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AN EMPIRICAL STUDY OF THE PERFORMANCE OF GREEN SUPPLY CHAIN MANAGEMENT IN SMALL AND MEDIUM - SIZED ENTERPRISES

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ABSTRACT: Sustainable development and environmental preservation are now widely regarded as overriding imperatives for protecting the earth from human activity. For organisations facing competitive, regulatory, and community challenges, balancing economic and environmental performance has become increasingly crucial. The number of organisations incorporating environmental principles into their strategic goals and operations is steadily growing. Environmental concerns about supply chain management are becoming more prevalent now as a result of a wider debate about how industry should address the issues of sustainability. Stakeholder pressures made it challenge for supply chain managers to integrate sustainable practices into their supply chain management. Green supply chains aim to reduce resource and energy consumption as well as pollution emissions, all in the pursuit of a socially responsible firm that balances economic, social, and environmental benefits. Environmental performance is integrated into the enterprise's internal and external management in green supply chain management, which is not the case in traditional supply chains. Hence, performance measurement benefits the green supply chain management process by stabilizing it and providing chances for improvement. However, developing performance measures for the green supply chain is a difficult task. Internal and external processes must both be assessed when it comes to green supply chain management. Thus, conducting an empirical study on the performance of green supply chain management is critical. In this backdrop, the present study examines the performance of green supply chain management in small and medium enterprises. The study is empirical and uses a survey method. For the study, the researchers employed both primary and secondary data sources. The research begins with the gathering of secondary data about small and medium-sized enterprises. Books, reports, journals and periodicals, websites, and other sources of secondary data were used. A questionnaire was used to obtain primary data from small and medium manufacturing enterprises. Analysis of one-way variance, student t test, analysis of co-efficient of variation, and percentage analysis were used to study the performance of green supply chain management. The paper suggests suitable measures for effective green supply chain management in small and medium enterprises.

Keywords: Green supply chain management, environmental sustainability, green business, sustainable development, etc.

1. INTRODUCTION

Sustainable development and environmental preservation are now widely regarded as overriding imperatives for protecting the earth from human activity. Environmental

degradation, global warming, melting glaciers and icebergs in the Polar Regions, and increasing sea levels all have an impact on the globe. The main reasons for the global environmental carrying capacity being surpassed include irrational resource consumption resulting from raw material acquisition, manufacturing, use, and disposal. For organisations facing competitive, regulatory, and community pressures, balancing economic and environmental performance has become increasingly crucial. Business operations can be extremely harmful to the environment. Business organisations, governments, and society must take speedy action to promote balanced growth in order to meet socio-economic goals without endangering the environment. Environmental awareness has gradually become part of the entire organisational culture, which has helped in the reengineering of organisational strategy. Government and other regulatory agencies' environmental regulations have prompted organisations to develop environmental plans for implementing green supply chain management practices. The number of organizations incorporating environmental practices into their strategic goals and operations is steadily growing. Environmental concerns about supply chain management are becoming more prevalent now as a result of a broader discussion about how industry should address the challenges of sustainability. Stakeholder pressures made it difficult for supply chain managers to integrate sustainable practices into their supply chain management.

1.1.Green Supply Chain Management

The concept of environmental, green, or sustainable supply chain management is gaining popularity around the world. It is a new organisational concept based on environmental sustainability to increase business profit and market share. In the literature, different definitions and concepts have been considered; nevertheless, there is no single definition that describes green supply chain management and its applications. Green supply chain management, according to Kovacs, is a technique for reducing negative environmental effect through actions within the organisation and supply chain. The definition of ‘sustainable,' according to Brown and Ratledge, is "an establishment that produces green output." Green supply chain management is described as the inter-organizational coordination of value chain operations that takes into account economic, environmental, and societal factors in order to improve organisational performance. Green supply chain management restructures the supply chain to incorporate techniques such as material recycling, remanufacturing, residual reuse, and environmental projects, reducing the total impact of industrial activity throughout the product's

life cycle. The complete distribution of products and services from suppliers, producers, and end users is covered by green supply chain management. Green supply chain management refers to the management of material, information, and capital flows, as well as cooperation among companies along the supply chain, while taking into account goals from all three dimensions of sustainable development, i.e. economic, environmental, and social, as well as customer and stakeholder needs. Green supply chain management is the strategic, transparent integration and achievement of an organization's social, environmental, and economic goals through the systemic coordination of key inter-organizational business processes in order to improve the individual company's and supply chain's long-term economic performance. Reuse, remanufacturing, and recycling are all part of the green supply chain management activities, which include green design, green procurement, total quality environmental management, environmentally friendly packaging, transportation, and different product end-of-life practices. Green supply chain management can reduce the negative effects of industrial operations while also increasing a company's competitive edge.

