

Leveraging Green Supply Chain Management

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Abstract – Green supply chain is the management of resources from vendors to manufacturers or service providers to customers and back with consideration of the natural environment in the most conscientious ways. Reducing environmental risk and increasing profitability are critical factors, and green supply chain management (GSCM) practices help organizations achieve that. Environmental consideration must be integrated into supply chain management practices and research. Adopting green supply chain practices may help enhance return on investment, reduce cost, improve sales, and improve corporate performance. The word green and sustainability are often used interchangeably and in a similar context, but there is a difference between the two. Green ensures products or services that reduce health and environmental aspects. Sustainability is a broader concept and takes care of social and financial aspects. During data analysis, three main themes emerged: (a) supply chain constraints, (b) changes in the operational supply chain model, and (c) change management. Seven key strategies were also developed pertaining to these three themes. Researchers and industry Practioner can utilize these themes and strategies to identify constraints, risks, and issues in the current system and work towards a green supply chain integrated ecosystem.

Index Terms – Green Supply Chain, Digitalization, Sustainability, Environment, KPIs.

I. INTRODUCTION

Green supply chain management (GSCM) integrates environmental thinking into traditional supply-chain management, including reducing, recycling, reusing, and substituting materials (Yan et al., 2016). Sustainable and green supply chain words are often used interchangeably, but there is a difference between the two. Green product is defined as "products and services that reduce health and environmental impacts compared to similar products and services used for the same purpose. On the other hand, sustainability can be represented by three pillars environmental, social, and financial responsibility. 40% of global supply chain emissions are due to the industrial supply chain. The supply chain organization of any company is responsible for more than 90% of its greenhouse emissions (GHG). It prompts them to minimize environmental impact by making their process more sustainable. It also prompts them to participate in global efforts to mitigate climate change. GSCM incorporates the principle of 4R1D (reduce, reuse, recycle, reclaim, and degradable) from manufacturing to operations to end-of-life management. Reduce principle is all about saving resources, reducing energy consumption, reducing emissions and waste, and reducing costs. Reusing is about designing a scheme to use again when material, technology, and recycling management are feasible. Sometimes reuse is impossible; in that case, the recycling principle can be used to obtain new usable substances and generate new value through recycling technologies. The recover principle is about regaining new values obtained again by incineration. The degraded principle helps erode the natural environment, so they do not pollute the natural ecological environment. It is helpful if the earlier three principles, reuse, recycle, and reclaim, are not feasible.

Businesses face two significant challenges responsible for the need for people's interest in GCSM. First is the standardization of the practices, and the second is the lack of a self-regulatory environment (Rupa & Saif, 2022). The supply chain's efficiency depends not only on the speed and reliability of operations but also on sustainability (shashi, 2022). A non-green supply chain will impact investment decisions by its current and future potential investors. A business with a green supply chain is a beneficial and attractive prospect for any other company looking to partner with it (Carter & Rogers, 2008). Another significant development is using electric vehicles (EVs) in transportation instead of traditional fossil fuel-based fleet. It helps in reducing carbon emissions and improves maintenance costs per delivery. Most manufacturing industries are also selecting suppliers with a proven track of using green supply chain practices at their facilities. This factor has become a critical metric in supplier selection criteria.

The aim of our study was to provide proven strategies to business practitioners on GSCM best practices. It will help them to explore various facets of environmental sustainability and regulation and promote compliance with GSCM standards in their organizations. Implementing GSCM strategies will also lead them toward competitive advantages. On the social front, implementing GSCM strategies will help communities to have a healthier natural environment.

II. PROBLEM STATEMENT

70% of business executives reported that they need to implement green supply chain management (GSCM) strategies into their operational initiatives (Geng et al., 2017). Reducing solid and effluent waste, air emissions, and consuming toxic materials are some of the expected results of implementing GSCM (Nishitani et al., 2016). The general business problem is that some business managers need to learn about GSCM. The specific business problem is that some business managers need GSCM strategies to improve business processes to minimize negative ecological impact.

