Management of Green Supply Chain: Need of Hours

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ABSTRACT
In present time due to fast industrialization the environment is being degraded by human activity. Environmental pollution is the main problem due to emission of toxic gases from the industries. As a result environmental issues particularly global warming attracting considerable attention and become more intense and widespread. The waste and emissions caused by industries and their supply chain are on eye of the consumer. The trend toward green or environmentally friendly, business practices are permeating about every industry and, at a more granular level. Globally companies and individuals are growing more and more environmentally aware. The demand for environmentally friendly products has increased over the years by consumers. To overcome this problem and to reduce environmental pollution, the manufacturing industries should include Green concepts in to supply chain. This has resulted in a growing need for integrating environmentally thinking into supply chain management processes. The purpose of the paper is to provide an overview of concept, benefits, barriers, practices of the GrSCM and the reasons why organizations should adopt for a green supply chain.

Index Terms: GrSCM, Green Supply Chain Initiatives, Green Supply Chain, Drivers, Reverse logistics, Green operations.

I. INTRODUCTION

1.1 Supply Chain Environmental issue in supply chain
Supply chain involves the movement of materials as they flow from their source to the end customer. Supply Chain includes purchasing, manufacturing, warehousing, transportation, customer service; demand planning, supply planning and Supply Chain management. It is made up of the people, activities, information and resources involved in moving a product from its supplier to customer. In sophisticated supply chain systems, used products may re-enter the supply chain at any point where residual value is recyclable.

Environmental issue in supply chain -
According to the London-based Committee on Climate Change (CCC) global greenhouse gas emissions must be reduced to under 50 percent of 2007 levels in order to keep the increase in average temperature within 2°C by 2050. This will require societies worldwide to develop patterns of consumption that emit 50-to-80 percent less CO2 than today. The role of business is central in CO2 emission reduction initiatives and key to the decarbonisation of societal consumption. Efforts to reduce greenhouse gas emissions, other pollutants, and waste within supply chains have been occurring in earnest since the late 1980s. (Paul Hoskin). Some of the key environmental issues in supply chain is:-
- Ozone depletion.
- Emissions greenhouse gas (GHG).
- Solid Waste.
- Water conservation.
- Sewage of Toxics liquid.
- Global warming.
- Various pollutions like-water, noise, air.

1.1 Defining Supply Chain Management
Integrating environment thinking into supply chain management, including-Product design, Material sourcing and selection, Manufacturing processes, Delivery of the final product to the consumers, End-of-life management of the product after its useful life. Green Supply Chain Management (GSCM) 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 lifecycle thus, creating a sustainable supply chain”. From cost compliance to value creation. An environmentally friendly supply chain, called a green supply chain. Green supply chains management will aims at confining the wastes within the supply chain system in order to conserve energy and prevent the release of dangerous materials into the environment. Green Supply Chain is a term used to describe a supply chain oriented for improved performance in measures of sustainability, cost reduction, emission reduction through the measure of the carbon footprint, and other metrics. The understanding of Green Supply Chains is driven by a change in perception from socially responsible behavior as a cost center, to an understanding of how socially and environmentally friendly practices can become value adding activities for a company.
The main components of GrSCM are Green procurement, Green manufacturing and Green distribution, and Implementation of the green policies. Supply chain management and environmental supply chain management is the base point of GrSCM (Lamming and Hampson 1996). The regulatory requirements and consumer pressures are driving GrSCM. Hence, the scope of GrSCM ranges from reactive monitoring of the general environment management programmes to more proactive practices implemented through various Reduce, Re-use, Rework, Refurbish, Reclaim, Recycle, Remanufacture, Reverse logistics, etc.

Green supply chain analysis provides an opportunity to review processes, materials, and operational concepts. As with continuous improvement programs, green supply chain analysis targets: Wasted material, Wasted energy or effort, and Under-utilized resources.