2. STATEMENT OF THE PROBLEM

The fast and continuing expansion of Indian industry has two key implications for environmental sustainability: environmental burden and resource scarcity. India's vast transportation infrastructure is built on gasoline and diesel, which would significantly increase the country's reliance on oil imports. Furthermore, economic growth increases energy and material consumption, contributing to environmental challenges and resource depletion issues. Despite the fact that some manufacturing supply chain organisations are aggressively implementing environmental strategies as a result of the variability in adoption rates, investment recovery and the growth of recycled material markets in India have gotten little attention. The manufacturing product market is still maturing, and it has yet to reach a critical mass that makes the formation of a used parts market economically viable. In recent years, green supply chain management has become a significant approach for the sustainable development of organisations, allowing them to achieve and maintain effective international competitiveness. Manufacturing enterprises have long recognized the importance of green supply chain management in boosting their competitiveness, and most have understood the benefits of moving to a more efficient and effective green supply chain. Green supply chain management improves competitiveness while also meeting environmental regulations and stakeholder pressure. Therefore, performance measurement benefits the green supply chain management process by stabilizing it and providing chances for improvement. However,

developing performance measures for the green supply chain is a difficult task. Internal and external processes must both be assessed when it comes to green supply chain management. Therefore, conducting an empirical study on the performance of green supply chain management is critical. In this backdrop, the present study examines the performance of green supply chain management of the small and medium enterprises in Cuddalore district.

3. OBJECTIVES OF THE STUDY

The aim of this study is to look into the performance of green supply chain management of the small and medium enterprises in Cuddalore district. In addition, the study has the following secondary objectives:

a) To assess the performance of green supply chain management of the small and medium enterprises in Cuddalore district.
b) To suggest suitable measures for effective green supply chain management of the small and medium enterprises in Cuddalore district.

4. TESTING OF HYPOTHESIS

The following null hypothesis was formulated to investigate the performance of green supply chain management in small and medium enterprises.

H_{01}: There is no significant relationship between the performance of green supply chain management among small and medium-sized manufacturing enterprises belonging to various institutional profiles.

5. RESEARCH METHODOLOGY

The study is limited to small and medium manufacturing enterprises in Cuddalore district. The topic of green supply chain management is extensive. The present study solely looks at the performance of green supply chain management in small and medium-sized manufacturing enterprises. The present study is empirical and uses a survey method. The researchers used both primary and secondary data sources. The research begins with the gathering of secondary data about small and medium-sized enterprises. Books, reports, journals and periodicals, websites, and other sources of secondary data were used. The researchers used a questionnaire to obtain primary data from small and medium manufacturing enterprises. Following a review of the relevant literature and extensive consultation with experts in related subjects, a questionnaire was developed. To arrive at useful conclusions, the data was entered into a master table. In the

Cuddalore district, there are 165 small and medium-sized manufacturing enterprises. About 85 small and medium-sized manufacturing enterprises implemented green supply chain practices out of the total. All small and medium manufacturing enterprises that have implemented green supply chain practices were chosen for this study using the census method. Analysis of one-way variance, student t test, analysis of co-efficient of variation, and percentage analysis were used to examine the performance of green supply chain management in small and medium-sized firms in Cuddalore district.

