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Original Article

Green Supply Chain Management- Paving Paths To Sustainbility

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Abstract

As the effects of environmental problems such as global warming, ozone layer depletion, pollution on the living conditions of the world's population become more apparent, an emphasis on environmental awareness has become more prominent. The general public has started to pay more attention to the potential consequences of this global environmental problem. Energy and environmental concerns are intricately linked to the supply chains of various goods. Increased public awareness of such concerns is reflected in the contemporary business environment as well as in government legislation. The green supply chain is a new trend in industrial development. Because of various legislation such as restriction of hazardous substances, waste electrical and electronic equipment, and eco-design of energy using products. While global warming has become an urgent issue, educating the general public how to achieve a green environment is essential. In addition, it is not only essential to produce a green product or just manage and control the whole supply chain under the required green guidelines, but it is also obligatory to treat the used materials and products properly.

***keywords**: Prominent, Reflected, Hazardous, Global, Equipment*

Information

The manufacturing sector, along with other sectors like construction and agriculture, has caused global warming and ecological disasters because of faster economic activities and improved living conditions. This has led to a growing concern for environmental sustainability, with green supply chain management (GSCM) being considered as a solution. The concept of GSCM is one of the latest innovations to improve the capabilities of supply chain management. Green supply chain management is defined as "the process of using environmentally friendly inputs and transforming these inputs into outputs that can be reclaimed and re-used at the end of their life cycle thus, creating a sustainable supply chain. A fundamental principle of green supply chains is reducing waste and overall energy use. The aim of GSCM is to find a balance between economic and environmental activities. The concept of GSCM evolved in the early 1990s when environmental issues became a burning question around the globe. It emphasizes how green practices can be adopted in firms to mitigate the environmental degradations and increase the economic and operational performance of firms, Integrating environmental thinking into supply chain management, including ecological design of products, purchasing green materials and components, reengineering of manufacturing steps towards eco - friendly, reverse logistics management of the product after its useful life. These practices are expected to reduce air emissions, solid wastes, effluent waste, and other toxic tangible or intangible materials in manufacturing industries. The research paper highlight the practices of GSCM and Challenges in implementation of concept in full fledge manner.

Objectives

1. To identify the benefits and challenges associated with the adoption and implementation of green supply chain initiatives
2. To analyze the various strategies employed by organizations to integrate environmental sustainability into their supply chain operations.

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Methodology

As this research is a descriptive study, the methodology was constructed based on review of the literature and the source of data is secondary source. The necessary secondary data was collected from various websites including those of Government of India, magazines, journals, other publications, etc.

Strategies adopts in Green supply chain management

1. Green Product Design

Green product design, also known as sustainable design, is the practice of creating products which have minimal environmental impact and a focus on long-term ecological and social well-being. It reduces their negative impact on the environment and human health while increasing opportunities for product reuse and recyclability. By implementing product design for sustainability, companies can reduce waste, optimize energy consumption, and improve product longevity. In a world where resources are finite, businesses must rethink their design strategies to create products that not only meet functional and aesthetic needs but also contribute to global sustainability efforts. Key aspects of green product Design include**:**

Energy Efficiency: Designing products that consume less energy during production and usage to lower carbon emissions and operating costs.

Durability and Longevity: Creating products that last longer, reducing resource consumption and minimizing waste.

Modular and Repairable Design: Allowing for easy repairs and upgrades to extend a product's lifespan and encourage circular economy principles.

End-of-Life Considerations: Ensuring recyclability, biodegradability, and responsible disposal to prevent landfill waste and encourage resource recovery.

2. Green material sourcing/Procurement

Green /Sustainable procurement is the process of sustainably sourcing goods and services, taking into account not only cost and quality but also environmental, social, and governance (ESG) considerations. It involves considering the entire lifecycle of a product, from sourcing raw materials to disposal, and prioritizing suppliers who demonstrate a commitment to sustainability.

3. **Green Manufacturing**

Green manufacturing, also called sustainable manufacturing or green production, is the production of goods in an environmentally and socially responsible manner. Green manufacturing minimizes negative environmental impacts while conserving energy and natural resources. This includes efforts to eliminate manufacturing waste sent to landfills, reduce water consumption, and integrate renewable energy sources to meet factory demands. Its aim to achieve net-zero or zero-carbon manufacturing, in which operations do not contribute to greenhouse gas emissions in the atmosphere. Green manufacturing practices include using technology to maximize operational efficiency, using renewable energy sources, sourcing sustainable materials, and protecting natural areas and ecosystems. Such environmentally friendly practices not only improve manufacturing sustainability but also provide business benefits such as cost savings, regulatory compliance, improved reputation and greater safety for both consumers and employees. Sustainable manufacturing is a forward-thinking process that aligns with global efforts to ensure a healthier planet for future generations.