1.2 Green Supply Chain Framework

This simplifies framework is based on the detailed framework explaining each of parameter and process of green supply chain. This detailed framework summarizes various processes of green supply chain and provides an overview of migration strategy and continuous improvement. In this framework the key to extracting business value lies in establishing a long-term green supply chain strategy that is aligned with corporate strategy and approached top-down – with strong sponsorship. It also requires a strong business case for the green supply chain that highlights a prioritized list of targeted opportunities and a phased adoption roadmap. Finally, the initiatives need to be integrated with other companywide projects to ensure that one does not compromise another.

In order to effectively implement a Green Supply Chain, the strategy should be embedded in the company’s Supply Chain and Operations organization, as well as part of Marketing and Sales. Corporate Communications should be linked with sustainability initiatives to ensure that the impact of the initiative is being communicated to customers, shareholders, and the general public. Green supply chain analysis provides an opportunity to review processes, materials, and operational concepts. As with continuous improvement programs, green supply chain analysis targets: Wasted material, wasted energy or effort, Under-utilized resources.

1.3 Conventional supply chain vs green supply chain

Conventional and green chains differ in several ways. First, conventional chains usually focus on economic objectives and values of the organization. In addition, it often concentrate more on controlling the final product, while neglecting the negative effects that occur during the production process. In conventional chains, the buyer and supplier selection criteria are the predominant standard is price. In traditional supply includes High ecological impacts, Price switching suppliers quickly, Short-term relationships, High cost pressure & Low prices, High speed and flexibility.

On the other hand, green chains significantly consider the ecological causes. In green chains, ecological objective is a part of the supplier selection criteria (Johnny et al., 2009). Green supply chain integrate, in addition to human toxicological effects, the ecologically negative effects on the natural environment, as well as the entire value-adding process, resulting in low ecological impacts during production. Accordingly, ecological considerations are key criteria during production in organizations that adopt a green supply chain, while assuring competitiveness, profitability, and economic sustainability. GrSCM includes, Economic and ecological, Integrated approach, Low ecological impacts, Ecological aspects (and price), Long-term relationships, High cost pressure, High prices, Low speed and flexibility. The following table illustrates the fundamental differences between conventional and green supply chain management.
Green supply chain management is thus the integration of environmental management into supply chain management. **Green supply chains management** will aims at confining the wastes within the supply chain system in order to conserve energy and prevent the release of dangerous materials into the environment.

### II. REVIEW OF LITERATURE

Literature review takes into consideration the broader concept of sustainable development and outlines how and why companies should be concerned with environmental and social issues in supply chain. Common benefits of GSCM in achieving sustainability are enhanced value for customers, cost reduction, increased operational efficiency and competitive advantage. The current trend in recent literature also indicates that a more cooperative model of SCM favors the environmental and social dimensions.

Managing supply chains gained notoriety in practice as evidenced by management and engineering literature in the early 20th century (Svensson, 2001). Some of the initial best practices of modern supply chains, such as lean and just-in-time (JIT) manufacturing can be traced to Henry Ford’s efforts to vertically integrate the automotive supply chain and organizational practices. Life-cycle analysis was an example of a framework that came out of green design. Works of Arena, Mastellone and Perugini (2003). Many researchers (2005) studied Green supply chain management: pressures, practices and performance within the Chinese automobile industry and Thailand electronics industry. They observed that increasing pressures from a variety of directions improve both their economic and environmental performance. Steve V. Walton, Robert B. Handfield, Steven A. Melnyk. Apr 2006, Journal of Supply Chain Management, “The Green Supply Chain: Integrating Suppliers into Environmental Management Processes” Using accepted qualitative research methods for case-based research, several primary areas for change to increase purchasing impact on environmental results are identified: 1. Materials used in product design for the environment 2. Product design processes 3. Supplier process improvement 4. Supplier evaluation 5. Inbound logistics processes

**International Journal of Management Reviews**, Feb 2007 “Green supply-chain management: A state-of-the-art literature review”, the literature on GrSCM is covered exhaustively from its conceptualization, primarily taking a ‘reverse logistics angle’. Using the rich body of available literature, including earlier reviews that had relatively limited perspectives, the literature on GrSCM is classified on the basis of the problem context in supply chain's major influential areas. It is also classified on the basis of methodology and approach adopted. Various mathematical tools/techniques used in literature vis-à-vis the contexts of GrSCM are mapped. A timeline indicating relevant papers is also provided as a ready reference. Finally, the findings and interpretations are summarized, and the main research issues and opportunities are highlighted. Su-Yol Lee, (2008) Supply Chain Management: An International Journal "Drivers for the participation of small and medium-sized suppliers in green supply chain initiatives", aims to describe what facilitates small and medium-sized suppliers in participating in green supply chain initiatives. These initiatives are inter-organizational initiatives attempting to improve environmental performance throughout the entire supply chain. This paper seeks to examine buyer green supply chain management practices, government involvement, and internal readiness of the suppliers themselves, as possible drivers.

