INTERNATIONAL RESEARCH JOURNAL OF ENGINEERING & APPLIED SCIENCES
ISSN: 2322-0821(O)
ISSN: 2394-9910(P)
VOLUME 12 ISSUE 1
Jan 2024 - Mar 2024
www.irjeas.org

Original Article

Implementation of Green Supply Chain Management Practices

Mansi Kulkarni[1], Sharad Sharma[2]

[1]*Padmabhooshan Vasant Dada Patil Institute of Technology, Pune, Maharashtra, India*
mansikulkarni198@gmail.com
[2]*Director and Research Consultant, AEG Consultancy Services PVT. LTD., Bhopal, M.P, India*
aegconsultancyservices@gmail.com

* *Corresponding Author:* mansikulkarni198@gmail.com

DOI –10.55083/irjeas.2024.v12i01005

Abstract: This research investigates the barriers to effective Green Supply Chain Management (GSCM) practices, focusing on the critical roles of environmental awareness, financial constraints, and regulatory compliance in organizations. It utilizes a mixed-methods approach, combining quantitative data from structured questionnaires with qualitative insights from expert interviews and case studies. The study begins with a comprehensive literature review to frame the hypotheses, followed by empirical data collection to evaluate these hypotheses. The findings are analyzed using statistical methods, including hypothesis testing and regression analysis, and are further enriched with expert opinions. Cronbach's Alpha values are used to assess the reliability of measurement instruments for various factors, including Environmental Awareness, Financial Constraints, and Regulatory Compliance. The research culminates in presenting actionable strategies and recommendations for overcoming identified barriers, thereby promoting the adoption of GSCM practices in industries, particularly in the context of organizational culture and regulatory environments. The research aims to provide actionable recommendations based on validated hypotheses and case study findings to enhance the adoption of GSCM practices in underdeveloped nations.

Keywords – Supply Chain Management, GSCM, Barriers, Sustainable Practices.

1. INTRODUCTION

Growing global challenge about climate change, exacerbated by means of recent environmental disasters, has intensified awareness at the impact of increasing CO2 emissions and air pollution, specifically in developing nations driven by automobile and business assets. Large-scale industries in iron, steel, and petroleum, together with smaller factories, contribute extensively to air pollutants in these regions. The survival of these polluting industries inside the developing global is facilitated by means of susceptible environmental

safety plans and standards. This phenomenon, called the pollution haven hypothesis, links environmental outcomes in growing countries to the relocation of excessive-polluting industries from evolved nations [1]. As a result of expanding environmental difficulties, combative techniques, and an expanded

ISSN(E): 2322-0821, ISSN(P): 2394-9910

worldwide understanding surrounding environmental concerns, Green Supply Chain Management (GSCM) has emerged as a steadily investigated area over the last few decades. While the field of GSCM has been investigated and defined throughout time, research on underdeveloped nations has lagged. Green Supply Chain Management is a collection of green management strategies designed to help businesses function more environmentally friendly and efficiently. It is also known as green logistics or sustainable supply chain management. It assesses the environmental and sustainability effect of every product and process throughout the supply chain, from raw material procurement to manufacture, distribution, and delivery. Green SCM is concerned with reducing waste and pollution, conserving resources, and lowering the carbon footprint of both goods and services [2]. The requirement for environment friendly business operations has resulted in the incorporation of themes such as ISO 14,001 authorization, The design process for Environment, Total Quality Management of the Environment, life cycle evaluation [31], waste management, and others into the business processes of many firms. Because these notions are related to only a few aspects of an organization's process, their impact is restricted. The European Union (EU) has introduced policies that include Restriction of Hazardous Substances (RoHS) and Waste Electronics and Electrical Equipment (WEE) that place extreme restrictions on the use of substances in products offered into the EU, thus guaranteeing that people and the environment are safeguarded from dangerous substances [3]. Assessing the relationship among GSCM and operational efficiency has significant effects. Improvement in productivity has always been a primary goal for both researchers and management. If the connection between GSCM and business outcomes is substantial, it may mean that researchers should pay more attention to GSCM in their study, and corporations should place greater emphasis on implementing environmental efforts in their supply chains. However, if the correlation is weak, managers and researchers may consider GSCM deployment to be less of a priority [4].

