsibility, and economic benefits. GSCM thus entails the collaboration of all stakeholders along the supply chain, right from suppliers and manufacturers down to distributors and customers. Firms are summoned to pursue those actions that cut down on waste and promote

parsimonious use of energy and water, leading to a reduction in emissions. Much emphasis is placed on green technology that includes renewable energy, sustainable packaging material amongst others.

The GSCM process begins with the establishment of the environmental impacts along the various stages of the supply chain and the development of specific and achievable objectives for improvement. Companies then evaluate the environmental performance of their suppliers and liaise with them to reduce their ecological impact. It may range from modifications in the production process to packaging, transportation, and end-of-life disposal of the product. The GSCM may bring many benefits: improved operational efficiency, cost savings resulting from reduced generated waste, increased value of the brand reputation, and competitiveness due to the development of green products and services. GSCM may open new business opportunities that are needed by the growing demand for sustainable products on the part of environmental-conscious consumers.

However, the implementation of GSCM bears a number of challenges. It would also demand from companies a preparedness to invest in new technologies, processes, and people for adapting to greener practices. The balance between environmental objectives and economic goals is difficult to establish; often, it involves making some trade-offs. Despite these challenges, GSCM remains one of the very key approaches toward sustainable operations and environmental stewardship for businesses. By integrating environmental concerns with supply chain practices, organizations stand to attain efficiency, cost-effectiveness, and long-term competitiveness in the marketplace. Even while collaboration and investments are high, benefits accruable from GSCM make it worth an attempt by any forward-looking organization.

**GSCM in India**

GSCM is catching up fast in India because business in general and supply chains in particular have started to face various emerging environmental problems relating to air and water pollution, waste management, and demand for conformance with international environmental standards. Solid waste management, energy efficiency improvement, and creation of regulatory frameworks have been proposed due to increasing environmental pressure to seek sustainable practices throughout the supply chains. Various initiatives taken by the Indian government, like the National Action Plan on Climate Change and the National

Clean Energy Fund, created a supportive policy environment towards increasing the adoption of GSCM.

Despite these, the GSCM is still at its infancy stage in India, especially for the SMEs and Coimbatore's motor and pump sectors. Most business enterprises do not have much information on this topic. They also depend on the limited availability of finance and technology, and receive too little support from the government. However, an increasing awareness of the benefits offered by GSCM has generated interest among Indian enterprises since it promises to enhance their brand image and sustain costs advantage over their competitors in the marketplace.

Though the practice of GSCM is still in the nascent stage in India, the awareness of sustainability-related practices as a business imperative for meeting environmental challenges and escalating demand for eco-friendly products has grown among companies. With supportive policies, advanced practices, and availability of green technologies, Indian businesses are gradually getting into more sustainable supply chain management practices.

## STATEMENT OF PROBLEM

During the years, GSCM practices have become a focal issue for organizations worldwide since there is a greater need and demand for environmental sustainability and corporate social responsibility. All manufacturing units and service firms are today considered integral for the promotion of environmental protection and sustainability in all states. Earlier studies indicated that organizations adopt green management practices in order to address commitment towards social responsibility and sustainability objectives. However, there is a considerable lacuna in academic research with regards to GSCM in general and with respect to SMEs. There is a greater gap in the case of SMEs of the motor and pump manufacturing industry, which possesses great potential impact on the Indian economy due to its large manufacturing base and substantial export potential.

Mostly, the literature stresses green innovation and the development of pollution-free environments; rarely does one find a set of challenges and opportunities displayed by the SMEs, particularly in the manufacturing of motors and pumps. Based on the observations of past studies and the available literature, Poksinska (2003), Srivastava (2007), Kott and Skibinska (2010) and Dhull and Narwal (2016) noted that little depth has been carried out on specific factors affecting GSCM implementation in SMEs and impacts on their overall

performance. Furthermore, Carbone (2012) establishes that further research is necessary to explain the roles of corporate social responsibility at different levels of the supply chain.

