

A Study of Green Supply Chain Management & Operations Strategy

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Abstract - As Industrial sector is growing rapidly, preserving the environment challenges. While the growth is forthcoming it is imperative that the development should happen in an environmentally sustainable manner so time has come to make industrial sensitive to the environment to maintain healthy and safe atmosphere.

This review article studies the impact of industrialization on environment and associated challenges through the process of gathering relevant current data or information to improve method of working to reduce environmental impact. There are various ways which can help to improve current manufacturing and Supply chain practices. This article focusses on the relevant research on GISCM and to know how various technological tools can be used for assessing the current situation in industries around the globe. It also throws light on current trends and challenges.

Indian industries need to transform cultural and start thinking strategy from lean to green integrated supply chain, Environmental performance parameters like green index and reducing greenhouse gases to eliminate the carbon footprints. Implementation and improving Energy Efficiency, Water Conservation, Renewable Energy, Greenhouse Gas Emission, Waste Management, Material Conservation, Recycling and Recyclability, Green Supply Chain, Product Stewardship & Life Cycle Analysis...etc.

Keywords: GSCM- Green Supply Chain Management, GISCM- Green Integrated Supply Chain Management, IEA- International Energy Agency, GISCM- Green Operations and waste management, LCA- Life Cycle Assessment, GHG- Green House Gases,

I. INTRODUCTION

The major need of Green supply chain came into existence after the quality revolution of the year 1980s and the supply chain revolution of the year 1990s. To enrich the traditional supply chain, green supply chain came into existence and the literature begins with corporate environmental management, environmentally conscious manufacturing strategy [3]. The work of the green supply chain started in 1989 and Kelle and Silver for the primary time developed a best forecasting system for organizations to forecast the product which will doubtless be reused. In 1991, additionally been joined to human resource management to realize structure property and property supply chains. GSCM has been thought of as a key half to influence structure property [4]. within the today's era of economic process, GSCM will increase numerous opportunities for consumers.

Resource inputs in ensuring that they supply better product & services to customers. It looks at however industries are

implementing green procurement, green design, green operations, green manufacturing and waste management as green integrated supply chain best practices. [4] [6] [11].

The increased attention given to the topic of Green Integrated Supply Chain Management (GISCM) or Green Supply Chain Management (GSCM) warrants the writing. [1].

As firms began to act with their suppliers electronically over the last decade, SCM has familial the forefront of structure follows to make inter-functional operations at intervals their organizations and to forge electronic connections with key customers. the most objectives of the SCM operate embrace value reduction, improvement and innovation of end-to-end processes between corporations and their customers and suppliers, improved communication and interaction among supply chain partners, and improved performance and productivity during an approach that edges all contributors within the supply chain [3]. With relevancy the rising world awareness

of environmental protection, businesses have used their GSCM to enhance their core competitive advantage. GSCM could be a more and more widely-diffused follow among firms that are seeking to improve their environmental performance. GSCM practices, that are viewed as cross-organizational and control system reduces the ecological impact of commercial activity while not sacrificing Productivity, Efficiency, Quality, Cost, dependability, Performance or energy utilization potency [3].

Supply Chain Management (SCM) is associate integral a part of our everyday life. nowadays it influences quite ever an outsized variety of human and economic activities. SCM has been thought of as a competitive strategy for desegregation suppliers, manufacturing and customers with the target of rising responsiveness and adaptability of manufacturing/service organizations. Now a day, firms have systematically tried to boost their business potency and effectiveness by reassessing their internal business operations like purchasing, manufacturing, logistic, materials management and distribution.

Considering this industries in India must work and rework thinking method of lean to Green manufacturing.

II. LITERATURE

Scott, (1993), In recent decades, globalization, outsourcing, and knowledge technology have enabled several organizations, like holler and Hewlett Packard, to with success operate cooperative supply networks within which every specialized business partner focuses on solely some key strategic activities.

Powell, (1990), this inter-organizational supply network is often acknowledged as a brand-newdesignof organization. However, with the difficult interactions among the players, the network structure fits neither “market” nor “hierarchy” classes.

Cooper et al., (1997), within the twenty first century, changes within the business setting have contributed to the event of supply chain networks. First, as AN outcome of globalization and therefore the proliferation of transnational corporations, joint ventures, strategic alliances, and business partnerships, vital success factors were known, complementing the sooner “just-in-time”, lean manufacturing, and agile manufacturing practices.