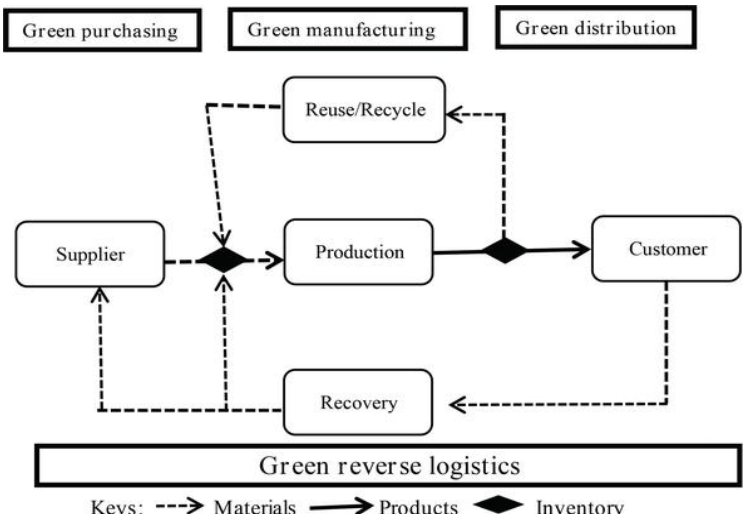


Fig. 1 Simple representation of GSCM [5]

The green supply chain distinguishes the implementations of the core sustainable development approach. It underlines how green approaches can be implemented in enterprises to reduce damage to the environment and improve economic and operational outcomes, whereas Figure 1 depicts a simplified model of a green supply chain [5].The burgeoning idea of green supply chain, aimed toward enhancing environmental overall performance during the entire supply chain, is undeniably gaining popularity. To effectively put into effect green supply chain management and achieve improved environmental sustainability, six key crucial fulfilment elements were recognized. Ethical management and internal management underscore the significance of fostering a tradition of sustainability inside businesses, with leaders playing a critical position in using environmentally responsible decision-making. Consumer management emphasizes the want to recognize and respond to client preferences for sustainable merchandise. Supplier management highlights the significance of participating with environmentally conscious suppliers [6]. Competitiveness stresses the advantage gained with the aid of organizations integrating inexperienced practices into their operations. The societal issue

acknowledges the broader impact of supply chain activities on society, considering social responsibility and network engagement. Regulatory compliance is essential, ensuring businesses perform inside legal frameworks. By addressing these factors, businesses can strategically put into effect green supply chain practices, contributing to a more sustainable and environmentally accountable business environment [7].

2. RELATED WORK

Supply chain management is essential to enhancing and putting into practice a company's competitive edge. Numerous studies and supporting data demonstrating the advantages of environmental measures for businesses may be found in the literature.Most Indian firms would need to transform their supply chains into green supply chains (GSCMs) by starting green procurement strategies and changing traditional supply chain management (SCM) to GSCM. Because of the anticipated change, several challenges can be foreseen when GSCM is adopted in traditional SCM. These obstacles are known as barriers, and industries need to prepare to get rid of them. Still, it will not be feasible to remove every obstacle at once [8]. Therefore, in the early phases of GSCM implementation, companies should identify those hurdles that essentially need to be addressed. The purpose of this study is to identify these essential challenges so that they can be removed when GSCM is implemented in enterprises. Rahman et al. (2020) recommend a fuzzy-based VIKOR (VIseKriterijumska Optimizacija I Kompromisno Resenje) framework for assessing barriers to implementing green supply chain management (GSCM) in a rising economy in [9]. The study employs a mixed-technique approach, combining literature assessment and critiques of decided on managers from the plastic enterprise in Bangladesh. Four predominant boundaries and twenty-five sub-boundaries applicable to GSCM implementation are identified. Wang et al. (2016) uses the Decision-Making Trial and Evaluation Laboratory (DEMATEL) to identify major obstacles to establishing Green Supply Chain Management (GSCM), addressing concerns about the environment in the packaging sector. The results point to important challenges, such as insufficient consumer knowledge, poor progress monitoring, inadequate training, and inadequate pressure for GSCM implementation [10]. Tumpa et al. (2019) focuses on the nascent adoption of green supply chain management in the Bangladeshi textile industry, an emerging economy context in [11]. Through a questionnaire survey with thirty practitioners in operations and supply chain management, fifteen barriers to green supply chain adoption were identified. The study reveals that low customer demand, financial constraints, and the absence of government regulations are significant barriers. Mathiyazhagan et al. (2013) addresses the challenges faced by Indian auto component manufacturing SMEs in implementing Green Supply Chain Management (GSCM) to align with increasing environmental awareness and regulatory pressures. Using Interpretive Structural Modeling (ISM) qualitative analysis, the research assesses the mutual influences among these barriers. The findings reveal variations in barriers across Indian auto component manufacturing industries, with the supplier barrier identified as the most dominant, particularly in maintaining environmental awareness. Mathiyazhagan et al. (2017) addresses the challenges faced by industries relying solely on traditional supply chain management (TSCM) models without environmental consciousness. Many industries globally are integrating green supply chain management (GSCM) concepts into their TSCM, facing numerous barriers during this transition.

