Driving towards Sustainable Development through Green Logistics

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Abstract

Green logistics is an important element of production system in today's business. It blends several efforts to quantify and control the environmental impact of production activities in an enterprise. This research is intended to emphasize upon the ways by which organizations can accomplish positive ecological effects by modifying their logistics practices, thereby moving towards the goals of sustainable development. The study also appraises an account of green logistics practices in the present Indian business environment. This paper presents a study on the different dimensions of green logistics, challenges faced by companies in pursuing it and proposes strategies, by analysing the alternatives for green practices along with organizational objectives.

Keywords: Green logistics, sustainable development, business environment

1. Introduction

In today's increasingly competitive environment, green logistics concerns are gaining prominent attention, since it is an important component of supply chain management and plays a crucial role in the improvement of transport system. Logistics facilitates in providing products and services as and when they are required to customers.

Ecological concerns have become vital for organizations, given the present context of globalization (Molina-Besch & Palsson 2014). Industrialisation and consumerism are ever-increasing which brings in a situation where trade pursuit of humans has instigated to spread adverse environmental impact (Ratnajeewa & Bandara, 2015). The larger focus is now on ecological pollution amongst logistics practices. In the recent past, interest has swung to the impact of logistics on climate change, due to the improved understanding of the danger being caused by global warming (McKinnon, Cullinane, Browne & Whiteing, 2010). Green logistics practice is the solution, as it consists of activities which are meant for the eco-efficient enterprise, of the forward and reverse flows of information and products, from the point of origin and the point of consumption to meet or exceed customer expectations (Carter & Easton, 2011).

Green Logistics is a research field that aims to assess and lower the environmental impact of logistics (McKinnon 2015). It includes various topics such as corporate environmental strategies, logistics systems for recycling, green supply chain management, and urban logistics. Among the advantages of implementing green logistics Carbone and Moatti (2008) states the optimisation of logistics flows and improving the company's image. Freight transport is a significant factor with major effect on the environmental sustainability of logistics systems

(Mitra 2014; McKinnon 2015). Srivastava (2007) discussed the evolution of the green paradigm within supply chain management, including freight transport, a blend between the environment and supply chain management for reducing pollution. Dekker, Bloemhof, and Mallidis (2012) presents four important decisions in logistics for the environmental impact: mode choice; intermodal transport; equipment choice and efficiency; and fuel choice and carbon intensity.

India is one of the leading economies in the world and a key emerging market that has a young population, escalating investment rates, big domestic demand and globally competent firms. Although, the unexpected Covid-19 crisis has taken its toll on the economy, it is expected that India will become the third largest economy by 2025 after China and the USA. The transport and logistics sectors are central to the development of a country, especially in India where it is expected to provide employment for 45 million people. The economic growth in India has led to the demand for virtually all transport services and underlines the value of providing an efficient logistics infrastructure in India. The Planning Commission of India has stressed that emphasis needs to be given to integrated transport solutions with individual transportation and distribution services.

In recent years, there has been growing concern about the environmental effects on the planet due to human activities, which is why it has an increasing amount of attention in the print and electronic media, in governmental agendas, in the academic literature and from the general public. Stakeholders are largely insisting firms to assume responsibility for any counter-effects their business activities might cause. The gaining attention to greener solutions does not leave logistics aside since it plays a very important role, because it is one of the main pollution sources and resource consumer. Green logistics is being studied in literature in the global context; however very little research subsists in order to better understand the role of green logistics in sustainable development.

1.1 Objectives of the study

This article analyses the relevance of green logistics, which still constitutes an unexplored field. The authors' primary objective is to conduct a conceptual research and define green logistics as the sum of different aspects. The other main objectives of this study are to identify the needs of green logistics, to assess the present situation of it in Indian business context, to find out the major challenges in implementing green logistics and to propose strategies to overcome those challenges and drive a sustainable development.

1.2 Research methodology and data source

Since green logistics is an emerging area, the scope of this study was limited to developing a concept paper on this subject. The data collection to support this methodology was by reviewing a large amount of literature. Literature reviews generally accomplish two objectives: first, they recapitulate existing research by identifying patterns, themes and issues. Second, they aid in identifying the conceptual content of the domain (Seuringa, 2008). So, a focused literature review happens to be a valid approach, as it is an essential step in structuring the research area which forms an integral part of the study conducted. The main sources of secondary data were research publications in international journals, related websites, magazines, newspapers, reports of independent consultants, etc.