Coase, (1998), Second, technological changes, significantly the dramatic fall in communication prices (a major factor of dealings costs), have junction rectifier to changes in coordination among the members of the provision chain network.

Scott and Westbrook (1991) and New and Payne (1995) describe supply chain management because the chain linking every component of the manufacturing and supply method from raw materials through to the tip user, encompassing many structure boundaries. in step with this

broad definition, supply chain management encompasses the complete price chain and addresses materials and supply management from the extraction of raw materials to its finish of helpful life.

Baatz (1995) any expands supply chain management to incorporate usage or re-use. supply chain management focuses on however corporations utilize their suppliers’ processes, technology, and capability to boost competitive advantage (Farley, 1997), and therefore the coordination of the manufacturing, logistics, and materials management functions among a company (Lee and Billington, 1992).

III. RESEARCH METHODOLOGY

The present study is to see the new model and notice the profitableness in green supply chain management system. Considering the character and objective of gift study still as resources of investigator normative survey methodology of analysis has been used. within the gift investigation all the steps and characteristic are followed that are essential for normative survey methodology of investigation.

The investigators studied the previous models in supply chain management system and can develop the new model in terms of acceptableness, value reduction, quality care and profitableness. The investigator additionally aimed toward finding out however these variables relate to accomplishment the objectives of the organization. The investigator will develop a form and can go survey methodology for locating the objectives. The sample can collect concerning one hundred executives of company industries of blood vessel Sectors. The sample space is going to be geographic area. The collected knowledge is going to be analyzed by completely different applied mathematics tools of Six Sigma like chi-square methodology ...etc.

Expected Outcomes of the Study of Operations & supply chain members should collaborate, sharing info for rising internal and external customer’s satisfaction, value reduction, product quality and profitableness of manufacturing industries. the aim of this analysis is to gift what’s the impact of the new greenmanufacturing Setups, greenmethod, Green procurement, green design, Green Operations and waste management. GISCAM within which a framework is combined with a prognostication module can gift, so, this can be coping with finding out the link between value reduction and Quality of integrated green supply chain management (ISCM) optimization. The projected framework is going to be determinate the potency of the tactic and therefore the impact of forecast accuracy on overall management performance of the greenIntegrated supply chain management.

1. Energy Efficiency-

The industrial sector is important for economic process however at the identical time consumes the foremost energy to manufacture merchandise we tend to use on a daily basis.

in step with a report by International Energy Agency (IEA), in 2009, business consumed a share of fortieth of the electricity and seventy-seven of coal worldwide. Governments are progressively faced with the challenge of providing energy to numerous sectors- households, manufacturing industries, transport, service, etc. In several countries, energy demand has outstripped supply resulting in generation deficit and peak load deficit. This deficit results in vast loss in gross domestic product. Governments are so progressively awake to the pressing must build higher use of the world's energy resources. additionally, in countries like Asian country, massive population haven't any access to electricity and restricted access to different clean or trendy fuels. [5]

According to a report by International Energy Agency (IEA), a big potential for any energy savings remains.

India being one in all the quickest growing economies within the world, the demand for energy is on the increase. Implementing energy conservation initiatives can scale back the demand, so serving to the state attain energy security. vast investments are created annually to line up power plants to satisfy the provision demand gap. Improved energy potency is so the foremost economic and pronto accessible means that of rising energy security. the advantages of a lot of economical use of energy are well-known and embrace reduced investments in energy infrastructure, lower fuel dependency, decrease in greenhouse emission emissions, multiplied fight and improved consumer welfare.

Businesses consume energy for varied reasons like operational machinery, running computers, workplace maintenance etc. The system implies energy observation and accounting moreover as technology that's less energy intensive. The system would facilitate the organizations to benchmark themselves at the national / international level, guides them towards changing into national / international levels of energy potency. Involvement of workers and building capability of them are a part of the Green Manufacturing Performance Observation System (GMPMS).

2. Water Conservation-

Fresh water represents but three.5% to 2.5% of the whole water on Earth. Of the balance ninety-six.5 % to 97.5%, 69.5% is blocked in glaciers and thirty.1% is within the sort of groundwater. Only 0.4% of the surface water is fit human consumption. This just about means if water supplied globally may be a glass, the potable water supplied would be a containerful. Industrial water consumption in Asian nation is 42 BCM and is predicted to extend to 161 BCM by 2050.