**Journal of sustainable development**, March 2009, Fengfei Zhou “Study on the Implementation of Green Supply Chain Management in Textile Enterprises”, write for The green supply chain management is a sort of modern management mode which could comprehensively consider the environmental influence and resource utilization efficiency in the whole supply chain and how to implement the green supply chain management in special industrial operation at present has become into one of hotspot problems. This article mainly studied the core contents that textile and apparel enterprises implemented green supply chain management. **International Conference on Industrial Engineering and Operations Management Dhaka, Bangladesh, January 9 – 10, 2010.** L. K. Toke, R. C. Gupta, Milind Dandekar “Green Supply Chain Management; Critical Research and Practices” discussed on the waste and emissions caused by the supply chain have become the main sources of serious environmental problems including global warming and acid rain. Green supply chain policies are desirable since reactive regulatory, to proactive strategic and competitive advantages. The novelty of this topic makes it difficult to
truly determine contradictory and conflicting issues that could be considered true “debates”. We will present some of the debates that do occur, but this paper appraisal of investigation, practice and evaluation of green supply chain management.

Journal of industrial engineering and management, June 2011 Sunil Luthra1, Vinod Kumar1, Sanjay Kumar2, Abid Haleem3 “Barriers to implement green supply chain management in automobile industry using interpretive structural modeling technique-An Indian perspective” emphasis on relevant barriers have been identified from literature and subsequent discussions with experts from academia and industry. International Journal of Managing Value and Supply Chains March 2012, Noor Aslinda Abu Seman1, Norhayati Zakuan1, Ahmad Jusoh1 and Mohd Shoki Md Arif “Green supply chain management: A review and research direction” Study to determine the new direction area of this emerging field. It shows that lack researches to examine the adoption and implementation of GSCM practices especially in developing countries such as Malaysia. Thus, the authors bring forward a proposed research direction on GSCM adoption and implementation in Malaysia’s manufacturing industries. Nimawat Dheeraj1 and Namdev Vishal2, Research Journal of Recent Sciences, June (2012), An Overview of Green Supply Chain Management in India; focused on Today’s environmental performance index (EPI) of India and the major four activities of the green supply chain management; namely green purchasing, green manufacturing, green marketing and reverse logistics.

III. OBJECTIVES OF THE PAPER

The research is done keeping in mind to investigate the role of green supply chain initiatives in various industries. The research work proposed in this paper is explorative in nature. The specific objectives of the paper are as follows:

- To provide an overview of emerging environmental issues in supply chain and the concept of GrSGM.
- To identify the ways to design and implement the concept of GrSCM by companies.
- To point out the rewards of implementing the concept of GSCM in various industry to show GrSCM as a need of hour.

IV. NEED OF STUDY

The field of supply chain management has more recently directed its attention to the role of the supply chain in both Impacts to the natural environment and the generation of environmental performance change. Along with the rapid change in global manufacturing scenario, environmental and social issues are becoming more important in managing any business. The issue of greening supply chains is critical for the successful implementation of industrial ecosystems and industrial ecology. This paper is an attempt to clarify the path towards GrSCM and highlight steps to be taken by business organizations to make implementation of green supply chain successful.

V. METHODOLOGY

A large amount of work has been done in field of green supply chain. The secondary information is gathered from various websites, journals, magazine Books, and Newspapers, Case studies, surveys, theoretical and conceptual works. Articles of renowned authors also included in the study. The present study has been divided in five sections – Introduction, literature review, objectives, and need of study, research methodology, Suggestions and conclusions.