Table 1 Comparative analysis of different Techniques used in determining barriers in adoption of GSCM.

Study	Methodology	Emerging Economy Context	Industry Focus	Key Findings
Rahman et al. (2020)	Fuzzy-Based VIKOR	Yes	Plastic	Identified 4 main barriers and 25 sub-barriers for GSCM in the plastic industry.
Wang et al. (2016)	DEMATEL	No	Packaging	Revealed challenges like insufficient consumer knowledge, poor progress monitoring, inadequate training, and lack of pressure for GSCM.
Tumpa et al. (2019)	Questionnaire Survey	Yes	Textile	Identified 15 barriers to GSCM adoption in the Bangladeshi textile industry, including low customer demand, financial constraints, and absence of government regulations.

Mathiyazhagan et al. (2013)	Interpretive Structural Modeling (ISM)	Yes	Auto Component Manufacturing	Assessed barriers in Indian auto component manufacturing SMEs, with the supplier barrier identified as the most dominant in maintaining environmental awareness.
Mathiyazhagan et al. (2017)	Structural Equation Modeling (SEM)	No	Multiple Industries	Addressed challenges faced by industries globally in transitioning from traditional SCM to GSCM.

3. PROBLEM FORMULATION AND DEVELOPMENT OF HYPOTHESIS

The study addresses the critical gap in understanding barriers to effective Green Supply Chain Management (GSCM) practices in underdeveloped nations. Despite the growing global emphasis on environmental sustainability, there is limited research on obstacles hindering GSCM implementation in these regions. The pollution haven hypothesis suggests that environmental consequences in developing countries are linked to the relocation of highly polluting industries from developed nations. This research aims to identify and analyse key barriers specific to underdeveloped nations, focusing on industries like plastic, packaging, textile, and auto component manufacturing.This study aims to delve into the intricacies of GSCM adoption, particularly in the context of underdeveloped nations facing unique challenges. The development of hypotheses serves as a structured approach to explore key aspects that contribute to or hinder the incorporation of environmentally conscious practices within supply chain operations. By formulating hypotheses related to environmental awareness, financial constraints, and regulatory compliance, this research endeavors to uncover critical insights into the dynamics of GSCM implementation. These hypotheses provide a framework for empirical investigation, offering a systematic exploration of the multifaceted factors influencing the success of GSCM initiatives in diverse organizational settings.

Hypothesis 1 (H1): There is a significant positive correlation between the level of environmental awareness within organizations and the successful implementation of Green Supply Chain Management (GSCM) practices.

Justification: Organizations that prioritize and foster a culture of environmental awareness are more likely to embrace and effectively implement GSCM initiatives. This hypothesis seeks to explore the impact of internal environmental consciousness on the overall success of GSCM practices, emphasizing the role of organizational culture in sustainable supply chain management.

Hypothesis 2 (H2): Financial constraints act as a significant barrier to the adoption of GSCM practices in industries.
Justification: Financial considerations play a pivotal role in decision-making within organizations. This hypothesis aims to investigate whether financial constraints pose a hindrance to the implementation of GSCM, as industries may perceive it as an additional cost. Understanding the financial aspect is crucial for devising strategies to overcome economic barriers to GSCM adoption.

Hypothesis 3 (H3): The level of regulatory compliance significantly influences the extent to which organizations implement GSCM practices.
Justification: Regulatory frameworks and compliance standards play a crucial role in shaping organizational behavior. This hypothesis aims to examine whether organizations are more likely to adopt GSCM practices when faced with stringent environmental regulations. By exploring the impact of regulatory compliance, the study seeks to understand how external factors influence the adoption of environmentally sustainable practices in supply chain management.