4. **Green marketing**

Green marketing, also known as environmental or sustainable marketing, involves the promotion of products and services which are safe for the environment Companies adopting green marketing highlights their commitment to environment conservation. This approach helps in differentiating their brand and build a positive public image by aligning business practices with global sustainability efforts. Green marketing includes promoting practices like creating environmentally sustainable products, packaging, and incorporating overall environmentally friendly practices in the entire product lifecycle, from sourcing to delivering to the customer. They try to use less plastic, save energy, and create less waste. They also make sure their products are safe for nature and people. For example, a company might use recycled paper for packaging instead of plastic. Some brands make shoes from old plastic bottles.

5. Green distribution and warehousing

Green distribution, also known as sustainable logistics, refers to the practice of minimizing the environmental impact of moving and storing goods. it involves all practices that reduce carbon dioxide, are economically viable and will bring about a better quality of life for the earth's future inhabitants. Green distribution practices range from changing the way distribution centres and vehicles are powered to implementing greater transparency regarding the environment and distribution practices.

6. Green transportation

Greening transportation refers to the methods a business adopts to ensure that its vehicles and other modes of transportation are environmentally friendly. To go green, transportation choices made by businesses range

from replacing their existing fleet with electric vehicles and introducing bio-fuels to using technology to optimize routes. Green transportation comes under the larger purview of green logistics that extends to other carbon-neutral practices - such as eco-conscious procurement, investing in green technology, optimising energy consumption, and other measures implemented - to reduce the ecological impact of storage, transportation, and distribution of goods and services.

7. Reverse logistics

This comprises of moving goods from consumers back to the manufacturer for reuse, recycling, or proper disposal. This practice reduces waste, recaptures value and promotes a circular economy by extending the lifecycle of products and components.

Principles of Green Supply Chain Management

- **Reduce**: It focus on Reduce waste and resource consumption. This includes optimizing packaging, using energy-efficient technologies, and reducing transportation distances.
- **Reuse:** Find a way of using material again instead of discarding it at one use.
- **Recycling:** Start recycling programs so as to manage waste effectively internally and externally
- **Recovery:** Getting valuable materials from waste which cannot be recycled or reused.
- **Degradable:** Products must be degradable; hence, they are easy to dispose of or break down.

Benefits of GSCM

1. Reduced Environmental Impact

GSCM greatly reduces carbon emissions, waste, and consumption of natural sources and entails the use of environmentally friendly practices in supply chain activities. Measures like embracing clean energy, utilizing environmentally friendly materials, and selecting efficient logistics help create a better world and make companies relevant to the United Nations Sustainable Development Programme.

2. Cost Savings

When GSCM is put into practice, organizations can experience significant cost savings since energy use, waste as well as resources are optimized. For instance, energy-efficient operations will reduce utility expenses, waste reduction will also reduce the expenses incurred in disposal. Further, the use of long-lasting and reusable materials in manufacturing helps in cutting long-run procurement costs, which is good for the environment and the firm's financial health.

3. Enhanced Brand Reputation

Pursuing sustainable supply chain management improves the company's brand reputation since consumers are increasingly concerned with sustainability. GSCM can be used to showcase a company's environmentally friendly image hence attracting customers who are environmentally sensitive and improving on customer loyalty. It also enhances a competitive standpoint in industries that seek a corporate green image.

4. Improved Risk Management

GSCM assists a business organization in managing risks in environmental legal requirements, supply chain breakdowns, and scarcity of resources. Hence, by actively following environmental standards and looking for a variety of sources, the companies minimize penalties for violations of standards and also guarantee the stability of the supply chain in terms of work continuity in extreme conditions.

5. Increased Innovation

Sustainability is always a key driver of change, and this is why we see that green practices lead to innovation. For instance, principles of eco-design call for developing reusable and low-energy products, and green logistics call for innovations in fuel-efficient vehicles. All these innovations not only support the concept of sustainability but also create new market segments and stimulate sustainable development.

6. Knowledge Sharing

GSCM encourages the sharing of advanced technologies and practices among supply chain partners, improving overall performance

Challenges in Implementations of Green Supply Chain Management Practices

1. Lack of customer's awareness

Limited awareness about the benefits of GSCM can hinder its adoption. Due to lack of awareness consumers are not willing to pay a premium price for eco-friendly products.

2. Lack of appropriate technology

Inadequate infrastructure for recycling, waste management, and renewable energy can hinder GSCM implementation.

3. Lack skills

There is lack of trained and experienced staff who have knowledge of each and every aspect of GSCM and who is perfect in each activity in whole process.

4. Lack of top level management commitment

Without strong leadership support, GSCM initiatives may struggle to gain traction. management may perceive sustainable practices as reducing productivity or even as adding extra layers of work.