III. RESEARCH METHODOLOGY

A multidisciplinary systemic review is conducted by reviewing various literature on sustainability and its applications in the supply chain. In this approach, we selected research articles from different sustainability disciplines and then looked from our perspectives at the utility and advantages of supply chain applications. The advantage of this methodology is that each aspect can be analyzed in detail, which is often required to answer complex research-related questions.

IV. LITERATURE REVIEW

Based on the implementation of GSCM practices, there are three types of companies, early adopters, followers, and laggards (Zhu et al., 2012a). The early adopters of green innovations will gain advantages such as a good corporate reputation and image, new customers and market shares, and competitive advantage (Carvalho et al., 2017). Fig.1 depicts the nine factors affecting the organizational intent to adopt green supply chain management (Maqsood et al., 2022). These factors are environmental, governmental, organizational, customer, supplier, economical, marketing, operational, and clean innovation technology (CIT).

The term “environment” refers to an enterprise’s overall responsibility for its long-term viability. Environment-friendly efforts across an enterprise’s GSCM may help the enterprise to enhance its environmental performance and green innovation (Wang et al., 2021). As per McKinsey's research, the supply chain is the reason for 90% of companies' environmental impact. The toxic chemicals used in production processes severely threaten the environment and sustainability (Shashi, 2022). A significant amount of waste is generated, which is hard to dispose of. Process manufacturing industries also heavily rely on a large volume of water for formulation processes, production, and cleaning, ultimately impacting the environment. Adopting the environmental factor must be included in strategic planning from top to bottom to achieve success and sustainable production (Maqsood et al., 2022).

Government factors also impact organizational intention to adopt green supply chain methodology. Governments are under immense pressure to enact legislation to curb these impacts. These restrictions, which include controlling greenhouse gas emissions, more specifically carbon dioxide (CO2), are becoming a growing interest. Companies are urged to incorporate these issues into supply chain management schemes (Zahiri et al., 2017). In many countries, the government subsidizes organizations that follow the green supply chain process. It also includes providing renewable energy and equipment at a subsidized rate.

Organizational factors also play a significant role in green supply chain implementation. A successful organization must set specific, time-bound goals for its corporate green supply chain initiatives. Sometimes they need to stretch their goals and connect their goals to their business strategies. Internal and external support from the bottom up and top down is also critical to achieving sustainability goals.