2. Literature Review

2.1 Green logistics

The logistics is seen as the actions by an organisation in which the objective is to minimize costs and maximize profits with concern for environment. The term was used mainly in business areas of companies and their financial reports. But, for many years, the term logistics was used along with "green" by creating "Green Logistics" - the term encompassing costs, yet had not appeared in financial reports.

As per Rodrigue et al.(2012), “green logistics” is defined as supply chain management processes, practices and strategies that lessen the environmental and energy footprint of freight distribution, while focuses on material handling, waste management, packaging and transport and according to Mesjasz-Lech (2011), Green logistics consists of all the activities related to eco-efficient management of the forward and reverse flows of products and information linking the point of origin and the point of consumption with a purpose to meet or exceed customer needs.

Lee & Klassen (2008) discuss green logistics as Green Supply Chain Management that can be defined as an organisation’s activity taking into account environmental concerns and integrating it into supply chain management, to improve the environmental performance of suppliers and customers, while according to Sibihi & Eglese(2009), green logistics practices include assessing the environmental impact of various distribution strategies, decreasing the energy usage in logistics processes, reducing waste and managing its treatment. From the sustainable development viewpoint, green logistics is defined as, “producing and distributing goods in a sustainable manner, taking account of environmental and social considerations” (Sibihi & Eglese, 2009).

2.2 Sustainable Development

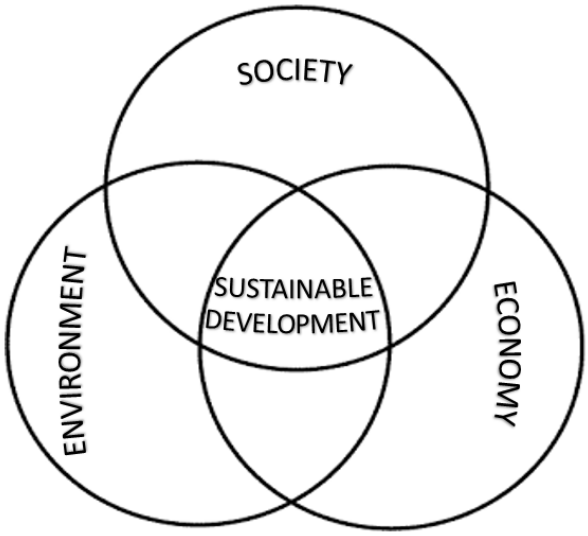
The term sustainability first surfaced in the literature over two decades ago and several academics and practitioners have proposed many definitions of the term. According to Linton et al. (2007), the term “sustainability” has been defined in various disciplines, such as engineering science, operations management and social science while according to Carter and Rogers (2008), there exists a divergence of definitions of sustainability in the literature.

The World Commission on Environment and Development entitled it as “our common future (1987)” which is better known as the Brundtland Report, defined sustainability as “using resources to meet the needs of the present without compromising the ability of future generations to meet their own needs.” From a corporate point of view, this definition proposes that focus should be on economic aspects of one’s business, as well as sustainability of natural resources and people the companies serve. This fundamental need was the starting point to eveolve concepts for the implementation of sustainability initiatives.

According to Willard (2002), the concept of the Triple Bottom Line (3BL) was proposed in the mid-1990 s, when a management think tank focused on accountability and commenced using the term in its work. Elkington (2004), defined 3BL in its simple form as businesses not just focusing on economic value that they add, but also on the environmental and social value that they add or damage. It may be noted that some people use different terminologies, such as 3P’s (profits, people and planet) and 3E’s (economics, equity and environment) to signify similar viewpoints to that of the 3BL, which are correspondingly the three pillars of sustainable development.

The three pillars of Sustainable Development is applicable to green logistics as well. As cited in the definitions of green logistics earlier, companies managed their logistics activities including freight transport, warehousing, packaging, materials management, etc. to meet customer expectations at least cost which refers only to the monetary terms (Nowakowska-Grunt, 2008). Now, the environment has also become a concern. It is treated as a factor of the cost. Some companies have already considered external costs of logistics especially with the environmental concerns such as climate change, pollution and noise into consideration.