5. Cost of Implementation

Implementing GSCM practices often requires significant upfront investment in new technologies, eco-friendly materials, and infrastructure. Sourcing green materials, implementing new technologies, and managing waste can increase operational expenses. For small and medium-sized enterprises (SMEs), these costs can be particularly burdensome, deterring them from pursuing sustainable initiatives.

6. Resistance to technology adoption

Implementing GSCM may require significant changes to existing processes and operations, leading to resistance from employees. people practicing the old supply chain management might look at the change as disruptive and unnecessary as they will feel that they will be overworked or that their jobs are at risk

7. Lack of clear Standards

To achieve the goals in implementing GSCM one has to assess and monitor the level of progress and results achieved, however, it is not easy since there are no clear indicators and yardsticks to work with. It may be challenging for organizations to identify the effectiveness of sustainability initiatives or the concordance with best practices.

GSCM- Indian perspective

A large number of Indian companies are following the concept of GSCM in order to conserve the environment and attaining the sustainability as a part of their corporate social responsibility (CSR). Some of which are explained following:

1. Tata Consultancy Services

TCS is committed to use environment friendly components in all its processes. Starting from the infrastructure, TCS has increased the usage of renewable energy in its offices. As of 2012- 13 data the solar water capacity is around 86,600 litres per day which is an increase of 55% from the previous year's figures. The company is also focusing on green procurement from its suppliers. It has given emphasis on procuring energy star rated equipment. The company has initiated various drives and internal communications among its employees regarding energy saving benefits. Some of the fundamental things like switching off the computers at the end of the day, minimizing the usage of lights to more technical like installing variable frequency drives. With the implementation of rain water harvesting, sewage treatment plants and other water management techniques TCS is able to reduce the use of fresh water by over 13% as compared to 2008 figures. A major challenge for all the IT majors is the issue of e-waste. The defunct/ obsolete computers are being legally disposed-off through government authorized recyclers. Promotion of video conferencing is done in all the TCS facilities to reduce the travelling of employees to client locations through automobiles, thus reducing the greenhouse gas emission.

2. State Bank of India

"Green channel counter", a first of its kind initiative by SBI bank, has given a new dimension to paperless banking. An account holder can transfer fund, withdraw money and even deposit money to another account without filling any physical forms. A mere swipe of card can do all these transactions. The bank has also launched solar powered ATM machines in remote areas which not only help in extending their customer base but reduces the power consumption by 1000 watts as compared to the conventional ATM machines.

3. Dr Reddy's

Pharmaceutical industry in India is facing a lot of heat from consumers as well as from regulators to reduce the environmental impact of its actions. In this scenario the supply chain of pharmaceutical companies has come under a lot of scanner. Dr. Reddy's is one such company that gives emphasis on sustainable sourcing. They have initiated a process of interaction with all the business partners known as "mentoring" in which all the stakeholders are guided about following good sustainable practices. The company also focuses on periodical training on quality to all its vendors especially for those who have recently become business partners. These kinds of half-yearly activities help the company to convey to all its partners their business processes and culture

4. India Tobacco Company Limited

ITC is a much diversified business house, ranging from FMCG to hotels, paper and packaging to agribusiness and so on. With an annual turnover of about $8 billion it is a part of the famed Forbes 2000 list. The company is leading by example in many green initiatives some of being the use ECF (Elemental Chlorine Free) technology, Ozone bleaching, energy and water management techniques and recently incepted the green boiler mechanism. By implementing the mentioned green techniques the company is able to reduce its dependence on fossil fuels like coal by over 100000 tons per annum. The recycling of waste materials has helped ITC to manufacture paperboards for packaging purposes. Through the use of e-choupals, ITC has built a significant advantage in raw material sustainability and thus is reaping benefits out of it. The company has therefore become a frontrunner in Green management initiatives and is committed to reduce carbon footprints.

Conclusion

Green Supply Chain Management is a pivotal component of sustainable business practices in present era. It integrates environmental responsibility into every aspect of the supply chain, from sourcing raw materials to product disposal. As environmental concerns continue to grow, businesses that prioritize GSCM will not only reduce their environmental impact but also gain a competitive advantage in the marketplace. By adopting strategies such as eco-design, reverse logistics, and green procurement, companies can build a more sustainable supply chain that meets both regulatory requirements and consumer demand for eco-friendly products. However, the successful implementation of GSCM requires overcoming challenges such as high initial costs, complexity, and resistance to change. But to make a sustainable future all companies must recognize the significance of GMCS and tries to overcomes the barriers in implementations. Government and legislative authorities should make guidelines and set a standard for GSCM, and should be committed towards green and sustainable future

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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