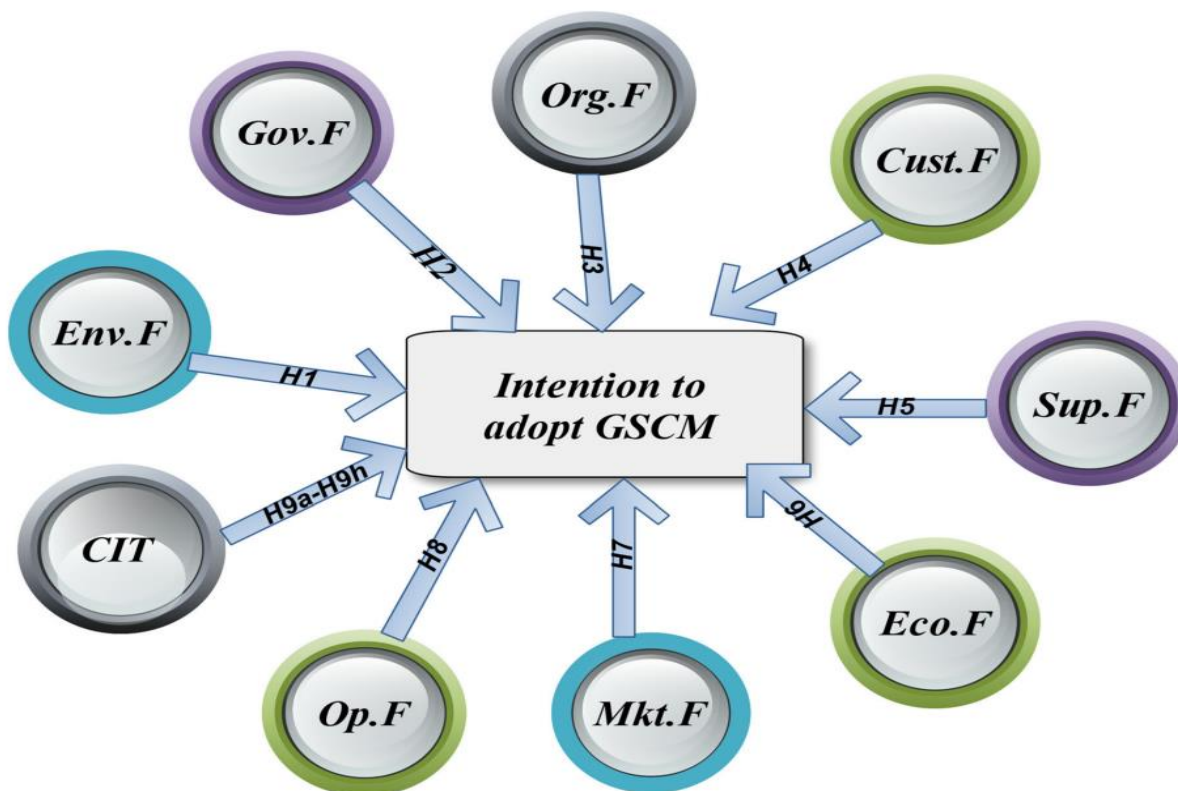


Fig. 1 Factors affecting the intention to adopt GSCM (source: Maqsood et al., 2022).

Customer satisfaction has emerged as a critical component in business strategy because higher levels of customer satisfaction are associated with increased customer loyalty, which may result in increased profits for the enterprise (Bowen & Chen, 2001). End customers demand eco-friendly products and services that do not damage the environment (Green et al., 2019). The demand from intermediate and end customers pushes manufacturers to rebuild or modify their operations (Shashi, 2022). The supplier-related factor is another crucial element to influence the green supply chain. The supplier's participation in GSCM implementation practices is positively significant since the supplier is responsible for environmental standards in material management, processes, and buying strategies (Lee et al., 2018). Green supplier collaboration influences enterprises' performance under specific conditions (Feng et al., 2020).

The economic factor helps to increase an enterprise's profit, reduce its extra costs, and influence the mitigation of the industrial climate in some countries (Wang & Feng, 2019). Organizations that adopt green supply chains are more efficient and generate more profits than organizations that do not follow sustainability principles. Organizations using GSCM formulate marketing strategies. An enterprise's operations are the "management of systems and procedures involved in manufacturing goods" (Chen et al., 2012). The GSCM practices enhance performance factors of operational factors. Clean, innovative technology (CIT) helps sustain production, consumption, and efficiency. Improves the enterprise's performance and produces new products to enhance sustainable production and consumption (Seman et al., 2019). According to several studies, CIT has been related to sustainable production, consumption, and enterprise performance (Zhou et al., 2021; Zhang et al., 2022).

Packaging has long been perceived as a waste-generating process and environmental concern to municipalities, governments, and consumers ((Jestratijevic et al., 2022). As per one survey, 75% of consumers are willing to pay for sustainable packaging. Many big brands now focus on eco-friendly packaging. It's also important to build traceability into the supply chain and ensure it's a focus for packaging partners. It allows the collection, consolidation, and share data that proves organizational sustainability credentials.

V. FINDINGS OF THE RESEARCH

During data analysis, three main themes emerged: (a) supply chain constraints, (b) changes in the business operational supply chain model, and (c) change management. Seven key strategies were developed pertaining to these three themes. These are discussed in detail in the following sections.