According to World Bank estimates, today about 700 million people live in countries experiencing water stress or scarcity. By 2035, it is projected that 3 billion people will

be living in conditions of severe water stress. Many countries with limited water availability depend on shared water resources, increasing the risk of conflict over these scarce resources. [7]

Effective water management methods are the decision of the hour to handle the water crisis. The green business manufacturing promotes property use of water through "reduce, recycle, reuse and reclaim" methods. It prescribes metering to observation water consumption; rain water gathers and water use reduction methods. Overall, this has the impact of reducing utility prices for businesses. The system additionally encourages firms to require efforts for groundwater recharge on the far side the fence to form plant water natural.

3. Renewable Energy-

Increasing energy supply from renewable sources reduces the risks from rising and volatile costs for fossil fuels additionally to delivering mitigation advantages. the present fossil fuel-based energy system is at the foundation of temperature change. Use of fossil fuels ends up in destruction of natural resources, air and pollution. Energy sector accounts for 58% of the greenhouse gas emissions. Some African countries, including Kenya and Senegal, devote more than half of their export earnings to energy imports, while India spends 45%. India being one of the fastest growing economies in the world, the demand for energy is on the rise. Demand has exceeded supply leading to a deficit of 10.1% and peak load deficit of 12.7%. Growing population and industrial growth additionally create a heavy challenge in terms of providing electricity. additionally, access to electricity in rural areas has been a challenge for many years. the dual challenge of energy security and temperature change brings a chance to scale back dependency on fossil fuels and increase the share of renewables in overall energy combine. several countries have set targets to get a share of their final energy from renewable sources. [7].

Investing in renewable sources that are supplied regionally – in several cases extravagantly might considerably enhance energy security and by extension, economic and money security.

- Solar Air Conditioning System
- Use of Producer Gas instead of Diesel
- Wind park
- Mini Hydro

The adverse effects on surroundings caused by the assembly and consumption of energy have resulted in severe environmental impacts across the world. With world economies taking commitments to scale back their share of carbon emissions contributive to the worldwide warming; it needs countries to seem at alternate sources of energy meet their growing energy demands. This not solely permits to

be used of energy that's clean however additionally reduces the dependence on fossil fuels, that are major contributors of green House Gases. Similarly, there are different sources of renewable energy that require to be explored and utilized. The green Company Performance System encourages businesses to use clean and renewable energy. the last word goal is to offset a thousandth of the current / thermal by renewable energy. though the initial investment on putting in instrumentation for generating renewable energy is comparatively high, the long run advantages of reduced maintenance value, low operational prices and value savings on fossil fuels makes it a remunerative proposition for businesses.

4. Waste Management-

The development of science and technology has augmented human capability to extract resources from nature. it's solely recently that industries are being control in charge of the harmful effects of the waste generated. augmented government laws and company responsibility are brining problems like pollution management, waste treatment and environmental protection to public notice. the normal approach adopted for clinical waste, agricultural waste, industrial waste and municipal waste is depleting the natural resources. consistent with a report by Indian Network for temperature change Assessment printed in 2007, waste management contributes to regarding three of worldwide GHG emissions. [12]. Waste management is at its infancy in most industries resulting in unhealthful and unsafe conditions within the geographic point. These facts necessitate a well-defined waste management approach within the trade. it's a serious requisite in leading Associate in Nursing trade towards environmental property. the most objective of this parameter is to make sure property management of waste, promote industrial hygiene and safety and conserve natural resources. this will be achieved by 100% utilization of all sorts of wastes through implementation of ideas like cradle to cradle and 'Integrated property [22] [23].

Waste Management. Integrated property waste management differs from the traditional approach towards waste management by seeking neutral participation, covering waste interference and resource recovery, together with interactions with alternative systems associate degreed promoting an integration of various environment scales. [22]. The parameter waste management paves the approach for integrated property waste management through waste assortment, segregation and disposal, waste management policy, reducing specific waste generation, use of waste as different fuel, reducing sewer water discharge or achieving zero wastewater discharge and at last reducing non GHG emissions below statutory limits. [21].