4. PROPOSED METHODOLOGY

The proposed methodology for the research is designed to systematically investigate and address barriers to the effective implementation of Green Supply Chain Management (GSCM) practices. Commencing with an in-depth literature review, the study aims to gather insights from existing theories and case studies related to GSCM. The subsequent formulation of hypotheses guides the development of a structured questionnaire, facilitating the collection of quantitative data on perceived barriers. Statistical analysis, including hypothesis testing and regression analysis, enables the validation of these hypotheses.

ISSN(E): 2322-0821, ISSN(P): 2394-9910

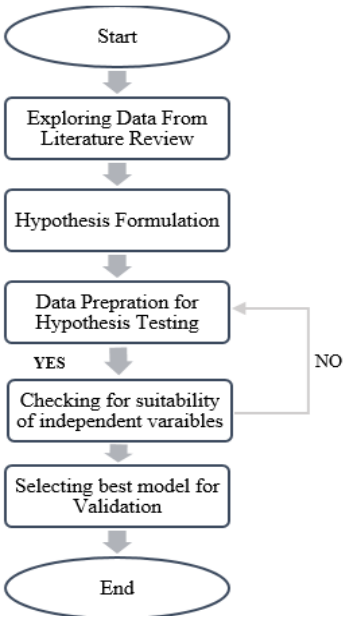


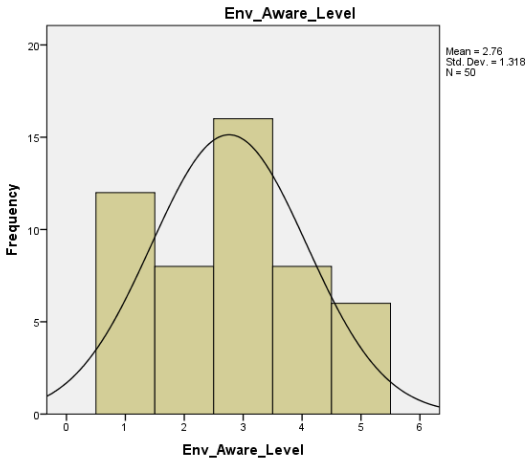
Fig. 2 Flowchart for the proposed Methodology

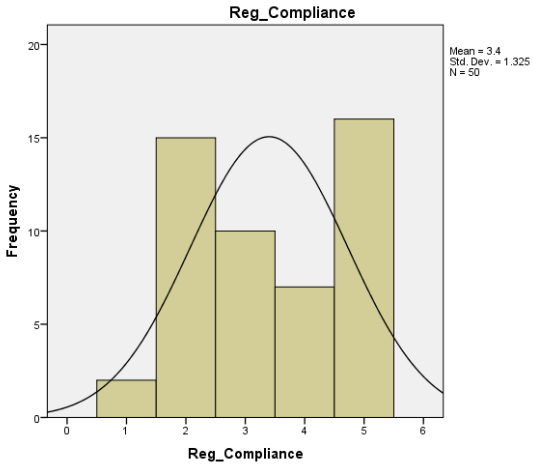
To enrich the study with qualitative perspectives, in-depth expert interviews are conducted. The validation process integrates both statistical findings and expert feedback. Following this, the study proposes tailored strategies for overcoming identified barriers, drawing from the validated hypotheses and expert insights. Case study analysis further substantiates these strategies. The research concludes by offering clear and actionable recommendations based on the validated hypotheses and case study findings, providing a holistic view of GSCM implementation challenges and potential solutions. The methodology is visualized through a comprehensive flowchart, ensuring clarity and coherence throughout the research process. Fig. 2 shows the flow chart of the proposed methodology.