Theme 1: Constraints in the existing supply chain processes

Identifying all known or unknown constraints must be part of an existing supply chain system analysis. It requires a thorough analysis of all nodes of the supply chain system.

The following two key strategies emerged pertain to the first theme:

1. Work through identified constraints

A few of the significant constraints that supply chain leaders counters are (a) Third-party manufacturers (contract manufacturing), (b) Special packaging requirements, (c) over-relying on single-sourcing vendors for raw materials and not improving continuity of supply by shifting to multiple suppliers globally, (d) Linear system (non-digitalized system), and (e) government and organizational policy. Based on all the constraints, companies need to develop their vision to implement various measures to counter them.

2. Develop a vision and goal for green supply chain commitments:

Organizations must establish and connect their business goals with united nations sustainability goals. Business processes are generally complex, and the manual process is still prevalent in many supply chain functional areas, including logistics and manufacturing. Leaders must develop their vision to implement green supply chain strategies by thoroughly understanding the current technological trends based on their business requirements. Making a sustainability commitment goal to the public helps organizations establish more connections to stakeholders pertaining to their contribution to society.

Theme 2: Changes in the business operational supply chain model

The second theme that emerged was the need for a modified business model to work through the sustainability issue mapped in each stage of the current supply chain. The sustainability team in an organization can be internal (and owned by the company) or external (outsourced or NGOs. These teams are provided with a specific task in sustainability that pertains to particular problem areas such as logistics (efficient transport, repackaging, fuels), sourcing, and environmentally responsible procurement activities. They are also assigned to evaluate financial benefits based on all sustainability-related measures. External agencies can create and communicate a uniform code of sustainable action industry-wide.

The following three key strategies emerged pertain to the second theme:

1. Digitalization:

Organizations have already acknowledged the significant impacts of innovative digital technologies as enablers of sustainable initiatives and for improving supply chain performances (Fuchs, 2008). Digital enablers, such as blockchain, can help track and trace whether products are environmentally produced and shipped (Anna, 2020). Blockchain traceability can also help determine social sustainability aspects if fair and safe work practices are followed and human rights are not violated in producing the products and services.

Supply chain organizations must digitize supply chain indicators instead of just keeping them in manual format and then apply digital enablers to harness the benefits (shashi, 2022). Digital tools like augmented reality are used for better workforce engagement and machine learning for identifying sustainability risks. As per Gartner, digital enablers enhance visibility, digitalization, and collaborations required for progressing the evaluation of sustainability programs in organizations. Digital analytical capabilities, including machine learning (ML) and predictive analytics of organizations, can help transform data into insights. An intelligent and informed decision can be taken to monitor sustainability-related metrics. Digitalization may provide opportunities for organizations to work with stakeholders and build trust by sharing information pertaining to broader sustainability strategies (shashi, 2022).

2. Multiple sourcing and establishing a supplier code of conduct:

Preferred vendors must follow sustainability norms, a critical vendor selection criteria for any organization. Depending on and over-relying on a single source of supply can result in shortages, delays, and reputation damages. Companies must diversify their supplier lists in different geographies. Organizations must develop a strategic partnership with external vendors with a vision and proven expertise toward a sustainable business. A supplier code of conduct is a significant and critical step in communicating and establishing expectations in the company's sustainability effort.

