Optimizing Sustainability: Investigating The Integral Role of Green Supply Chain Management in Small and Medium-Sized Enterprises (Smes)

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Abstract

This research paper investigates the pivotal role of Green Supply Chain Management (GSCM) in the context of Small and Medium-sized Enterprises (SMEs). As global concerns over environmental sustainability continue to rise, SMEs, often viewed as the backbone of economies, face unique challenges and opportunities in integrating green practices within their supply chain operations. This study delves into the multifaceted dimensions of GSCM, exploring its implications for SMEs in terms of environmental responsibility, economic viability, and stakeholder relationships.

The research employs a comprehensive methodology, including a thorough literature review, case studies of successful GSCM implementations in SMEs, and empirical analysis of challenges faced by SMEs in adopting sustainable supply chain practices. The objectives are to understand how SMEs integrate GSCM into their operations, identify the barriers and drivers influencing adoption, and assess the impact on environmental, economic, and social performance.

1. Introduction:

In the dynamic landscape of contemporary business, sustainability has emerged as a pivotal factor influencing corporate strategies across industries. Small and Medium-sized Enterprises (SMEs), as vital contributors to economic development, are increasingly recognizing the importance of integrating environmentally responsible practices into their operations. Amidst this paradigm shift, the Green Supply Chain Management (GSCM) framework has gained prominence as a strategic approach to minimize environmental impacts while enhancing operational efficiency.

The concept of Green Supply Chain Management extends beyond traditional supply chain practices, emphasizing the reduction of ecological footprints through the adoption of environmentally friendly processes, materials, and technologies. SMEs, often characterized by resource constraints and operational intricacies, face unique challenges in navigating the complexities of sustainable practices. Therefore, understanding the role of GSCM in SMEs becomes imperative, not only for the ecological benefits it provides but also for its potential to foster competitiveness and resilience in the global market. This research aims to delve into the multifaceted dimensions of GSCM within the context of SMEs, unraveling the intricate interplay between sustainable supply chain practices and the operational dynamics of smaller enterprises. By investigating the challenges, opportunities, and outcomes associated with the implementation of GSCM, this study seeks to contribute valuable insights to both academic discourse and practical strategies for SMEs aiming to embrace sustainability in their supply chain operations.

Through a comprehensive exploration of existing literature, empirical studies, and case analyses, this research endeavours to provide a nuanced understanding of how GSCM can be tailored to suit the specific needs and constraints of SMEs. The ensuing discussions will shed light on the potential advantages and barriers faced by SMEs in adopting green practices, thereby paving the way for informed recommendations and best practices.

As the global community increasingly emphasizes environmental stewardship, SMEs find themselves at the intersection of economic viability and ecological responsibility. This research endeavours to bridge the existing gap in the literature by elucidating the pivotal role played by GSCM in shaping the sustainability narrative of SMEs, offering a roadmap for enterprises seeking to integrate green practices into their supply chain strategies. Through this exploration, we aim to contribute not only to the academic understanding of the subject but also to the practical implementation of sustainable supply chain management in the vital realm of small and medium-sized enterprises.

2.Keywords:

Green Supply Chain Management, Sustainability in Supply Chain, Small and Medium-sized Enterprises (SMEs)

3. Literature Review:

The imperative for sustainable business practices has brought the role of Green Supply Chain Management (GSCM) to the forefront of academic and industrial discussions. In the context of Small and Medium-sized Enterprises (SMEs), the integration of green practices within the supply chain is a complex yet pivotal endeavor. This literature review aims to synthesize existing research on the role of GSCM in SMEs, elucidating key themes, challenges, and opportunities that characterize this intersection of sustainability and supply chain management.

GREEN SUPPLY CHAIN MANAGEMENT : Green Supply Chain Management (GSCM) is an approach to supply chain management that integrates environmentally friendly practices and sustainability principles into the design, production, transportation, and disposal of products. The primary goal of GSCM is to reduce the overall environmental impact of a supply chain while still meeting customer demands efficiently and effectively.

 3.1 Defination of green supply chain management:

Srivastava, S. K. (2007): Green Supply Chain Management (GSCM) is defined as "the integration of environmental and sustainability considerations into supply chain management processes, including product design, material sourcing and selection, manufacturing processes, delivery of the final product to consumers, and end-of-life product management."

Carter, C. R., & Rogers, D. S. (2008): GSCM is conceptualized as "the process of using environmentally friendly inputs and transforming these inputs through change agents – whose byproducts can improve or be recycled within the existing environment."