4. RESULT ANALYSIS

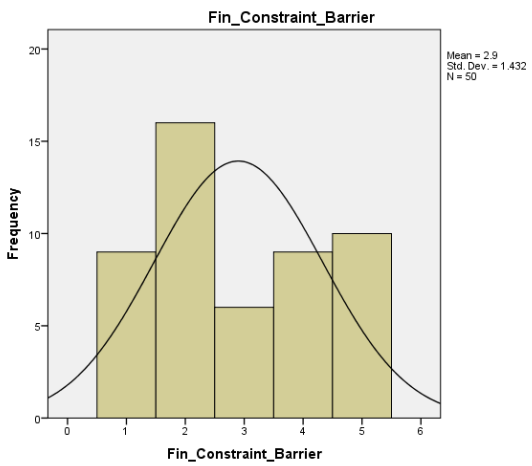
4.1 Data preparation

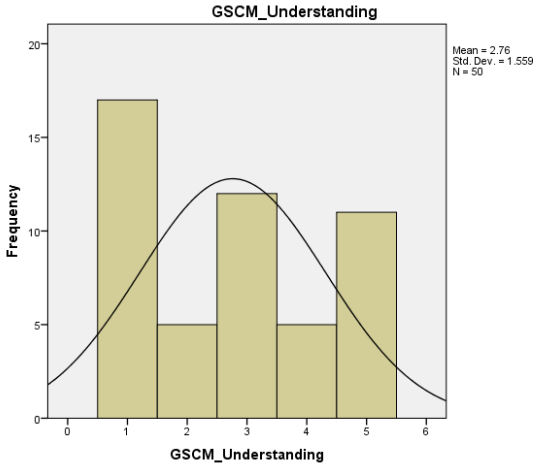
The collected data on "Env_Aware_Level" (Environmental Awareness Level), "Reg_Compliance" (Regulatory Compliance), and "GSCM_Understanding" (Understanding of Green Supply Chain Management Benefits) provides insightful evidence for evaluating three key hypotheses related to the adoption of Green Supply Chain Management (GSCM) practices.





ISSN(E): 2322-0821, ISSN(P): 2394-9910





Hypothesis 1 (H1): Environmental Awareness and GSCM Practices
The "Env_Aware_Level" data indicates a diverse range of environmental awareness within organizations. With 24% of respondents indicating 'Very Low' environmental awareness, and an equal percentage reporting 'High' to 'Very High' awareness, there's a clear variance in how organizations perceive their environmental impact. The largest segment, constituting 32%, has a 'Moderate' level of awareness. This variance suggests that while some organizations might be well-positioned to implement GSCM practices due to higher awareness levels, a significant portion may lack the necessary awareness, potentially hindering the adoption of these practices. This data supports Hypothesis 1 to some extent, indicating that higher environmental awareness could correlate with better implementation of GSCM practices, though the relationship is not uniformly strong across all organizations.

Hypothesis 2 (H2): Financial Constraints as a Barrier
Regarding "Fin_Constraint_Barrier," the data suggests varied perceptions of financial constraints as a barrier to GSCM adoption. While 18% do not view financial constraints as significant, 38% consider them 'Highly Significant' or 'Extremely Significant'. This diversity in perception underscores that financial constraints are a critical barrier for a substantial segment, thereby lending support to Hypothesis 2. However, the fact that a significant portion of respondents only find these constraints 'Slightly Significant' or 'Moderately Significant' suggests that the impact of financial barriers on GSCM adoption is not uniformly prohibitive and may vary across different organizational contexts.

Hypothesis 3 (H3): Regulatory Compliance's Influence
In terms of "Reg_Compliance," 32% of respondents report 'Very Well' compliance, suggesting a strong regulatory foundation conducive to GSCM practices. However, 34% report 'Poor' to 'Very Poor' compliance, highlighting challenges in regulatory adherence which might impede GSCM adoption. This mixed compliance scenario provides partial support for Hypothesis 3, suggesting that while regulatory compliance is influential, its impact on GSCM practice implementation may vary depending on the organization's compliance level.