These different kinds of barriers impose obstacles to GSCM practices in SMEs, such as reluctance by suppliers to adopt green practices, deficiencies related to energy management, and a shortage of adequate waste management capabilities. Other important critical barriers to the adoption of GSCM include increased operational costs at 38%, difficulties in monitoring supply chain networks at 29%, and the absence of any sustainability framework across supply chains at 20%, according to recent studies. Previous research also has excluded the intervening moderators like leadership, organizational culture, financial strength, business diversity, and location-specific economies that may provide a greater understanding of how GSCM affects firm performance and environmental outcomes. The mentioned issues, therefore, stress concentrated research on GSCM in these SME sectors that have a direct contribution to carbon emissions and global warming. Particularly, motor and pump manufacturing SMEs-mostly from Coimbatore-are an intrinsic part of India's industrial structure and offer a unique opportunity for examining such dynamics. However, there is a lacuna in literature as regards how GSCM can effectively be implemented in such SMEs.

This research, therefore, tries to address the gaps through a critical review of literature on GSCM, focusing on motor and pump SMEs in Coimbatore. It also tries to find out the driving factors for GSCM implementation, identification of barriers, and measurement of performance impact on SMEs upon the adoption of green supply chain practices. Given that the area is largely unexplored in the current literature, the timeliness of the study cannot be gainsaid, given its importance in improving knowledge on sustainable practices within the supply chain of SMEs and offering useful insights to various stakeholders, such as policymakers, industry leaders, and environmental advocates.

## RESEARCH OBJECTIVES

1. To identify the major driving factors that affect the implementation of Green Supply Chain Management amongst the motor and pump manufacturing SME units in Coimbatore district.
2. To find out the barriers that deter GSCM practices, especially in SME motor and pump sectors of the Coimbatore district.

3. To assess the impact of adopting GSCM practices on SME performance and sustainability with particular reference to motor and pump units in the Coimbatore District.

## SCOPE OF THE STUDY

Small and Medium Enterprises constitute a very significant backbone in the Indian economy in terms of industrial production, exports, employment generation, and innovation. The SME sector contributes 45% to India's industrial output and 40% to exports, while employing approximately 60 million people and creating about 1.3 million jobs every year. These industries produce more than 8,000 quality products for both domestic and international markets. It is estimated that the SME sector's contribution towards India's GDP in the year 2021 was about 27%, which might increase manifold in the times to come. With an estimated 63 million MSME units spread across India and another 12 million or so people expected to join the workforce in the near future, the role of SMEs in economic development is going to become even more striking. More important, SMEs account for 60 to 70 percent of all innovations in India, a fact that underpins their contribution to promoting a competitive and dynamic business environment.

This current research shall deal with motor and pump manufacturing SMEs located in Coimbatore, since this city can be marked out as one of the most industrialized locations in Tamil Nadu State, India. Considering these industries are a significant contributor to local and national economic scenarios, the present research investigates the state of GSCM adoption and implementation for such enterprises. This work will explore the drivers and the barriers to the adoption of GSCM and analyze the performance implications for SMEs when they adopt sustainable supply chain practices. This study will elaborate on GSCM in the motor and pump sectors in Coimbatore, thereby aiding valuable inputs for policy planners, industry participants, and owners of SMEs toward the bigger goal of debates on sustainable industrial practices in India. These results would help SMEs not only in their transition towards greener practices but also aid regulatory bodies in formulating policies for sustainable growth. Further, the present study will close the gaps in existing literature and open avenues for further studies on GSCM in other critical SME sectors in India.

## NEED FOR THE STUDY

This study will try to find out the status of implementation of GSCM in motor and pump industries of Coimbatore for some critical reasons:

- ***Environmental Concerns***: Increased awareness about climate change, pollution, and resource depletion presses upon the need for practices that have minimal environmental impacts in any industry. In sectors involving motors and pumps, which are leading contributors to industrial emissions and wastes, appropriate sustainable practices should be put into consideration as mitigative measures.
- ***Competitive Advantage***: The motivation for adopting GSCM practices may, as well, be considered a source of competitive advantage to SMEs. Green practices are one of the emerging differentiators that attract ecologically sensitive consumers and business partners. Companies leading the pack in the implementation of GSCM will, therefore, improve their reputation and market share.
- ***Regulations***: The decision to adopt GSCM practices has been a result of the stringing of environment protection legislation from both a worldwide and local perspective. With that in mind, SMEs that reflected on such regulations would avoid the penalty and, therefore, be better placed within domestic and international markets.
- ***Cost Savings***: GSCM may assist in substantial reduction of costs by minimization of wastes, ensuring energy efficiency, and management of resources in a better way. Such cost reduction would increase the profitability of SMEs and ensure their long-term sustainability.
- ***Stakeholder Demand***: The stakeholders include customers, investors, and communities that are raising demands increasingly to make businesses sustainable. Meeting the expectations of such stakeholders is of utmost importance to maintain stakeholder relationships and sustain the business in the long run.