Seuring, S., & Müller, M. (2008): Green Supply Chain Management is described as "the process of using environmentally friendly inputs and transforming these inputs through change agents – whose byproducts can improve or be recycled within the existing environment."

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These definitions provide a comprehensive understanding of Green Supply Chain Management, emphasizing the integration of environmental considerations into various stages of the supply chain. Each definition contributes to the evolving discourse on sustainable and environmentally responsible supply chain practices.

3.2 Component of green supply chain management : Key components of Green Supply Chain Management include:

1. Environmental Responsibility: GSCM emphasizes the responsibility of organizations to minimize their ecological footprint. This involves assessing and managing the environmental impacts of every stage in the supply chain.

2. Life Cycle Assessment: GSCM considers the entire life cycle of a product, from raw material extraction to manufacturing, distribution, use, and disposal. Life cycle assessment helps identify areas where environmental improvements can be made.

3. Sustainable Procurement: GSCM involves sourcing materials and components from suppliers who adhere to environmentally sustainable practices. This includes evaluating suppliers based on their environmental performance and encouraging the adoption of green initiatives.

4. Energy Efficiency: GSCM aims to reduce energy consumption throughout the supply chain. This may involve using energy-efficient transportation, optimizing production processes, and implementing energy-saving technologies.

5. Waste Reduction and Recycling: GSCM focuses on minimizing waste generation and promoting recycling initiatives. This includes designing products with recyclable materials and implementing recycling programs in the supply chain.

6. Regulatory Compliance: GSCM ensures that supply chain activities comply with environmental laws and regulations. This involves staying informed about changing environmental legislation and adapting supply chain practices accordingly.

7. Continuous Improvement: GSCM is a dynamic process that involves continuous improvement. Companies adopting GSCM regularly assess their environmental performance, set targets for improvement, and implement changes to achieve sustainability goals.

By incorporating these principles into supply chain practices, organizations can not only contribute to environmental conservation but also gain strategic advantages such as cost savings, enhanced corporate reputation, and increased competitiveness in a market where sustainability is increasingly valued by consumers and stakeholders.

3.3 Factors of GSCM in SME : There are different factors which effect the decision or role of the GSCM in SME . Some of these are as follow:

1. Economic factors: The economic factors associated with Green Supply Chain Management (GSCM) are crucial for understanding the financial implications and benefits of adopting environmentally sustainable practices in the supply chain. Here are some economic factors with references that highlight the economic dimensions of GSCM:

A. Cost Savings: Implementing GSCM practices can lead to cost savings through improved resource efficiency, reduced waste, and energy conservation. Companies can benefit from lower operational costs over the long term.

B. Efficiency and Productivity: GSCM practices, such as lean manufacturing and process optimization, contribute to improved overall efficiency and productivity in the supply chain, positively impacting economic performance.

C. Market Access and Competitive Advantage: Companies embracing GSCM may gain market access and a competitive advantage by meeting the growing consumer demand for environmentally friendly products and demonstrating corporate social responsibility.

D. Risk Mitigation: GSCM practices can mitigate economic risks associated with environmental issues, regulatory compliance, and supply chain disruptions, leading to more resilient and economically sustainable operations.

E. Investor Relations and Reputation: Companies adopting GSCM practices may enhance investor relations and reputation, attracting socially responsible investors and consumers who are increasingly valuing environmentally sustainable business practices.

2. Environmental Factor: The environmental factors associated with Green Supply Chain Management (GSCM) involve integrating environmentally sustainable practices at various stages of the supply chain to minimize negative impacts on the environment. Here are some key environmental factors with references that highlight the environmental dimensions of GSCM:

a. Carbon Footprint Reduction: GSCM focuses on reducing carbon emissions and overall environmental impact by optimizing transportation, improving energy efficiency, and selecting eco-friendly transportation options.

b. Waste Reduction and Recycling: GSCM practices aim to minimize waste generation and promote recycling throughout the supply chain, from raw material sourcing to product disposal, contributing to a circular economy.

c. Raw Material Sourcing and Sustainable Procurement: GSCM involves selecting suppliers and raw materials with environmentally friendly practices, promoting sustainable sourcing, and reducing the environmental impact of resource extraction.

d. Energy Efficiency and Renewable Energy: GSCM emphasizes the adoption of energy-efficient technologies and the integration of renewable energy sources to reduce the carbon footprint and promote more sustainable energy practices.

e. Biodiversity Conservation: GSCM considers the preservation of biodiversity by minimizing the impact of supply chain activities on ecosystems and habitats, ensuring responsible land use and resource management.