5.1 Way of Designing Green Supply Chain

1. Green Design of Product and Processes

Hendrickson et al (2001) suggested that the concept of green design mainly focus on three goals for a sustainable future:

- Reduce or minimize the use of non-renewable resources.
- Manage renewable resources to insure sustainability.
- Reducing or eliminating the toxic and other harmful emissions to the environment, including emissions contributing to the environment.

2. Green Procurement of product and processes

Nicolas suggested some typical Green procurement program elements: Recycled content products

- Energy efficient products and energy efficient standby power devices
- Alternative fuel vehicles, alternative fuels, and fuel efficient vehicles
- Bio-based products
- Non-ozone depleting substances
- Alternative fuels and fuel efficient vehicles
- Environmental Protection Priority Chemicals

3. Green Manufacturing

Many major production or manufacturing process changes occur in the following categories (Atlas & Florida, 1998):

- The dependence changes on human intervention
- Continuous process is preferred instead of batch process
- Changing the nature of the steps in production process
- Eliminating the steps in production process
- Changing cleaning processes

4. Green Distribution of product and processes

Green packaging: The system evaluation indicators are used to monitor and control the packaging system (Zhang and Liu, 2009).

- Green Procurement
- Green Manufacturing
- Green Distribution
- Reverse Logistics
- Reuse/Recycle/Re-Assembly
- Reuse/Recycle/Refurbish
Green Logistics

Jiange (2008) of School of Economics and Management, Zhongyuan University of technology, Zhengzhou, P.R.China defined —Green Logistics as producing and distributing goods in a sustainable way and activities include measuring the environmental impact of different distribution strategies, reduction in energy usage for logistic activities, reducing waste and managing its treatment

Reverse Logistics

According to srivastva (2007) reverse logistics activities differ from those of traditional logistics. Reverse logistics networks have some characteristics related to the coordination of two markets, supply uncertainty, returns disposition decisions, postponement and speculation (srivastva 2007).

Activities in Reverse logistics: All the activities that a company carries out to collect the used, damaged, unwanted, or outdated products, as well as packaging and shipping materials from the end-user or reseller can be considered as reverse logistics activities. One product has been returned

Reverse Logistic Activities

Products
- Return to supplier
- Resell
- Refurbish
- Remanufacture
- Recycle
- Landfill

Packaging
- Reuse
- Refurbish
- Reclalm materials
- Recycle

5. Waste management

The waste management sector includes methods of collection of waste, waste diversion, recycling, generation of energy from waste, and disposal with a specific focus on electronic waste. It is important when deciding which disposal method to use that you consider not only the environmental effect of the disposal route but also the costs and savings, CSR benefits and hidden environmental impacts such as amount of transport or energy used to manage the disposal method.

Attaining a triple bottom line effect that provides financial benefits to your company, gives back to society and meets environmental targets is something that can be achieved through reviewing your waste management strategy.

The waste hierarchy shown throughout this output (pictured on the right) ranks the methods of dealing with waste by their environmental impact, with waste minimization and prevention being the preferred route and landfill the least environmentally friendly option.

5.2 Green Supply Chain Implementation Best Practices

"A number of approaches for implementing GSCM practice have been proposed. Four green supply chain implementation best practices identified; (Hsu and Hu, 2008). Wikerson (2005); align green supply chain goals with business goals, evaluate the supply chain as a single life cycle system, use green supply chain analysis as a catalyst for innovation, focus on source reduction to reduce waste.

1. Align green supply chain goals with business goals

Most businesses usually define green supply chain goals and business goals separately. This may lead to businesses defining supply chain goals without a true understanding of the business case and value propositions. A supply chain goal should always support the attainment of the business goals. A company should therefore look at its overall business goals and identify how a transition to a green supply chain can help achieve those goals.

2. Evaluate the supply chain as a single life cycle system

A life cycle system allows a holistic view of the supply chain from raw material extraction to final disposal of materials. This ensures full visibility across the entire supply chain and an understanding of the end-to-end impact of green supply chain management programs. In this way, it becomes easier to identify opportunities for the program to deliver business value such as lower costs or improved competitive advantage (GSC, 2011).