6. ANALYSIS AND INTERPRETATIONS

The profile of the selected manufacturing enterprises is shown in Table 1. 64.29 per cent of the 84 enterprises have been in operation for less than five years. 10.71% of enterprises have been in operation for 6-10 years. In that order, 8.33 per cent have been in business for 11-15 years and 16.67 per cent have been in business for more than 15 years. Out of 84 enterprises, 55.95 per cent are sole proprietorships, 32.14 per cent are partnership firms, and 11.90 per cent are companies. Food items, chemical and pharma, and woodwork and furniture account for 45.24 per cent, 5.95 per cent, and 2.38 per cent of the 84 enterprises, respectively. Electrical engineering, concrete and bricks, and miscellaneous manufacturing operations account for 9.52 per cent, 2.38 per cent, and 34.5 per cent of enterprises, respectively. ISO certification is held by 23.81 per cent of enterprises, whereas ISO non-certification is held by 76.19 per cent. Small enterprises account for 94.05 per cent, while medium enterprises account for 5.95 per cent. Annual sales of 51.19 per cent and 20.24 per cent of the 84 enterprises are between Rs. 5 crore and Rs. 6-10 crore, respectively. Annual sales of Rs. 11-15 crore and above Rs.15 crore account for 13.10 per cent and 15.48 per cent of the firms, respectively.

Table 1: Enterprise Profile

Profile of the Enterprises		No. of Respondents	Percentage
Years of existence	Upto 5	54	64.29
	6 - 10	9	10.71
	11 - 15	7	8.33
	Above 15	14	16.67
Type of ownership	Sole proprietorship	47	55.95
	Partnership	27	32.14
	Company	10	11.90
Nature of operations	Food products	38	45.24
	Chemical and Pharma	5	5.95
	Woodwork and furniture	2	2.38
	Electrical and engineering	8	9.52
	Concrete and bricks	2	2.38
	Miscellaneous operations	29	34.52
ISO certified	Certified	20	23.81
	Non-certified	64	76.19
Size of enterprise	Small scale enterprise	79	94.05
	Mediums scale enterprise	5	5.95
Annual sales (Rs. in crore)	Upto 5	43	51.19
	6-10	17	20.24
	11-15	11	13.10
	Above 15	13	15.48

Source: Primary Data

Table 2: Relationship between Enterprise Profile and Green Supply Chain Management Performance– t Test

Enterprise Profile	Calculated Vale	Table Value	DF	Result
ISO certification	2.764	2.637	82	Significant
Scale of operation	9.867	2.637	82	Significant

Source: Primary Data

The calculated t value for ISO certification is (2.764) greater than the table value at the 1% level of significance (2.637). Hence, there is a significant difference in green supply chain management performance between ISO certified and non-certified enterprises. The calculated t value for the scale of operation is (9.867) greater than the value in the table at a 5% significance level (2.637). Hence, there is a significant difference in green supply chain management performance between small and medium-sized enterprises. The null hypothesis (H_{01}) is then rejected.

Table 3 : Relationship between Enterprise Profile and Green Supply Chain Management Performance –ANOVA

Enterprise Profile	Source of Variation	Sum of Squares	DF	Mean Square	F	Result
Years of existence	Between groups	3	887.369	295.790	0.525	Ns
	Within groups	80	45093.048	563.663		
	Total	83	45980.417			
Ownership pattern	Between groups	2	433.134	216.567	0.385	Ns
	Within groups	81	45547.283	562.312		
	Total	83	45980.417			
Nature of operations	Between groups	5	2686.185	537.237	0.968	Ns
	Within groups	78	43294.231	555.054		
	Total	83	45980.417			
Annual sales	Between groups	3	8209.887	2736.629	5.796	**
	Within groups	80	37770.529	472.132		
	Total	83	45980.417			

*Ns: Not significant ** Significant at 1 per cent level*
Source: Primary Data.

At a 5% significance level, the calculated F value is (0.525) smaller than the table value (2.719). Hence, no significant relationship exists between the performance of green supply chain management and the years of existence of the select enterprises. At a 5% significance level, the calculated F value is (0.385) less than the table value (3.109). The test results are insignificant. It implies that there is no significant relationship between the performance of green supply chain management and the ownership patterns of select enterprises. At a 5% significance level, the calculated F value (0.968) is less than the table value (2.332). It means that there is no significant relationship between the performance of green supply chain management and the performance of select enterprises engaged in various manufacturing operations. As a result, the null hypothesis (H_{01}) of no significant relationship between enterprise profile (year of existence, ownership pattern, and nature of operations) and green supply chain management performance is accepted. At a 1% level of significance, the calculated F value (5.796) is greater than the table value (4.036). Hence, a significant relationship exists between the performance of green supply chain management and the enterprises' annual sales. Therefore, the null hypothesis (H_{01}) is rejected.