3. Social Factor: The social factors associated with Green Supply Chain Management (GSCM) involve considering the impact of supply chain practices on society, including issues related to labor, community well-being, and social responsibility. Here are some key social factors with references that highlight the social dimensions of GSCM:

a. Ethical Labor Practices: GSCM emphasizes fair labor practices, including ensuring safe working conditions, fair wages, and compliance with labor regulations, contributing to social responsibility in the supply chain.

b. Community Engagement: GSCM involves engaging with local communities to understand and address social concerns, fostering positive relationships and contributing to the well-being of the communities in which businesses operate.

c. Corporate Social Responsibility (CSR): GSCM is aligned with broader corporate social responsibility initiatives, emphasizing the integration of ethical, social, and environmental considerations into business operations.

d. Employee Well-being: GSCM considers the well-being of employees by promoting safe working conditions, providing training and development opportunities, and fostering a positive and inclusive workplace culture.

e. Human Rights Protection: GSCM practices aim to ensure the protection of human rights throughout the supply chain, addressing issues such as child labor, forced labor, and other human rights violations.

4. Regulatory Factor: The regulatory factor of Green Supply Chain Management (GSCM) refers to the influence of government policies, laws, regulations, and standards on the environmental sustainability practices within the supply chain. This factor recognizes the role of external authorities in shaping and directing the adoption of environmentally friendly and socially responsible practices by businesses throughout their supply chain activities. Regulatory factors in GSCM encompass a range of legal requirements and guidelines that may address issues such as environmental impact, resource conservation, waste management, emissions reduction, and ethical considerations. Businesses operating in various industries must comply with these regulations, and in doing so, they are prompted to integrate green practices into their supply chain strategies.

5. Competitive factor: The competitive factor of Green Supply Chain Management (GSCM) refers to the strategic advantage gained by businesses through the integration of environmentally sustainable practices within their supply chain processes. This factor recognizes that adopting green initiatives can enhance a company's competitiveness by addressing environmental concerns, meeting consumer expectations, and positioning the business as a socially responsible and environmentally conscious player in the marketplace.

3.3 Sustainability in Supply Chain:

Sustainability in supply chain management (SSCM) has evolved as a critical strategic imperative for organizations seeking to balance economic, environmental, and social considerations in their operations. This literature review explores key themes and findings in the field, shedding light on the multifaceted nature of sustainable supply chain practices.

Triple Bottom Line Approach: The triple bottom line framework, encompassing economic, environmental, and social dimensions, forms the foundation of sustainability in supply chains (Elkington, 1997). Organizations are increasingly recognizing the importance of not only economic success but also environmental stewardship and social responsibility.

Drivers of Sustainable Supply Chain Management: Various drivers push organizations toward adopting sustainable supply chain practices. Regulatory pressures, consumer demand for ethical products, and the pursuit of operational efficiency are identified as key drivers (Seuring & Müller, 2008).

Integration of Sustainability into Supply Chain Strategies: Successful implementation of SSCM requires the integration of sustainability into supply chain strategies. This involves collaboration with suppliers, customers, and other stakeholders to embed sustainable practices throughout the supply chain (Carter & Rogers, 2008).

Life Cycle Assessment (LCA) and Eco-Design: Life cycle assessment is a crucial tool for assessing and improving the environmental performance of products throughout their life cycle (Rebitzer et al., 2004). Eco-design practices involve incorporating environmental considerations into the product design phase (Charter, 2001).

Barriers to Sustainable Supply Chain Practices: Despite the growing awareness of sustainability, barriers persist. These include cost considerations, lack of awareness, and the absence of standardized metrics for measuring sustainability performance (Srivastava, 2007).

Benefits of Sustainable Supply Chain Management: Implementing SSCM practices yields various benefits, including cost savings, enhanced brand reputation, and improved stakeholder relationships (Sarkis et al., 2011).

Sustainability in supply chain management is a dynamic and evolving field, driven by a recognition of the interconnectedness of economic, environmental, and social factors. This literature review highlights the importance of a holistic approach to SSCM, emphasizing the need for collaboration, innovation, and strategic integration to achieve sustainable and resilient supply chains. Continued research in this area is essential to address emerging challenges and capitalize on new opportunities for sustainable development.