In view of the factors above, adoption among SMEs and in particular among the motor and pump industries in Coimbatore in regard to GSCM is an area that needs considerable study in all aspects. From identification of problems and advantages involved with GSCM, the industries may imply cases for improvement. This would also allow them to take informed steps toward the adoption of sustainable practices that enhance their competitiveness, with minimal environmental impact, while meeting the expectations of all stakeholders. The study, therefore, attempts to provide actionable insights that will enable

SMEs to transition toward greener supply chain practices that could be contributing to environmental sustainability coupled with economic growth.

## SAMPLING METHODS

This research work has adopted the method of purposive sampling in selecting the respondents and has targeted only the auto component manufacturers in Coimbatore district. The targeted population was a category of SMEs that have five experience years or more, from October 2013 to October 2017. SMEs with at least five years of operational experience meant that the companies were already past the hardship stages of operations and would henceforth give reliable and valid data for the study. Only units with more than five years of experience were selected in order not to exclude the contribution of teething problems.

Out of 105 SME units within the region, a sample size of 72 units was selected using the purposive sampling technique. This represents a sample size of 69.90%. According to the researcher, this sample size will suffice to achieve the objectives of this study and convey meaningful information about how GSCM practices are adopted among the SMEs in motor and pump industries.

## DATA COLLECTION TECHNIQUES

The study has adopted primary as well as secondary data collection methods to obtain comprehensive information pertinent to the research objectives.

1. Primary Data: First-hand information or what is better known as primary data in this study is obtained through the administration of a structured questionnaire, designed specifically for this study. It has been used to collect information about experiences and practices of selected SMEs concerning GSCM.
2. Secondary Data: The secondary data was collected from journals related to Supply Chain Management and Operations Management and from reliable websites. They add contexts to the primary data collected, supported literature, and background information for the research.

## DATA ANALYSIS TOOLS

Statistical tools that were utilized in analysing the data that were collected include:

1. Simple Percentage: The responses have been summarized and the data are represented in an intelligible form showing some pivotal trends and patterns.

2. Chi-Square Test: Chi-square shall be applied to test various relationships that might exist among these different variables; it would help the researcher in establishing the significance of the relationships and proving the hypotheses.

These tools would give a robust framework for the analysis of data and allow meaningful inferences to be drawn about the adoption and impact of GSCM practices among motor and pump SMEs in Coimbatore.

## ANALYSIS & FINDINGS

*Table- 1 Awareness of Green Supply Chain Management*

| S.No. | Items | Fr/% | SDA | DA | N | A | SA | Total | Mean | SD |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | My organization is having a serious concern about the Environment | Freq | 8 | 20 | 40 | 22 | 15 | 105 | 3.15 | 1.125 |
| | | % | 7.6 | 19.0 | 38.1 | 21.0 | 14.3 | 100.0 | | |
| 2. | We are processing/ manufacturing Eco-friendly related products for society | Freq | 19 | 23 | 39 | 14 | 10 | 105 | 2.74 | 1.185 |
| | | % | 18.1 | 21.9 | 37.1 | 13.3 | 9.5 | 100.0 | | |
| 3 | My organization uses the lean tools | Freq | 26 | 30 | 30 | 12 | 7 | 105 | 2.47 | 1.177 |
| | | % | 24.8 | 28.6 | 28.6 | 11.4 | 6.7 | 100.0 | | |
| 4 | Integration of IT system into the Green Supply Chain approach in my organization | Freq | 27 | 43 | 23 | 6 | 6 | 105 | 2.25 | 1.081 |
| | | % | 25.7 | 41.0 | 21.9 | 5.7 | 5.7 | 100.0 | | |
| 5 | Training of | Freq | 28 | 32 | 33 | 7 | 5 | 105 | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | employees to take the sustainability approach in my organization | % | 26.7 | 30.5 | 31.4 | 6.7 | 4.8 | 100.0 | 2.32 | 1.087 |