Figure 2.1: The three pillars of Sustainable Development



(Source: Authors' compilation)

Green logistics is thus defined as efforts to assess ways of reducing these external factors and achieve a more sustainable equilibrium between environmental, economic and social objectives (see Figure 2.1). All efforts in the "green" logistics area are therefore driven on contributing and ensuring sustainability (Hans, 2011). There are basically two reasons which compel companies to green their logistics services - marketing demand and concern for environment. These days most of the consumers prefer green products to purchase and even they are much conscious for every kind of activity in the chain and wish it should be green so that this planet will become safer to live a longer life. A research done by Alan McKinnon (2010), concerning the key drivers for green logistics, found that managing good relations is the key factor while designing alternative network is the least factor for implementation of green logistics by organisations. Therefore, the primary purpose for businesses to promote their green image via management of logistics is to improve their public relations, not to help the environment.

3. The need for Green Logistics

Green logistics or eco-logistics means the array of sustainable policies and measures meant to reduce the environmental impact caused by the activities of business in an area. This logistics concept influences the constitution of processes, structures and systems or equipment in the transport, distribution and storage of materials. The traditional methods of logistics often leaves

environmental sustainability on the side-lines during decision-making. Conversely, the goal of green logistics is to find an equilibrium with ecology and economy.

The objectives of green logistics are outlined below.

Green logistics seeks to:

- Estimate the carbon footprint of logistics operations to establish a beginning point for considering sustainability measures and controlling their results. One of the most popular methods for calculating energy consumption and greenhouse gas emissions is the UNE-EN 16258:2013 international standard.
- Lessen air, soil, water and noise pollution by analysing the effect of each logistics area, especially those related to transport.
- Use supplies judiciously by re-using containers and recycling packaging.
- Extending sustainability to the supply chain, eco-logistics is also shaped by the design of products and their packaging. Both must be designed to minimise their environmental impact.

The compelling reasons why green logistics is gaining ground are:

- Green logistics policies denote a strategic advantage over the competition. Not only do they revalue a brand and set it apart, but they also prepare the company for the future, which inevitably must be sustainable.
- Measures for saving energy is an effective strategy for dealing with rising supply costs.
- They confirm that a business is complying with environmental regulations.

4. Green Logistics and the Indian experience

Around one-fourth of global CO_2 emissions are due to fossil fuel combustion in transport sector, according to International Energy Association. While Europe and other developed nations have taken firm actions to reduce Green House Gas (GHG) emissions from logistics and transportation sector, the developing countries have hardly moved beyond paying lip service. As seen in the developed world, increase in emission is in lockstep with economic progress. For example, the CAGR in Indian CO_2 emissions from transport sector due to fossil fuel combustion has been about 4.5 % compared to 1.16 % in OECD nations and 1.04 % in North America in the previous decade (Carbon Brief, 2019). Thus, environment and growth are often expressed in mutually antagonistic terms, especially in India, which is in a great hurry to catch up on growth.

In reality, even as logistics moves goods within supply chains, the environmental impact is much beyond the often-criticised GHG emissions from freight and passenger transport: warehouses stand as a threat to safety of the neighbourhood, especially, if stocked with hazardous goods; terminals at ports, airports and stations contribute to noise pollution as vehicles move; discarded packaging spoils the landscape; incorrect waste disposal contaminates land and water. For revitalising and implementing green logistics in India, there is a requirement to address the issue at three levels: public policy, business and individual.

These three tiers intermingle with and influence one another. But no cut-and-dried or easy solutions are prevailing. In any case, government intervention for right pricing, incentivising, laying down regulations and enforcing them is imperative.

Over the years, the stake of rail transport has decreased significantly by more than two-thirds from 89 % in 1951, while the share of road transport has improved seven-fold from 10 % within the same period. Restoring rail as a basic mode of transport, especially for freight, would be necessary, as rail emissions (per tonne-km) are around five times lower than road emissions. Indian roads still retain a major share of transportation as they alone can provide door-to-door delivery, until the country move on to intermodal transport with roads providing only the last-mile delivery.