Since the waste assortment and disposal facilities has scope to enhance, most of the waste stagnates at its place of origin. This ends up in dangerous materials obtaining

disposed-off to the setting and inflicting grave danger to living beings.

The Green Company Performance System recommends waste management ways that alter businesses to Stewardship and segregate differing kinds of waste. The system presents pointers on waste inventory study to alter businesses to quantify information on quantity of waste generated and thus empower them to adopt appropriate waste disposal ways. The performance system conjointly recommends waste reduction ways. [5] [6] [11].

5. Material Conservation, utilization &Recyclability

Without the raw materials required to drive production, development would grind to a halt. property development needs conservation of raw materials used for manufacturing by creating processes a lot of economical and by victimization raw materials with most recycled content. [12].

There are several edges of getting a fabric conservation and recycle policy:

- Reduced environmental liability
- A lift to company's image for being environmentally aware
- Raised employee's morale & environmental awareness
- Improved management of materials
- Increased business opportunities reduced prices and increased opportunities

Material conservation, utilization and recyclability focuses on:

- Reducing material consumption,
- Reducing consumption of consumables like chemicals, additives, lubricating oils, etc,
- Reducing packaging materials
- Increasing recycled or perishable content within the product thus it is often simply recycled at the tip of its helpful life.

Points are awarded supported the world as material consumption varies greatly reckoning on the kind of trade.

Material conservation and utilization is closely associated with waste management. it's obvious that a lot of we tend to conserve and recycle/ re-use, the less waste we tend to generate. except this, by reusing materials there's an explicit saving in prices. the value savings is within the kind of reduced material prices (as we tend to use the identical material) in addition reduced waste disposal cost (since lesser waste is generated). The GMPMS promotes use and utilization of raw materials and discourages use of virgin materials. It even goes a step more in encouraging businesses to make sure that not solely they reuse/ recycle raw materials however their product too ought to be recyclable/ bio-degradable. [21].

6. Green Supply Chain:

Ahead of the competition, firms wish to be recognized as an element of the new breed of world recognized companies known as “environmentally accountable companies”. Universal awareness on warming and on however customers feel concerning victimization their product is encouraging firms to include life cycle thinking into their property initiatives. Increase in environmental regulations and customers preferring to try to business solely with firms having a definite environment friendly image is dynamic the approach companies look at their supply chain. Environmental potency or environmental impact reduction is currently being introduced as a call variable within the supply chain.

[3] [14] [16]. Benefits of green supply Chain perspective, greening the whole supply chain involves watching every of the following-

- Procurement
- Packaging,
- Warehousing
- Distribution and transportation,
- Supplier audits & recognition programs.

As environmental awareness among consumers increase, the demand for merchandise with lower environmental footprint will increase. keep with consumer sentiments, businesses can should not solely green their operations, however additionally across them supply chain. This entails a rethink of the business’s current acquisition method. Studies have shown that improved green supply chain processes mean that lower waste-disposal, lower environmental impact at the seller premises and, often, reduced materials prices. The GMPMS aims to create businesses attentive to these advantages to their bottom-line in order that they're inspired to implement green supply chain processes. [17] [24] [25].

7. Green House Gases Reduction:

According to Intergovernmental Panel on Climate Change (IPCC) the major greenhouse gases are:

1. Carbon dioxide (CO₂)
2. Methane (CH₄)
3. Nitrous oxide (N₂O)
4. Hydrofluorocarbons (HFCs)
5. Perfluorocarbons (PFCs) and
6. Sulphur hexafluoride (SF₆)

Business organizations and trade as a full has taken a lead role in many voluntary initiatives to scale back their emissions. Increasing GHG levels within the atmosphere and associated impacts have instigated many government and non-governmental organizations, businesses, and people to take proactive measures to curtail the speed of

growth of emissions. [13]. many governments have undertaken legislative steps to reduce the speed of increase of GHG levels within the atmosphere through measures like introduction of emission commercialism programs, voluntary programs, carbon or energy taxes, and rules and standards on energy potency. completely different countries across the world have additionally adopted voluntary targets to scale back GHG emission levels. for instance, [15].