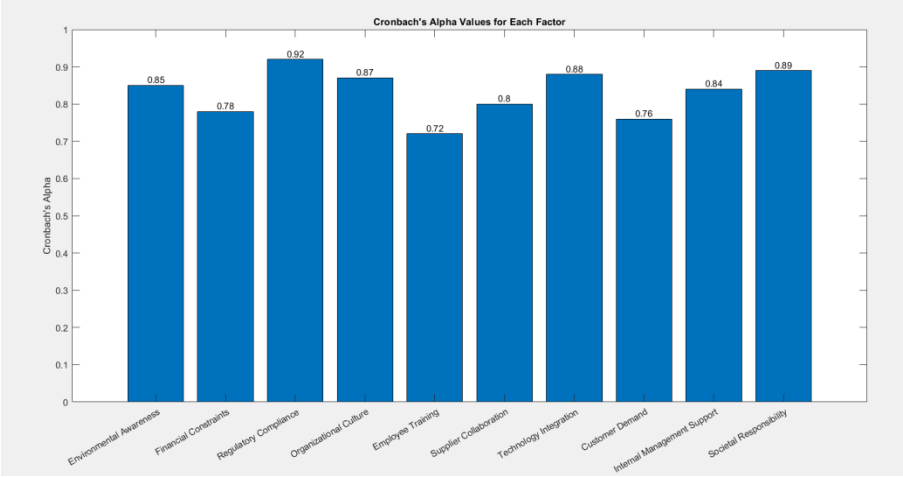
The data collectively validates the hypotheses to varying degrees. It highlights that environmental awareness, financial constraints, and regulatory compliance are indeed influential factors in the adoption and successful implementation of GSCM practices. However, the extent of their influence is not uniform across different organizations. This suggests a need for customized strategies addressing these factors to enhance GSCM adoption, which may include educational initiatives to raise environmental awareness, financial support to overcome economic barriers, and efforts to improve regulatory compliance and understanding of GSCM benefits. The findings point towards a multifaceted approach for the widespread adoption of GSCM practices, taking into account the varied organizational contexts and challenges. The descriptive statistics for the factors affecting Green Supply Chain Management (GSCM) are summarized in the table. Each factor represents a distinct dimension influencing the implementation of GSCM, and the number of items within each factor signifies the comprehensive coverage of aspects considered for measurement. For instance, Environmental Awareness consists of 10 items, indicating a diverse range of elements contributing to the assessment of environmental consciousness within organizations. Similarly, factors such as Financial Constraints, Regulatory Compliance, Organizational Culture, Employee Training, Supplier Collaboration, Technology Integration, Customer Demand, Internal Management Support, and Societal Responsibility exhibit specific counts of items, highlighting the multidimensionality

ISSN(E): 2322-0821, ISSN(P): 2394-9910

of each aspect. These descriptive statistics provide a concise overview of the breadth and depth of considerations encapsulated within the framework, ensuring a comprehensive evaluation of barriers and facilitating informed decision-making for the successful implementation of GSCM practices.

Factor	Cronbach's Alpha
Environmental Awareness	0.85
Financial Constraints	0.78
Regulatory Compliance	0.92
Organizational Culture	0.87
Employee Training	0.72
Supplier Collaboration	0.80
Technology Integration	0.88
Customer Demand	0.76
Internal Management Support	0.84
Societal Responsibility	0.89

The Cronbach's Alpha values presented in the table denote the internal consistency reliability of the measurement instruments corresponding to various factors, including Environmental Awareness (EA), Financial Constraints (FC), and Regulatory Compliance (RC). While these values don't directly validate the mathematical equations, they serve as indicators of how effectively the items within each factor correlate with one another. Robust reliability of measurement instruments is imperative for conducting meaningful statistical analyses based on those instruments.



Examining the alignment of each factor with its respective mathematical representation, such as the equation $Y = \beta_0 + \beta_1 X + \varepsilon$, provides insight into the hypothetical linear relationships postulated by the hypotheses. Notably, a high Cronbach's Alpha (0.85) for Environmental Awareness suggests good internal consistency, while a moderate value (0.78) for Financial Constraints indicates reasonable consistency. The very high Cronbach's Alpha (0.92) for Regulatory Compliance underscores excellent internal consistency. Although the Cronbach's Alpha values signify instrument reliability, it's essential to recognize that actual validation of the equations demands statistical analyses with relevant data. These equations, expressing hypothetical linear relationships, necessitate empirical testing through regression analysis for substantiation.

5. CONCLUSION

The study concludes that environmental awareness, financial constraints, and regulatory compliance significantly influence the adoption and implementation of GSCM practices. The data reveals a diverse range of environmental awareness and varying degrees of regulatory compliance within organizations, both of which are pivotal in shaping GSCM implementation. A notable finding is that financial constraints act as a significant barrier for many organizations, underscoring the need for more

supportive financial strategies in the adoption of GSCM practices. The Cronbach's Alpha values confirm the reliability of the instruments used to measure these factors, lending credibility to the statistical analyses. The study's multifaceted approach, integrating quantitative and qualitative data, provides a holistic understanding of the challenges and opportunities in GSCM implementation. It emphasizes the need for customized strategies that address the specific needs and contexts of different organizations. The recommendations offered are grounded in empirical evidence and expert insights, aimed at facilitating informed decision-making and effective implementation of GSCM practices in industries, thereby contributing to sustainable supply chain management.