3. Use green supply chain analysis as a catalyst for innovation

Green supply chain analysis provides an opportunity to review processes, materials, and operational concepts. It targets wasted material, wasted energy or effort and under-utilized resources (Wilkerson, 2005).
Chatterjee, Mazumder (2010) and Murrey (2011) observe that businesses that want to make a transition to a greener supply chain should review all their business processes to identify areas where adopting a greener outlook can actually improve their business. Since pollution and waste represent incomplete, ineffective, or inefficient use of resources, this will ensure continuous improvement in all your supply chain operations (GSC, 2011).

4. Focus on source reduction to reduce waste

The recycle and re-use waste management programs focuses on management of waste after it has been created. On the other hand Source Reduction focuses on the prevention or the reduction of wastage during production rather than managing it after it has been generated with the aim of efficiently utilizing resources by examining how business is conducted, how materials are used, and what products are purchased. Source reduction can be achieve measure such as: using reusable instead of disposable materials, eliminating certain items, repair and maintenance of equipments, using durable products, using recycled products (Cohen, 2005).

5.3 Drivers for Adoption of Green Supply Chain Initiatives

Drivers are the motivators or inducements that motivate business organizations to adopt green supply chain initiatives. Various drivers that have a potential to motivate organizations to adopt environmental initiatives. There are five type of environmental stakeholders group who drive green initiatives within an organization:

- **Regulatory drivers:** Who either set regulations or have the ability to convince governments to set standards. Such as Environmental protection legislation, Guidelines policies and code of conduct
- **Community drivers:** Environmental organizations and all those other potential lobbies, who can mobilize public opinion in favor of, or against, an organizations environmental policies. These are Choice editing, Word of mouth viral marketing, and Pressure group
- **Organizational drivers:** Who are directly related to an organization and can have a direct financial impact on the organization such as Proactive leadership, CSR, Profitability, Supply chain partners, Competitive pressure
- **Media drivers:** Who have the ability to influence society’s perceptions? Like Perception creation and management, Public creation gauging and reporting, Impetus towards positive charge
- **Consumer drivers:** Who seek emotional resonance alongside the cost and convenience factors of where and when they buy a particular product. These are Emotional resonance with product and company- feel good factor, Consumer activism, Loyalty creation and retention.

Based on the roles of each player in the supply chain there are different incentives to migrate towards Green Supply Chains and briefly these are as follows:

5.4 Obstacle in Successful Implement GrSCM

Implementing GSCM has never been easy. Organizations are likely to face certain challenges some of which include:

1) **The industries** would be able to adopt the world trend and get a deeper understanding of the environmental problems in their future. As now they don’t follow any GrSCM they show more interest on implementing it. There are obstacles for practicing green supply chain into their concern. We have identified various obstacles to implement GrSCM. Cost is a major barrier to improved SME environmental performance. For example, the cost of ISO 14001 certification is estimated to be high.

The identified barriers are explained as:

2) Lack of information about the green supply chain best practices
3) Supplier reluctance to change towards GSCM
4) Lack of good quality of human resources
5) Lack of Government support
6) Lack of IT implementation
7) Lack of management commitment
8) Unawareness of customers
9) Pressure of Lower Prices
10) Fear of Success
11) Global sourcing making tracing of carbon footprint difficult.

5.5 Rewards of Going Green supply practices in various industries

**Retail Industry**

GSCM practices that are being implemented in distribution activities include:

- Energy efficiency;
• Reduction of greenhouse gas (GHG) emissions;
• Water conservation or processing;
• Waste reduction;
• Reduced packaging/increased use of biodegradable packaging;
• Product and packaging recycling/re-use; and
• Green procurement practices.