The mean satisfaction score with the performance of green supply chain management practices is high among enterprises with a existence of 6-10 years (414.33), sole proprietorship enterprises (411.06), enterprises engaged in miscellaneous operations (416.72), ISO certified enterprises (421.30), medium scale enterprises (477.60), and enterprises with annual sales of more than Rs.15 crore (431.69). There is consistency in the performance of green supply chain

management practices among enterprises with a existence of more than 15 years (2.52 per cent), partnership firms (3.38 per cent), chemical and pharma enterprises (2.66 per cent), ISO non-certified enterprises (3.35 per cent), small scale enterprises (3.37 per cent), and enterprises with annual sales of less than Rs.5 crore (3.09 per cent).

Table 4: Enterprise Profile and Performance of Green Supply Chain Management - Mean and Coefficient of Variation

Enterprise Profile		No. of Respondents	Mean	Standard Deviation	CV
Years of existence	Upto 5	54	410.22	24.86	6.06
	6 – 10	9	414.33	33.62	8.11
	11 – 15	7	403.14	18.09	4.49
	Above 15	14	404.29	10.18	2.52
Ownership pattern	Sole proprietorship	47	411.06	28.03	6.82
	Partnership	27	406.19	13.74	3.38
	Company	10	407.60	22.39	5.49
Nature of operations	Food products	38	405.42	18.10	4.46
	Chemical and Pharma	5	403.20	10.73	2.66
	Woodwork and furniture	2	402.50	16.26	4.04
	Electrical & engineering	8	406.38	15.72	3.87
	Concrete and bricks	2	400.00	28.28	7.07
	Miscellaneous operations	29	416.72	31.58	7.58
ISO certification	Certified	20	421.30	40.04	9.50
	Non-certified	64	405.27	13.57	3.35
Scale of operation	Small scale enterprise	79	404.75	13.66	3.37
	Medium scale enterprise	5	477.60	40.19	8.41
Annual sales	Below 5	43	403.49	12.46	3.09
	6-10	17	408.82	14.62	3.58
	11-15	11	404.64	17.59	4.35
	Above 15	13	431.69	45.40	10.52

Source: Primary Data.

The majority of manufacturing enterprises are satisfied (34.52%) with the performance of green supply chain management, followed by dissatisfied (30.95%) and highly satisfied (17.86 per cent). 15.48% of enterprises are neither satisfied nor dissatisfied with the performance of green supply chain management, while 1.19 per cent are highly dissatisfied. The average score indicates that enterprises are most satisfied with human and technological resources (3.76), followed by eco manufacturing (3.74), eco product design, and eco accounting (3.69). The enterprises, on the other hand, have lower mean satisfaction scores for investment recovery (2.89), operational performance (3.01), and environmental performance (3.12).

Table 5: Satisfaction with Performance of Green Supply Chain Management

	Level of satisfaction	Total	

Performance dimensions	Highly satisfied	Satisfied	Neither satisfied nor dissatisfied	Dissatisfied	Highly dissatisfied		**Mean score**
Eco procurement	24 (28.57)	24 (28.57)	11 (13.10)	23 (27.38)	2 (2.38)	84 (100.0)	3.30
Eco product design	25 (29.76)	28 (33.33)	11 (13.10)	20 (23.81)	0 (0.00)	84 (100.00)	3.69
Eco manufacturing	25 (29.76)	29 (34.52)	14 (16.67)	15 (17.86)	1 (1.19)	84 (100.00)	3.74
Eco accounting	23 (27.38)	30 (35.71)	13 (15.48)	18 (21.43)	0 (0.00)	84 (100.00)	3.69
Financial performance	21 (25.00)	30 (35.71)	13 (15.48)	19 (22.62)	1 (1.19)	84 (100.00)	3.61
Eco logistics design	16 (19.05)	28 (33.33)	17 (20.24)	22 (26.19)	1 (1.19)	84 (100.00)	3.43
Marketing and communication	6 (7.14)	27 (32.14)	15 (17.85)	34 (40.48)	2 (2.38)	84 (100.00)	3.01
Environmental performance	8 (9.52)	28 (33.33)	15 (17.86)	31 (36.90)	2 (2.38)	84 (100.00)	3.12
Customer co-operation	24 (28.57)	29 (34.52)	11 (13.10)	19 (22.62)	1 (1.19)	84 (100.00)	3.67
Human and technological resources	25 (29.76)	31 (36.90)	11 (13.10)	17 (20.24)	0 (0.00)	84 (100.00)	3.76
Internal environmental management	12 (14.29)	30 (35.71)	13 (15.48)	28 (33.33)	1 (1.19)	84 (100.00)	3.29
Operational performance	4 (4.76)	30 (35.71)	14 (16.67)	35 (41.67)	1 (1.19)	84 (100.00)	3.01
Stakeholders	5 (5.95)	36 (42.86)	13 (15.48)	29 (34.52)	1 (1.19)	84 (100.00)	3.18
Vendor selection	11 (13.10)	27 (32.14)	12 (14.29)	32 (38.10)	2 (2.38)	84 (100.00)	3.15
Intangible performance	9 (10.71)	29 (34.52)	15 (17.86)	30 (35.71)	1 (1.19)	84 (100.00)	3.18
Investment recovery	7 (8.33)	24 (28.57)	9 (10.72)	41 (48.81)	3 (3.57)	84 (100.00)	2.89
Overall	15 (17.86)	29 (34.52)	13 (15.48)	26 (30.95)	1 (1.19)	84 (100.00)	3.37