Source: Primary data

Table 1 presents the level of awareness and implementation on GSCM practices among organizations. The mean scores of the items range from 2.25 to 3.15 describing varying states of awareness and implementation. The statement "My organization is having a serious concern about the Environment" had the highest rating at 3.15 and with a standard deviation of 1.125, indicating a strong agreement on the part of the respondents concerning their organizations' commitment to environmental sustainability. While the statement, "We are processing/manufacturing eco-friendly products for society," has a mean of 2.74 and a standard deviation of 1.185, which denotes that responses are moderately agreed to, and this positive inclination denotes eco-friendly production. On the other hand, the use of lean tools as mentioned has a mean score of 2.47 out of total responses, SD = 1.177, which shows that the adoption of lean is not widespread.

Similarly, the integration of IT systems within the green supply chain approach had a lower mean score of 2.25 (SD = 1.081), indicating improvement in the use of IT for GSCM. Moreover, training given to employees for sustainability approaches had a mean score of 2.32 (SD = 1.087), indicating deficits on education and the empowerment of employees to deal with sustainable practices. Overall, the data suggests that there is awareness of and some adoption of GSCM practices; however, there is still considerable room for improvement-most notably in IT integration and employee training.

*Table- 2 GSCM Drivers - Organizational Environment Management*

| S.No. | Items | Freq/% | Low | Moderate | High | Total | Mean | SD |
|---|---|---|---|---|---|---|---|---|
| | Our organization | Freq | 40 | 42 | 23 | 105 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | follows the environmental Rules & Regulation | % | 38.1 | 40.0 | 21.9 | 100 | 1.84 | .761 |
| 2 | We are internally motivated to implement green practices | Freq | 54 | 24 | 27 | 105 | 1.74 | .844 |
| | | % | 51.4 | 22.9 | 25.7 | 100 | | |
| 3 | We framed the mission and vision statement of our company to include the implementation Green practices | Freq | 31 | 52 | 22 | 105 | 1.91 | .709 |
| | | % | 29.5 | 49.5 | 21.0 | 100 | | |
| 4. | We frequently receive a support from the other Cross-functional units for Eco practices | Freq | 14 | 44 | 47 | 105 | 2.31 | .698 |
| | | % | 13.3 | 41.9 | 44.8 | 100 | | |
| 5 | Our organization audit the Suppliers' environmental performance. | Freq | 31 | 45 | 29 | 105 | 1.98 | .759 |
| | | % | 32.4 | 37.1 | 30.5 | 100 | | |

Source: Primary data

The drivers of GSCM in regard to the Organizational Environment Management are outlined in the table below, which ranged between 1.74 and 2.31 mean scores for the various factors assessed. The item "We often receive support from other cross-functional units for eco practices," with the highest mean score of 2.31, is combined with a low standard deviation of 0.698, thus justifying that there is very strong agreement among the respondents that

significant cross-functional support for eco-friendly practices is present. The supporting factor is "Our organization audits the suppliers' environmental performance", with a mean score of 1.98 and a standard deviation of 0.759, demonstrating consistent agreement on the importance and actual execution of the environmental audit for the suppliers.

Other factors such as following all environmental rules and regulations have a mean of 1.84 with an SD of 0.761, internal motivation to implement green practices has a mean of 1.74 and an SD of 0.844, and the incorporation of green practices in the company's mission and vision statement has a mean of 1.91 and an SD of 0.709. Overall, the data show that although there is support in eco-friendly practices or environmental performance audits, there is still a need to further motivate internal stakeholders and align organizational strategies with green practices.