High-Tech Industry
The players in the high-tech industry have now embarked on a path towards achieving a "Green Enterprise." However, the road map towards a greener supply chain is full of challenges that each organization has to overcome. This industry can increase its profit up to 10% by focusing on the following problems in the industry:
• Waste management
• Energy conservation
• Sustainable operations
• Recycling

FMCG Industry
Profitability can be improves up to 4% by implementing green supply chain in the FMCG industry. This change can be an important factor considering the lower margins and excessive completion on this industry. Key additional investments required while going green are:
• Retooling plant and change in packaging material
• Supplement for hazardous material
• Analysis and change management Effective packaging

Logistic Industry
Going green in logistic industry can bring in profit by as much as 10% in compared to traditional; supply chain. Some key logistic activities that have potential to reduce greenhouse gas emissions are:
• Newer fuel efficient vehicle in place of old end of life vehicles
• Fleet management
• Waste recollection and reverse logistics
• Waste treatment
• Change management and continuous improvement.

Construction Industry
Saving from green building over their life time from green design and the increased energy efficiency can reduced heating cost up to 80% in an average building. It is estimated that construction industry by adopting green supply principles can increase its profitability by 10%. Green design and substation of inputs and green process would be more profitable.

Automobile Industry
Green supply chain in automobile industry can increase profitability by up to 6%. Key contributing factor towards profit are:
• Design for disassembly
• Reduced procurement cost and increased recycling of material
• Effective maintenance of vehicle
• Reduced cost of disposal of unrecyclable waste due to minimal or no use of hazardous material.

Chemical Industry
Green practices can result in overall profitability enhancement of up to 3% in chemical industries. Key factor that increase cost when compared with traditional supply chain are as follows:
• Risk management for efficient product handing
• Substitution of hazardous material
• Treatment of hazardous waste
• Retooling plant and new manufacturing techniques.
• Clean and safe working environment increase productivity and employee satisfaction

Electronics Industry
Profitability can be improved up to 4% by implementing green supply chain management in electronic industry.
• Reduced packing
• Design for disassembly and assembly and recycling and raw material procurement

VI. SUGGESTION

1. Develop a strategic plan, set clear, comprehensive objectives for your green supply chain initiative.
2. Assess your current environmental impact.
3. Implement green practices internally.
4. Address your suppliers’ environmental responsibility.
5. Communicate your company's environmental policies to your suppliers, and have them complete a self-assessment questionnaire about current practices. Audit the responses to ensure they're accurate. If a vendor is out of compliance with one of your requirements, help it develop a remediation plan.
6. Investigate where your company can conserve resources and compose a strategic sourcing and supplier engagement;
7. Engage your employees as champions of the effort;
8. Implement conservation measures throughout operations and facilities, improve efficiency of site operations and balance the economies of stock levels, service and order quantities;
9. Optimize network and transportation and provide integrated service management, returns, reverse logistics and parts management;
10. Communicate your green efforts to stakeholders;
11. Seek ways to integrate an overall strategic approach to sustainability in all areas of your company;
12. Support industry and community sustainability initiatives.

VII. CONCLUSION

In recent decades, with regard to the rising awareness of environmental protection, businesses have employed GSCM to maintain competitive advantage. Due to Environmental issues on major concern for business as
well as public organizations, efficient green policies need to be designed to alleviate these issues. Emerged benefits of green supply chain facilitate managers and other stakeholders trying to integrate environmentally sound choices into supply-chain management. However, more integrative contributions are needed of best practices, green technology transfer and environmental performance measurement. GSCM practices, which are viewed as closed loop reduces the ecological impact of industrial activity without sacrificing quality, cost, reliability, performance or energy utilization efficiency. Proper design of these green policies require proper understanding of the steps needed towards sustainability as well as barriers and obstacles facing greening activities. GrSCM has been emerged as an approach for greening the product design, material management, manufacturing process, distribution and marketing, and RL according to the requirements of environmental regulations. Implementation of ‘green supply policy’ in supply chain is cheaper and motivates environmentally friendly packaging to carbon-footprint reduction. Green supply chain has additional benefits, from waste reduction, to create values financially and socially to the customer but also leading to Remanufacturing & Reverse Logistics. GrSCM is here to stay, the ‘green revolution’ has not yet started, and GrSCM is the need of hour.

VIII. SCOPE FOR FURTHER RESEARCH

This study will help academicians, practitioners and researchers to understand integrated GrSCM from a wider perspective. Based on our problem context classification and scope for future practice and research, an evolutionary timeline has been prepared taking into account all the relevant and seminal papers published in the area of GrSCM.

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