Some of the best sourcing practices are defined as under:

- A. During pre-qualification of the supplier, make suppliers undertake independent environmental certification mandatory.
- B. Build environmental criteria into supplier contract conditions
- C. Regular audit of suppliers for environmental performance and assessments

3. Innovation in packaging materials

A package is the “face” of a product and often represents the only product exposure consumers experience before purchase (Jestratičević et al., 2022). Many companies do have stringent regulations regarding the safety of the packaging. Packaging must be temper resistant and, unlike other industries, meant for single use. Reusing or refilling is not possible in some industries, such as pharmaceuticals. Companies must work towards innovating packaging material instead of using single-use conventional blister packaging. Recent innovations happened in developing polyolefin laminate as an alternative packaging material 70% recyclable and may lower the packaging-associated cost by 60% [15]. There is also innovation around bioplastic derived from renewable plant-based biodegradable sources and bio base effervescent tablet packaging derived from corn and sugarcane [15]. Packaging waste represents a significant part of the municipal solid waste stream, causing considerable environmental concerns (United States Environmental Protection Agency, 2018). According to the United States Environmental Protection Agency (2018) report, packaging waste in the United States accounted for 82.2 million tons, or 28% of the total waste generated, in 2018 (Jestratičević et al., 2022).

Theme 3: Establishing robust change management processes

The third theme that emerged during the data analysis was developing change management capabilities for green supply chain-related processes. It will help in many things, such as training internal and external stakeholders, sustainability-related communications, and acquiring a certification, such as ISO 14001. This certification will also help organizations achieve managerial, economic, and environmental advantages.

The following two key strategies emerged pertain to the third theme:

1. Establish the center of excellence (COE) for green supply chain management:

Center of Excellence (COE) can help improve green supply chain practices. It will also help in behavioral changing of all partners of the supply chain ecosystem towards sustainability. COE can also help any organization acquire ISO 14001 certification and offers significant economic benefits to multinational organizations, such as operational efficiency, worldwide recognition of product/brand, marketing advantages, enhanced competitiveness, and better waste management resulting in cost reduction (Cherrafi et al., 2016). COE can establish best practice resources industry-wide and not limited to their domain only. Regular training by COE must be conducted for their employees, suppliers, and external partners. COE may collaborate with external organizations and must attend sustainability summits to bring different perspectives. It will help organizations to optimize sustainability for the entire supply chain ecosystem.

2. Develop the key performance indexes (KPIs) to monitor sustainability performances:

Establishing baseline metrics helps organizations assess the improvement need and serves as a starting point. Collecting supplier data through self-assessment of compliance standards may provide a starting point for the vendor's sustainability capability (shashi, 2022). Their performances must match the supplier code of conduct discussed in the previous strategy. Most industries have already developed industry-wide surveys to reduce the burden on suppliers of responding to multiple requests for information which varies in format and content by each company (Wollmuth, 2014). The suppliers and other external partners also need regular feedback regarding their help in the organization's sustainability effort. They must be engaged constructively, and any additional action must be encouraged. Retaining existing suppliers or providing more business to suppliers with strong sustainability performances can drive continuous improvement and increase efficiencies in the supply chain. A digitalized sustainability dashboard can ensure all critical sustainability metrics and actionable items for the organizations. The dashboard may provide visibility to all the stakeholders in the organization.

VI. CONCLUSIONS

This study aimed to explore GSCM strategies that supply chain managers use to gain competitive advantages over others. Three themes emerged, and seven strategies emerged from data analysis. A factor that determines the success of corporate sustainability management is the ability to incorporate environmental sustainability into the organization's vision and activities (Dayan et al., 2017). Adopting GSCM practices may improve corporate economic performance, such as reducing product cost, improving sales, and enhancing return on investment (Younis et al., 2019). Business managers can apply GSCM strategies to improve environmental performance, reduce waste, save costs, and improve their competitive advantage (Daddiet al., 2016). Enterprises can save costs by complete processing, replacing, reprocessing, or recycling manufacturing inputs (Govindan et al., 2015). Using renewable energy, recycling, and sustainable packaging are all part of organizational core strategies now. Green supply chain performance is now part of corporate performance also. As per Gartner's research, a green supply chain has impacts that span the entire value chain — from plan to source, make, and deliver to the service domain. Achieving green supply chain goals is a prized asset, and businesses that understand how to make that work will be able to bring investors, regulators, and consumers on their side.

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