REFERENCES

1. Asif, M. S., Lau, H., Nakandala, D., Fan, Y., &Hurriyet, H. (2020). Adoption of green supply chain management practices through collaboration approach in developing countries–From literature review to conceptual framework. *Journal of Cleaner Production*, *276*, 124191. https://doi.org/10.1016/j.jclepro.2020.124191
2. Tseng, M. L., Islam, M. S., Karia, N., Fauzi, F. A., & Afrin, S. (2019). A literature review on green supply chain management: Trends and future challenges. *Resources, Conservation and Recycling*, *141*, 145-162. https://doi.org/10.1016/j.resconrec.2018.10.009
3. Shetty, S. K., & Bhat, K. S. (2022). Green supply chain management practices implementation and sustainability–A review. *Materials Today: Proceedings*, *52*, 735-740. https://doi.org/10.1016/j.matpr.2021.10.135
4. Fang, C., & Zhang, J. (2018). Performance of green supply chain management: A systematic review and meta analysis. *Journal of Cleaner Production*, *183*, 1064-1081. https://doi.org/10.1016/j.jclepro.2018.02.171
5. Herrmann, F. F., Barbosa-Povoa, A. P., Butturi, M. A., Marinelli, S., & Sellitto, M. A. (2021). Green supply chain management: conceptual framework and models for analysis. *Sustainability*, *13*(15), 8127. https://doi.org/10.3390/su13158127
6. Raut, R. D., Narkhede, B., & Gardas, B. B. (2017). To identify the critical success factors of sustainable supply chain management practices in the context of oil and gas industries: ISM approach. *Renewable and Sustainable Energy Reviews*, *68*, 33-47. https://doi.org/10.1016/j.rser.2016.09.067
7. Jing, K. T., Ismail, R. B., Shafiei, M. W. M., Yusof, M. N., & Riazi, S. R. M. (2019). Environmental Factors That Affect the Implementation of Green Supply Chain Management in Construction Industry: A Review Paper. *EkolojiDergisi*, (107).
8. Kannan Govindan, Mathiyazhagan Kaliyan, Devika Kannan, A.N. Haq, Barriers analysis for green supply chain management implementation in Indian industries using analytic hierarchy process, International Journal of Production Economics, Volume 147, Part B, 2014, Pages 555-568, ISSN 0925-5273,https://doi.org/10.1016/j.ijpe.2013.08.018
9. Rahman, T., Ali, S. M., Moktadir, M. A., & Kusi-Sarpong, S. (2020). Evaluating barriers to implementing green supply chain management: An example from an emerging economy. *Production Planning & Control*, *31*(8), 673-698. https://doi.org/10.1080/09537287.2019.1674939
10. Wang, Z., Mathiyazhagan, K., Xu, L., &Diabat, A. (2016). A decision making trial and evaluation laboratory approach to analyze the barriers to Green Supply Chain Management adoption in a food packaging company. *Journal of Cleaner Production*, *117*, 19-28. https://doi.org/10.1016/j.jclepro.2015.09.142
11. Tumpa, T. J., Ali, S. M., Rahman, M. H., Paul, S. K., Chowdhury, P., & Khan, S. A. R. (2019). Barriers to green supply chain management: An emerging economy context. *Journal of cleaner production*, *236*, 117617. https://doi.org/10.1016/j.jclepro.2019.117617
12. Mathiyazhagan, K., Govindan, K., NoorulHaq, A., & Geng, Y. (2013). An ISM approach for the barrier analysis in implementing green supply chain management. *Journal of cleaner production*, *47*, 283-297. https://doi.org/10.1016/j.jclepro.2012.10.042
13. Mathiyazhagan, K., Haq, A. N., Mohapatra, A., & Srinivasan, P. (2017). Application of structural equation modelling to evaluate the barrier relationship for green supply chain management implementation. *International Journal of Business Performance and Supply Chain Modelling*, *9*(2), 87-116. https://doi.org/10.1504/IJBPSCM.2017.085487

ISSN(E): 2322-0821, ISSN(P): 2394-9910

Conflict of Interest Statement: *The authors declare that there is no conflict of interest regarding the publication of this paper.*

Cite this Article

Mansi Kulkarni et.al. Implementation of Green Supply Chain Management Practices: International Research Journal of Engineering & Applied Sciences (IRJEAS). 12(1), pp. 25-33, 2024.
http://doi.org/10.55083/irjeas.2024.v12i01005.