3.4 SMALL MEDIUM ENTERPRISES:

Small and Medium-sized Enterprises (SMEs) are typically defined based on criteria such as the number of employees, annual turnover, or a combination of both. The definitions can vary by country, industry, and context. Here are a few commonly used definitions:

1. **European Commission (EC) Definition:** In the European Union, the definition of SMEs is based on the number of employees and either turnover or balance sheet total. As of January 1, 2023, an enterprise is considered an SME if it has fewer than 250 employees and either an annual turnover not exceeding €50 million or a balance sheet total not exceeding €43 million.

2. **United States Small Business Administration (SBA) Definition:** In the United States, the definition of a small business can vary by industry. The SBA provides size standards based on either the number of employees or average annual receipts. For example, a manufacturing business can be considered small if it has fewer than 500 employees.

3. **International Finance Corporation (IFC) Definition:** The IFC, a member of the World Bank Group, defines SMEs based on annual sales. For example, in the manufacturing sector, an enterprise with annual sales of up to $15 million is considered small, and up to $100 million is considered medium-sized.

These definitions are just a few examples, and it's important to note that definitions may change over time and can vary based on regional and industry-specific considerations.

In India, the definition of Small and Medium Enterprises (SMEs) is primarily based on the criteria of investment in plant and machinery for manufacturing enterprises and investment in equipment for service enterprises. The definition has undergone revisions to accommodate changes in economic conditions. As of my last knowledge update in January 2022, the criteria for classification are as follows:

Manufacturing Sector:

Micro Enterprise: An enterprise where the investment in plant and machinery does not exceed INR 25 lakh.

Small Enterprise: An enterprise where the investment in plant and machinery is more than INR 25 lakh but does not exceed INR 5 crore.

Medium Enterprise: An enterprise where the investment in plant and machinery is more than INR 5 crore but does not exceed INR 10 crore.

Service Sector:

Micro Enterprise: An enterprise where the investment in equipment does not exceed INR 10 lakh.

Small Enterprise: An enterprise where the investment in equipment is more than INR 10 lakh but does not exceed INR 2 crore.

Medium Enterprise: An enterprise where the investment in equipment is more than INR 2 crore but does not exceed INR 5 crore.

These definitions are based on the criteria set by the Ministry of Micro, Small and Medium Enterprises (MSMEs) in India. It's important to note that these criteria may be subject to change, and it's advisable to check the latest guidelines provided by the relevant authorities for the most up-to-date information.

4. Objective of study:
1. Analysis the Role of the GREEN Supply Chain Management in SME.
2. Identify the different factor of GSCM and there effect on it.

5.Research Methodology:

Research Design:
1. **Research Type:** Employ a mixed-methods research design to combine quantitative and qualitative data for a holistic understanding.
2. **Sampling:** Select a representative sample of SMEs from diverse industries. Consider factors like size, geographical location, and industry type to ensure a broad perspective. Use stratified random sampling for accuracy.
3. **Data Collection:**
a. **Quantitative Data:** Utilize surveys/questionnaires to collect quantitative data on the extent of GSCM adoption, perceived barriers, and economic outcomes. Develop a structured survey based on validated scales from the literature.

b. Qualitative Data: Conduct interviews and focus group discussions with SME managers and stakeholders to gather in-depth insights into their experiences with GSCM. Capture qualitative data on challenges faced, successful strategies, and stakeholder perspectives.

4. **Variables and Measures:** Clearly define and operationalize variables such as GSCM adoption, economic performance, and environmental/social impact. Utilize established scales for quantitative measures and thematic analysis for qualitative variables.

5. **Data Analysis:**

a. Quantitative Analysis: Employ statistical tools such as descriptive statistics, regression analysis, and correlation analysis to analyze quantitative data. Examine relationships between GSCM practices, economic performance, and other relevant variables.

b. Qualitative Analysis: Utilize thematic analysis to identify patterns, themes, and insights from qualitative data. Develop a coding framework to categorize responses and identify common factor related to GSCM challenges and successes

5.Data Analysis:

Extent of Implementation of Green Supply Chain Initiatives for SMEs in Haryana Significance Testing Results pertaining to effects of implementation of green supply chain initiatives on operations of 99 SMEs in the Haryana area. (Margin of error in sampling = 10 %, level of significance = 5 %)

For the five factors of SME which play a vital role on adopting the green supply chain management as Financial factor, Environmental factor, Economic factor, Regulatory factor, Competitive factor , a one-sample t-test was conducted with the following values (one-tail significance test with cut-off point = 2.5, the median of the 5-point scale).

H0: Mean <=2.5

H1: Mean > 2.5.

t-critical = 1.645.