Source: Primary Data

7. SUGGESTIONS

1. Select manufacturing enterprises can implement global green supply chain management best practices by ensuring that environmental criteria are considered when

sourcing items and that they buy from environmentally certified suppliers. Furthermore, policies can be developed to assure the procurement of ecologically friendly products.

2. As it is critical to assess the environmental, occupational health, and resource-related consequences of a product throughout its life cycle, including the extraction and processing of raw materials, production, transportation and distribution, use, remanufacturing, recycling, and final disposal, select manufacturing enterprises can use the life cycle analysis concept, which must be viewed as one with long-term benefits.
3. To improve product design and find new market prospects, select manufacturing enterprises must use innovative green product development processes that consider environmentally friendly raw materials and processes. Green design can include structural and product designs. Select manufacturing enterprises can implement these practices by using biodegradable raw materials and inputs in product design, as well as regularly upgrading their product offering to meet environmental standards.
4. Select manufacturing enterprises should strive for sustainability through recycling, reuse, and reverse logistics to improve competitiveness, improve environmental performance, and minimize waste to save money. Pinch analysis, industrial energy, and energy and life cycle analysis should be used to implement these strategies. Furthermore, rather than waiting until the garbage has piled, select manufacturing enterprises can control solid waste through efficient water usage.
5. Select enterprises require sustainable development, thus public awareness and demand for green products must be encouraged. Hence, green products should be developed to meet the needs of green consumers. Customers' awareness of green products should be raised through advertising initiatives.
6. International environmental agreements like the Kyoto agreement, the Climate Change Treaty, and the Montreal Protocol have an impact on manufacturing enterprises and governments. Hence, the government can direct manufacturing companies to implement GSCM in accordance with international environmental agreements. Furthermore, many countries have a variety of bodies that promote green concept in society, such as ministries, departments, or councils. In India, numerous ministries are focusing on environmental issues. Therefore, similar bodies should exist at the state level to promote GSCM.
7. As part of their commitment to the society to solve environmental challenges through strategic collaborations, non-governmental organisations should play a vital role in

greening the supply chain, particularly in collaboration with key stakeholders.

8. CONCLUSION

Climate change, ozone layer depletion, biodiversity loss, pollution, degradation, and the depletion of air, water, minerals, and land are all examples of environmental degradation brought on by the rising global economy. These concerns have become crucial for organisations as their stakeholders expect that they address environmental and social sustainability in their operations. Organizations that want to reduce their environmental effect may find that managing increasingly complicated supplier relationships is a challenge. Green supply chain management has arisen as a method of combining environmental and supply chain management features. As a practical means of pursuing an environmentally focused approach, green supply chain management practices have been developed. Therefore, possible policy measures, regulatory frameworks, and activities to encourage GSCM have become critical. Hence, the present study was conducted with 84 small and medium-scale manufacturing enterprises in the Cuddalore district to address the economic and environmental elements of sustainability, particularly in the context of green supply chain management. The study proposed a number of measures for effective GSCM operations. The researchers will be amply rewarded if the study prompts policymakers to take constructive action.

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