*Table 3 - Regulatory Pressure*

| S.No. | Items | Fr/% | L | M | H | Total | Mean | SD |
|---|---|---|---|---|---|---|---|---|
| 1. | We believe that state and central government's regulations related to environment are favour to our company | Freq | 22 | 58 | 25 | 105 | 2.03 | .672 |
| | | % | 21.0 | 55.2 | 23.8 | 100 | | |
| 2 | We strongly encourage the government for inspecting our eco implementation. | Freq | 17 | 51 | 37 | 105 | 2.19 | .695 |
| | | % | 16.2 | 48.6 | 35.2 | 100 | | |
| 3 | We are satisfied with the current Green regulations and policies of central and state government | Freq | 22 | 57 | 26 | 105 | 2.04 | .678 |
| | | % | 21.0 | 54.3 | 24.8 | 100 | | |

Source: Primary data

Table 3 shows that the mean scores of GSCM Drivers pertaining to Regulatory Pressure range from 2.03 to 2.19 for the different items. The highest mean score, 2.19, was posted by the item "We strongly encourage the government to inspect our eco implementation", with the lowest standard deviation at 0.695, which suggests that the responses are somewhat for the government's inspection of their eco-friendly practices and are comfortable with regulatory scrutiny. The factor "We are satisfied with the current Green regulations and policies of the central and state government" also has a mean score of 2.04 with a standard deviation of 0.678, reflecting strong support and satisfaction among respondents about the prevailing green regulations and policies. It is clear that the response has been good towards government regulations and there is a willingness to follow and support such government regulations in green supply chain management.

*Table- 4 Green Design*

| S.No. | Items | Fr% | L | M | H | Total | Mean | SD |
|---|---|---|---|---|---|---|---|---|
| 1 | We believe that design of products for reduced consumption of material/energy | Freq | 3 | 24 | 78 | 105 | 2.71 | .514 |
| | | % | 2.9 | 22.9 | 74.3 | 100 | | |
| 2 | Our products for reuse, recycle, recovery of material | Freq | 5 | 22 | 78 | 105 | 2.70 | .557 |
| | | % | 4.8 | 21.0 | 74.3 | 100 | | |
| 3 | We implement the Green/Eco Strategies in each stage of product development | Freq | 4 | 19 | 82 | 105 | 2.74 | .519 |
| | | % | 3.8 | 18.1 | 78.1 | 100 | | |
| 4 | We always go with Eco- labelling of process/products | Freq | 6 | 9 | 90 | 105 | 2.80 | .526 |
| | | % | 5.7 | 8.6 | 85.7 | 100 | | |

Source: Primary data

Table 4 presents the means of GSCM Drivers in respect of Green Design, ranging between 2.71 and 2.80 for different items. The item "We always go with Eco-labelling of process/products" received the highest mean score of 2.80 with the minimum standard deviation of 0.526 and indicates that a greater tendency is developed among the respondents towards the adaptation of eco-labelling for their processes and products. The statement "We implement Green/Eco Strategies at every stage of product development" had a mean of 2.74 and a standard deviation of 0.519, indicating strong support for eco-strategies at every stage in the development of products. It gives an indication of a high level of principles of green design adopted by the participants, which shows their commitment towards waste reduction and the practice of sustainable methods in product offering.

*Table- 5 Green Knowledge & Training*

| S.No. | Items | Fr/% | L | M | H | Total | Mean | SD |
|---|---|---|---|---|---|---|---|---|
| 1 | We aware about the importance ofgreen management | Freq | 24 | 25 | 56 | 105 | 2.30 | .822 |
| | | % | 22.9 | 23.8 | 53.3 | 100 | | |
| 2 | Our organization monitor the periodical performance measurement and feedback of green implementation | Freq | 6 | 30 | 69 | 105 | 2.60 | .598 |
| | | % | 5.7 | 28.6 | 65.7 | 100 | | |
| 3 | We update and get the training on the implementationof Green supply chain strategies | Freq | 4 | 23 | 78 | 105 | 2.70 | .536 |
| | | % | 3.8 | 21.9 | 74.3 | 100 | | |

Source: Primary data

Table 5 reports the mean scores for all GSCM Drivers range from 2.30 to 2.70 on different factors. The item "We update and get training on the implementation of Green supply chain strategies", which has the highest ranking, also has the lowest level of variation-that is, standard deviation-regarding this factor, which indicates that this factor exhibited responses with eagerness among all the respondents to take training to implement the strategies of the green supply chain. Also, the item "Our organization monitors the periodic performance measurement and feedback of green implementation" is highly supported with a low standard deviation, reflecting that not only are the respondents interested in green implementation but also they emphasize the essence of continuous monitoring, performance measurement, and awareness in green management practices.