In recent years, the Indian Logistics and Supply chain have undergone a lot of changes, thanks to the steady acclimatisation of 'smart', technologically empowered operational processes, along with enhanced growth opportunities. Additionally, as per the Global Ranking of the World Bank's 2018 Logistics Performance Index, India jumped to 44th position from its previous 54th position 2014, registering improvement in overall ranking in all the six elements of the logistics performance index. However, India's fast-track rise to become a global economy has led to a disturbing impact on its ecology and environment. India's poor Environmental Performance Index, which dropped from 141/180 in 2016 to 177/180 in 2018, is a clear alarm for the economy to immediately adopt sustainable practices so as to stay globally relevant.

Adapting to global trends and the 'Green' revolution that is bringing about the acceptance of environmentally responsible business practices worldwide, the next wave of disruption for Indian logistics is evolving, with a steady progression of 'Green Supply Chain Management (GSCM)' process, that is gradually making its impact. GSCM or Green Logistics is the process of adapting and adopting environmentally responsible practices that are sustainable and effective in abating the ecological impact of traditional logistics activities. However, the slow acceptance of GSCM practices in India, can mainly be due to three fundamental factors:

- Lack of strong environmentally responsible public policy for businesses
- Lack of cost-effective infrastructure that can boost GSCM
- Lack of public awareness and preference towards environmentally positive products and services

Meanwhile, there are marginal players and a few start-ups that are working towards creating a cost-effective and collaborative solution to make GSCM a more viable and popular practice among modern Logistic players. The emergence of third-party logistics (3PL) service providers and the new trend of outsourcing vs the conventional in-house logistic operations are steps in the direction. The recent implementation of digitisation in logistics is also driving initiatives like consolidation, reduced dependency on physical documents, faster modes of transport, smart warehousing and freight management, etc., all of which are also impacting to reduce environmental impact brought about by conventional SCM.

5. Challenges facing green logistics today

Today, the logistics industry is not famous for its high degree of sustainability. Companies face major obstacles in implementing environmental policies in the area of logistics. This is due to several causes:

1. Dependence on fossil fuels, especially in transport

Effective, economically viable solutions have yet to be found to discourage the sector's fuel reliance in goods transport.

2. Last Mile Deliveries' impact on urban traffic

In particular, e-commerce deliveries have significantly increased the volume of delivery vehicles in large towns and many operate without carrying full loads when dealing with mixed orders.

3. Lack of infrastructure

Local authorities are in the course of standardising emission limits. However, a cross-sectoral agreement is required to implement measures in place to build new facilities that meet the needs of those involved in logistics activities.

4. Businesses which need to invest

Whether logistics operations are carried out in-house or outsourced, the tight rates and margins involved don't always let you think about investing in infrastructure, process automation or more efficient handling equipment.

5. The invisibility of logistics to consumers

An additional problem exists because, for the customer, logistics is invisible and increasingly so. It is difficult to apply green logistics policies when the customer demands, for example, 24-hour deliveries that prevent consolidating and optimising the loads or making the most of transport flows. Moreover, logistical costs are rarely itemised in an invoice. This reduces their relevance and, thus, lowers the reasons for a company to invest in its environmental sustainability.

6. Strategies for green logistics approaches

6.1 Include eco-friendly criteria in procurement policies

Sustainability criteria can be included in a company's purchasing and procurement policy when it comes to assessing suppliers' proposals. These can refer to:

- *Product characteristics:* e.g., buying eco-friendly packaging and restricting the use of plastic in packaging.
- *Manufacturing processes:* international regulations guarantee favorable environmental management, which ensures that an environmental management system has been implemented in the company's global operations.
- The *supplier's location*, prioritising those nearest to its facility.

In this way, the prospects of buying eco-friendly supplies could be evaluated. For instance, more and more efficient industrial vehicle alternatives curtail greenhouse gas emissions, especially in the light duty category. Furthermore, it is worth looking into whether investment or a subsidy is available to aid purchase them.

6.2 Optimize transport fleet management

Transport is a dominant carbon footprint area in the logistics chain. Being one of the major contributors to environmental degradation, the transport sector alone causes about one-fourth of global CO_2 emissions. Apart from CO2 emission, transportation also contributes to 30% of particulate matter in the air in metros, leading to air pollution, noise pollution, and degradation of green cover and open spaces due to the heavy infrastructure development in building wider roads and expressways. To limit emissions further, it is necessary to use systems that assist delivery route planning and prioritize load pooling. Implementation of *Green Transportation* can facilitate the replacement of fossil fuel-based technology with bio-fuel based one or with alternatives like CNG, hybrid, battery-operated vehicles, and equipment, etc. Moreover, taking into consideration details like fuel efficiency, payload management, routing, and driving methods can lead to 'green transportation' more economical and sustainable.