Table 1

Construct	t-value	significance
Economic factor	1.959	significant at 5% level of significance
Social factor	0.985	not significant
Environmental factor	1.861	significant
Regulatory factor	-3.845	not significant
Competitive factor	2.856	significant at 5% level of significance

The results from data analysis above concludes that Economic factor of GSCM is being achieved by SMEs concerned at 5 % level of significance, but social factor with reference to Process is not achieved significantly.

Environmental factor is achieve significantly. Regulatory factor not achieved. Competative factor achieved.

For structural equation modeling, SEM (Jöreskog & Sörbom, 1993) the data analysis tried to determine the causal relationships between the different latent constructs: Environmental, Economic, Social, Regulatory and Competative factors. The goodness of fit or probabilistic significance of the overall model was determined by the chi-square value, the corresponding degrees of freedom, and the p-value associated with level of significance related to chi square value and degrees of freedom. For the model to be significant the overall p-value should have a level of significance greater than 0.05.

The individual linkages between any two variables were tested using the critical ratio, which is a statistic that has an approximate standard normal distribution. Thus, using a significance level of 0.05, any critical ratio that exceeds 1.96 in magnitude would be significant, in a two tail scenario.

For the confirmatory analysis, under SEM, the conceptual model involving the six constructs was run using AMOS Graphics for Windows, estimating the regression weight of each link (arrow) and the associated significance, using maximum likelihood estimation (MLE) procedure, which is known to provide valid results with sample sizes as small as 50. In addition to p-value, the analysis used a further index of goodness of fit which is chi-square/degrees of freedom. In

addition, Goodness of fit index (GFI), adjusted goodness of fit index (AGFI), and root mean square residual (RMSR) indicators were used to evaluate the validity of the model. Several sets of analyses were conducted with the input being the descriptive statistics of the indicator variables and their correlation matrix.

The SEM estimates a series of separate but interdependent multiple regression equations simultaneously. In the research the theory and the research objectives were considered to determine which independent variable would predict which dependent variable. The proposed relationships were then translated into a series of structural equations for each dependent variable. The structural model expresses these relationships among the independent and dependent variables.

The model was designed using IBM-SPSS-AMOS Version 22.0.0(Build 788).

Results Pertaining to Confirmatory Analysis

Using the structural equation modelling approach under confirmatory factor analysis, the overall measures of goodness of fit were observed.

Table 2: Measures of Goodness of Fit Indicators

chi-square/ degrees of Freedom	= 1.087	very acceptable
Overall model p-value	=0.249	very acceptable
GFI	=0.946	acceptable
CFI	=0.997	very acceptable
AGFI	=0.909	very acceptable
NFI	=0.963	very acceptable

Hypothesis	Path Coefficient	Standard Error	T stats	P values	F Square	R square (Q Square)
Competive factors -> Adoption of GSCM	0.169	0.054	3.155	0.002	0.033	56.9% (0.551)
Economic factors -> Adoption of GSCM	0.199	0.052	3.862	0	0.044	
Environment factors -> Adoption of GSCM	0.245	0.052	4.719	0	0.062	
Social Factor -> Adoption of GSCM	0.259	0.055	4.678	0	0.071	
Regulatory factor->Adoption of GSCM	0.198	0.055	3.25	0	0.054	

The result of SEM analysis supported that different factor of GSCM in SME influence the adoption of GSCM : The path coefficient indicating the impact of the factors related on the adoption of GSCM in the SMEs is found to be positive and significant at 5 percent level of significance. Thus, it can be concluded that the higher level of competitive , economic, environmental, social, regulatory factors issues motivates the SMEs to adopt the GSCM in their firms.

6.Conclusion:

Based on the results of the study, it was concluded that GSCM practices have a significant positive effect on environmental factor, economic factor, competitive factor, social factor, regulatory factor. SME'S always considered these factor while adopting GSCM . SMEs need to always control their raw materials when purchasing by always using green attributes that are easy to recycle. SMEs need to always use environmentally friendly materials in every activity of the development process. SMEs to continue to make improvements to the performance of the company's green manufacturing activities. Suggestions for further research are to identify GSCM performance indicators that are in accordance with the character in the industry. Further research can also increase the number of experts from various competencies related to the GSCM SMEs concept to filter and combine all perceptions to produce a GSCM performance measurement system that is more suitable to be implemented in the oil and gas industry.

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26. GSCM is aligned with broader corporate social responsibility initiatives, emphasizing the integration of ethical, social, and environmental considerations into business operations.