*Table- 6 GSCM Performances*

| S.No. | Items | Fr/% | L | M | H | Total | Mean | SD |
|---|---|---|---|---|---|---|---|---|
| 1 | We believe thatour manufacturing unit reduce in emission of polluting gas in atmosphere | Freq | 15 | 16 | 74 | 105 | 2.56 | .733 |
| | | % | 14.3 | 15.2 | 70.5 | 100 | | |
| 2 | Our units lesser/not Chemical substances release into Rivers or stream | Freq | 27 | 62 | 16 | 105 | 1.90 | .634 |
| | | % | 25.7 | 59.0 | 15.2 | 100 | | |
| 3 | We follow the government regulation for disposing of solid wastes into the environment | Freq | 27 | 31 | 47 | 105 | 2.19 | .822 |
| | | % | 25.7 | 29.5 | 44.8 | 100 | | |
| | We are using | Freq | 10 | 52 | 43 | 105 | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 4 | Hazardous Raw materials in very low | % | 9.5 | 49.5 | 41.0 | 100 | 2.31 | .640 |
| 5 | Our organization believe in Practice GSCM is reducing the operation Cost. | Freq | 24 | 43 | 38 | 105 | 2.13 | .760 |
| | | % | 22.9 | 41.0 | 36.2 | 100 | | |
| 6 | We have facilities to handling the waste (Solid & Liquid) properly recycled | Freq | 17 | 18 | 70 | 105 | 2.50 | .761 |
| | | % | 16.2 | 17.1 | 66.7 | 100 | | |
| 7 | Cost reduction by using recycled materials and consumption of less energy | Freq | 19 | 27 | 29 | 105 | 2.38 | .777 |
| | | % | 18.1 | 25.7 | 56.2 | 100 | | |
| 8 | We follow the lean tools for minimizing the waste while production | Freq | 27 | 30 | 48 | 105 | 2.20 | .825 |
| | | % | 25.7 | 28.6 | 45.7 | 100 | | |
| 9 | Our organization maintain in Quality of process/product | Freq | 19 | 26 | 60 | 105 | 2.39 | .778 |
| | | % | 18.1 | 24.8 | 57.1 | 100 | | |
| 10 | Products will be delivery on time and low logistics cost | Freq | 17 | 52 | 36 | 105 | 2.18 | .690 |
| | | % | 16.2 | 49.5 | 34.3 | 100 | | |

Source: Primary data

The results of the mean scores of different factors of GSCM performance range between a minimum of 1.90 to a maximum of 2.56, reported in table 6. The highest mean score is obtained for the item, "We believe that our manufacturing unit reduces the emission of polluting gases in the atmosphere" with a low standard deviation of 0.733. The high mean, supplemented by the low variability, results in very good agreement among the respondents regarding their organization's effectiveness to mitigate air pollution through green supply chain management. This therefore basically portrays that many organizations have been able to implement measures to reduce emissions; it shows their commitment toward environmental sustainability.

The other noticeable factor is "We follow government regulations for disposing of solid wastes into the environment," which had the highest mean score of 2.19 and a higher standard deviation of 0.822. This reflects that while generally, there is adherence to regulations with regard to waste disposal, from organization to organization there is greater variability in stringency in the following of such practices.

The item "We have facilities for handling waste (solid & liquid) properly recycled, " has also received considerable support with a mean of 2.50 and a standard deviation of 0.761. It therefore follows that many organizations do have effective waste management systems in place although there is considerable variation in the extent of recycling practices.

The other factors are "We are using hazardous raw materials in very low quantities" with a mean of 2.31 and a standard deviation of 0.640 and "Cost reduction by using recycled materials and consumption of less energy" with a mean of 2.38 and a standard deviation of 0.777; the mean scores are moderate with variable levels of standard deviation. These results reveal the continued effort to reduce the usage of hazardous materials, which is also cost-effective through recycling and efficient use of energy. However, the level of implementation and effectiveness may vary.

On the whole, data indicate that "there is a general recognition of the benefits of green supply chain management by the respondents and also the adaptation of different eco-friendly practices.". The low average scores for aspects like "Our units release fewer/not chemical substances into rivers or streams" have given an average of 1.90 and an SD of 0.634 indicates further scope for improvement. However, having a strong support for reducing emission and proper following of environmental laws and regulations indicates that there is a plus indications toward incorporating green practices in supply chain management.