These initiatives to scale back emissions are being seen with a spotlight on cost-reduction and maximizing profits. compliant with the norms for the longer term and gaining market-based incentives of being a cleaner company builds trust and opinion publicly as a property company. This successively helps in satisfying varied stakeholders, attract investments and customers. Hence, effective GHG management results in sound business sense. [34].

8. Product Stewardship (Extended Producer Responsibility)

These gases close the planet lure heat and so a rise in their emissions ends up in inflated temperatures on earth. so as to scale back the adverse effects of temperature change, many initiatives targeted on reducing gas emissions are being enforced. Product Stewardship is one such initiative that helps cut back waste generated additionally as toxicity of venturesome substances. [9]. Product Stewardship is additionally an initiative which will assist in reducing gas emissions by reducing the number of fuel needed to manage a product throughout its life cycle.

Product Stewardship means that being chargeable for all phases of a merchandise lifecycle – from design to finish of life and places the primarily responsibility with the producer. Product Stewardship intends to handle the subsequent 5 key areas. every of the below key areas are delineate intimately within the five credits that follow.

- Design for environment or environmentally conscious design
- Extended producer responsibility
- Quality management and environment risk assessment
- Influence consumer behaviour
- Reduce toxicity or hazardous substances used in the product and process

Product Stewardship is Extended Producer Responsibility over the Life cycle of a product on the far side production, throughout distribution, use and disposal of merchandise. The GMPMS encourages businesses to design and develop a product that has ‘Nil/Least’ environmental impact (CO₂, Water, material and harmful content) throughout its lifecycle.

9. Life Cycle Assessment:

Awareness of the unsustainable levels of resource consumption and important impacts of merchandise on the atmosphere is growing among consumer, policy manufacturers and businesses. corporations haven't continuously thought of environmental impacts of the provision chains or the employment and end-of-life processes related to their merchandise. [8].

Life Cycle Assessment (LCA) is that the most comprehensive technique to assess the environmental impacts of a product, method or activity throughout its life cycle; from the extraction of raw materials through to process, transport, use and disposal. In period it had been primarily used for product comparisons, for instance to match the environmental impacts of disposable and reusable merchandise. nowadays LCA has several applications. it's used because the basis for eco-labeling and consumer awareness programs throughout the planet. [18]. LCA has emerged as a valuable decision-support tool for each policy manufacturers and trade in assessing the cradle-to-grave impacts of a product or method. [7] [10].

LCA helps corporations verify risks and environmental optimization potential for a product/ method at every stage of the life cycle.

LCA has several applications like:

- Marketing (does the product have less impact than others?)
- Purchasing (which product has the least impact?)
- Design (what should be changed to make product more environment friendly?)
- Benchmarking across an industry (who is best/worst? where do we stand?)
- Year to year tracking of environmental performance (are we getting better or worse?)
- Policy (where should we have regulations to get bigger benefits?)

Several initiatives are being taken to scale back the environmental impact of merchandise at completely different stages – production, distribution, use and disposal. there's a necessity to possess an analysis of the impact of the merchandise throughout its life cycle, to maneuver towards merchandise of lower impact. [19].

IV. CONCLUSION

Indian industries must strength the green integrated supply chain with improvement of Environmental performance, green index and reducing greenhouse gases to eliminate the carbon footprints. By the Implementation and rising Energy potency, conservation, Renewable Energy, greenhouse emission, Waste Management, Material Conservation, utilization and Recyclability, green supply Chain, Product billet & Life Cycle Analysis. this may be

cultural transformation in Indian trade to begin thinking strategy from lean to green.

- Communicates the corporate commitment towards environmental sustainability to all stake holders
- Enhances the competitiveness of the company through resource conservation and improved efficiency
- Current Standing- The GMPMS is an easy way for businesses/ companies to compare themselves against their peers or competitors
- Businesses can use the recommendations of the green manufacturing performance system to develop a long-term plan to improve competitiveness as well as ecologically sustainable
- Most governments are prescribing strict environmental compliance guidelines for companies. Companies that accept the green manufacturing performance system will have a 'head start' in complying with these requirements and thus have an advantage over non-complying competitors
- With consumer awareness related to the environment growing at a fast pace, green rated companies will enjoy considerable consumer support and goodwill
- Many business owners/ managers wish to adopt environmentally healthy practices but are not aware of what needs to be done. The green manufacturing performance system can act as an excellent guide for such businesses

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