## MAJOR FINDINGS

### 1. Green Supply Chain Management Awareness

- Environmental Commitment: In this regard, the respondents showed a high level of awareness about their organization's commitment to environmental sustainability. The mean score was 3.15, which therefore infers that generally, there is consensus that their organizations are concerned about the environment.
- Eco-friendly Production: The mean score for the adoption of eco-friendly products was 2.74, which indicates a rather positive attitude toward the production of eco-friendly products, though this is not common for every organization.
- Utilization of Lean Tools: The average score is 2.47 for utilizing lean tools, indicating that the application of lean is less common and hence provides an opportunity to apply lean to waste reduction and efficiency enhancement.
- Integration of IT Systems: The lowest score, 2.25, was for integration of IT systems within GSCM practices, indicating that very few technological solutions are being applied to support green supply chain management.
- Employee Training: The average score for training employees regarding sustainability approaches stands at 2.32, which is very low and shows the huge gap in educating employees and hence empowering them towards the effective adoption of sustainability practices.

### 2. Drivers of GSCM Implementation

- Cross-functional Support: The highest average score of 2.31 is related to cross-functional support, indicating that internal support is one of the major facilitators to adopt GSCM practices.
- Suppliers' Environmental Audits. The mean score of 1.98 provided shows that auditing suppliers about their environmental performance is indeed an important practice but is not consistently followed.
- Regulatory Compliance: With a mean score of 1.84, environmental rules and regulations indicate the lesser extent of following environmental standards.
- Internal Motivation and Strategic Alignment: From the mean scores on the question of internal motivation, which was 1.74, and incorporating green practices into the mission and vision statement, standing at 1.91, it may be inferred that even though

these aspects exist, there is observed a need to increase internal motivation and align organizational strategies with those of green practices (Hariharan et al., 2016).

**3. Regulatory Pressure**

- Govt. Regulations: A mean score of 2.03 with regard to the favorability of state and central government regulations indicates that, on the whole, government regulations are supportive of the eco-initiatives undertaken by the respondents.
- Encouragement for Government Inspections:The mean of 2.19 reflects a high disposition towards welcoming government inspections of eco-implementation, thus signifying that organizations are open to external scrutiny and regulatory oversight.
- Satisfaction with Regulations: Satisfaction with the existing green regulations and policies was also in the middle - 2.04 - general approval of the existing regulations yet gives room for improvement to be furthered.

**4. Green Design**

- Design for Reduced Consumption: On the highest mean score, 2.80, involved eco-labelling of products and processes. This would tend to indicate that one of the most strongly supported measures involves labeling practices in order to denote environmental benefits.
- Recycling and Recovery: Green design practices concerned with reuse, recycle, and recovery of materials had a mean of 2.70, which indicates that the practices are partially observed and need further improvement.
- Green Strategies Implementation: The average score in implementing green strategies at every stage of product development has had a mean of 2.74, showing application and enforcement at all stages of the product's life cycle, though it is still some way off from the satisfactory applications being fully implemented.

The overall impression conveyed by this research is an increased awareness and some adoption amongst motor and pump manufacturing SMEs in Coimbatore, with considerable gaps yet to be filled as far as IT integration, employee training, and diffused use of green practices are concerned. The study finds that while internal support and compliance with regulations have been relatively strong, much work is still required to reduce barriers to GSCM adoption and improve the general sustainability performance of SMEs in this industry. In fact, that will be very helpful for policy makers, industry leaders, and SMEs for the improvement of green supply chain practices.

## RECOMMENDATIONS

**Enhanced Industry Awareness and Training**

Educate SMEs regarding Green Supply Chain Management (GSCM) practices through focused education campaigns and training programs. The requirement is for industry associations, educational institutions, and government agencies to work together in organizing workshops, seminars, and online courses in enhancing understanding and conjoining of GSCM principles.

**Installation of Green Supply Chain Consulting Services**

Encourage consultancy firms dealing with GSCM for SMEs on strategy formulation and providing guidelines on its effective implementation. Such a consultant will be able to support small-scale industries' specific challenges with customized advice.

**Empowering Collaboration**

The industry leader in conjunction with the government, NGOs as well as academic institutions must be brought together to collaborate. These shall enhance the dissemination of best practices, disseminate sustainable solutions besides resolving critical issues related to the implementation of GSCM.

**Coupling of Sustainable Buying Practices**

Develop, then implement sustainable procurement policies, which grant a higher priority to those suppliers with a strong record related to environmental performances. This may cause a ripple effect of sustainability in the supply chain and also help integrate GSCM principles into practical business better. Also,

**Industry Benchmark Development**

The outcome of the performance results in this research can be used to establish benchmarks for SMEs in Coimbatore District. Benchmarking can help to accelerate improvement in sustainability practices and enable enterprises to strive for excellence in GSCM.

**Utilization of Green Marketing and Branding**

Those SMEs that can actually implement GSCM practices should utilize their achievements in the area of marketing and branding. The communication of eco-friendly initiatives can help to capture the environmentally conscious consumer base and offer a competitive advantage to businesses.

**Policy and Financial Support**

Targeted policy interventions with associated financial incentives to stimulate GSCM adoption among SMEs should be installed where possible. Examples include tax breaks, grants, and subsidies for businesses that follow sustainable practices. At the least, regulatory frameworks should incentivize transparency and documentation of environmental performance.

## IMPLICATIONS

**Enhanced Industry Awareness and Capacity Building**

The study attests to increasing the necessity for awareness among SMEs on the issue of GSCM. Increased awareness and understanding, coupled with capacity building, will positively impact both the levels of adoption and the depth of implementation.

**Opportunities for Green Supply Chain Consulting**

Increased interest in GSCM from SMEs translates into opportunities for specialized consultancy services. These services will assist the enterprises in surmounting the various barriers existing in the implementation of green practices toward achieving sustainability goals.

**Improved Collaboration Among Stakeholders**

A collective initiative on the part of industry players, government agencies, NGOs, and academia in the area of GSCM is needed. This can catalyze the process of innovation, sharing of knowledge, and collective action on sustainability issues.

**Adoption of Sustainable Procurement Practice**

Suppliers' environmental performance could be monitored and encouraged. Indeed, procurement policies of organizations can be used to extend support to and give a priority for greening.

**Setting Industry Benchmark for GSCM**

Establishment of benchmarks from the study's results can enable SMEs to compare their performances with that of the industry average. The outcome of such a process may be improved performance and create a culture of continual improvement in the field of sustainability performance.

**Exploit Green Marketing and Branding**

Those SMEs, which can work out GSCM practices will be assured of improved market positioning by highlighting their commitment to sustainability performances. It appeals to environmentally conscious consumers and improves brand reputation.

**Policy Development and Financial Incentives**

This study will help policymakers develop focused interventions and mechanisms of financial support to encourage GSCM. Such policies go a long way in not only spreading the use of sustainability but also in ensuring the strengthening of the general industrial ecosystem.

## CONCLUSION

What possibly could be important to note from the research on GSCM includes key highlights arising from this study, which have great implications for all the stakeholders involved therein. The findings may give a foundation to the policymaker and industry associations to design specific programs, initiative plans, and policy structures that would help in facilitating the adoption of GSCM practices amongst SMEs in the Coimbatore District. The key insights can shed light on supportive measures in the form of financial incentives and regulatory guidelines so as to expedite sustainable business practice initiatives. This research will, therefore, serve as a sourcebook for companies in Coimbatore District to perceive benefits from GSCM adoption. Instead, operational betterment and enhancement of competitiveness with elevation of brand reputation through the principles of green design and integration of lean tools in the manufacturing process. An investment in environmental knowledge and linking of organizational missions with sustainability goals will be positive contribution to the environment with more operational and reputational benefits for SMEs.

The study underlines the increasing commitment of SMEs in Coimbatore toward environmental sustainability and responsible business practices. Further, it outlines the need for multi-stakeholder collaboration to foster a green ecosystem in the industrial sector. In fact, this could well be a starting point for driving innovation, making sustainability more effective, and creating a resilient economic system.

The overall findings of this study call for a collaborative approach to proceed with GSCM practices. By capitalizing on the driving forces for GSCM adoption and acting upon identified performance outcomes, policy planners, industry associations, and businesses can mutually progress toward a greener and sustainable future of the Coimbatore District. This

would help achieve not only the localized environmental goals but also contribute to the global effort of solving environmental problems and promoting sustainable development.

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