6.3 Warehouse that follows sustainable construction and management standards

Traditional warehouses, being concrete structures, consume huge amount of energy, especially for lighting, and HVAC systems required for moderating a temperature -controlled storage. They also need optimum space utilization or planning, contributing to additional wastage of energy and other utilities, while producing a lot of heat in the environment. Traditional structures are huge and absorb a lot of heat, necessitating more energy to keep them cool. Additionally, they are never strategically located, thus adding to extra transport and distribution efforts, which in turn create more carbon footprint of the Supply Chain. *Green Warehousing* is implementing technology empowered management systems (WMS) and warehouse identification to improve operations and lower waste. Besides, the use of pre-engineered steel structures and LEED-certified green buildings in the place of traditional concrete buildings helps optimise energy consumption and sets up a smarter layout for comfortable operations. Switching over to alternative energy sources like solar panels for lighting, recycling water and installation of automated systems that check energy utilization, are all helping modern logistic providers to go 'green' and build cost-effective, economic and sustainable warehousing operations.

The boom in the logistics sector is driving demand for new warehouses or forcing companies to redesign their infrastructure to meet market requirements. As such, there are several ways in which eco-logistics can be used in warehouse design:

- *The so-called 4.0 logistics buildings take center-stage*: their design and construction incorporate environmental protection measures that guarantee sustainable management of the building. The BREEAM or LEED certifications are two such seals that validate logistics warehouse sustainability. These certifications are given by analysing issues such as the water and energy consumption efficiency, the use of alternative energy sources, the selection of construction materials and waste management throughout the entire process.
- *In-warehouse monitoring and promotion of energy savings:* these can be adopted in different ways. For example, the total automation of some processes in the warehouse makes it viable to limit artificial lighting requirements (following the practice known as *lights-out manufacturing*). Another way to adhere to sustainable logistics approaches is to use as little packaging as possible on products to limit resource wastage, or to make use of adaptive packaging options which are more versatile.

6.4 Enable measures to reduce and recycle the waste produced in warehouse

Although a significant part of warehousing processes, packaging by itself, has been a major contributor to environmental hazards, especially with the rise in e-commerce. Conventional packaging material made of synthetic plastic can create havoc with the ecology as it takes hundreds of years to breakdown, filling up lands and oceans in the due course. Further, irresponsible waste disposal at warehouse levels is a major reason for environmental degradation. *Green Packaging and Waste Recycling* can contribute many ways in creating a Green Supply Chain. By implementing efficient packaging that is ideal, weighs less and therefore easier to transport, could be the first step. Replacing the plastic packaging with a bio-degradable material like paper and cardboard could be the next major transition. Besides, when disposing waste, it is advantageous to set up a recycling system to efficiently process the large amounts of waste, mainly from packaging, before sending it to landfills.

One of the ways to help implement green logistics in a warehouse is to use sustainable criteria to manage the waste generated. For instance:

- Create a *waste sorting process according to the materials to be recycled*.
- *Reduce in-warehouse paper usage* by implementing IT solutions such as the Easy WMS warehouse management software.
- *Regulate special waste management* so that they conform with appropriate recycling procedures.

6.5 Improve Stock Management and Reverse Logistics processes

Reverse Logistics is a process that takes care of recovery or retrieval of parts, recycling of products and disposal of packaging waste. Although negligible in India, reverse logistics plays a key role in the green logistics and has been steadily growing, thanks to a substantial rise in the e-commerce sector, contributing to a huge packaging needs, as well as an increase in doorstep deliveries, and collection of returned goods. In terms of IT systems and hardware which form a significant chunk of e-commerce, disposal and e-waste management is a real challenge. Reverse logistics has been playing a vital role in managing optimum e-waste management by offering a structured system of collecting and re-distributing faulty IT hardware to e-waste units. Apart from efficient disposal and recycling of products, reverse logistics has helped optimise costs, reduced packaging waste and helped spread awareness among end consumers about ecological and safe discarding of products, thereby promoting a cleaner and greener ‘circular economy’.

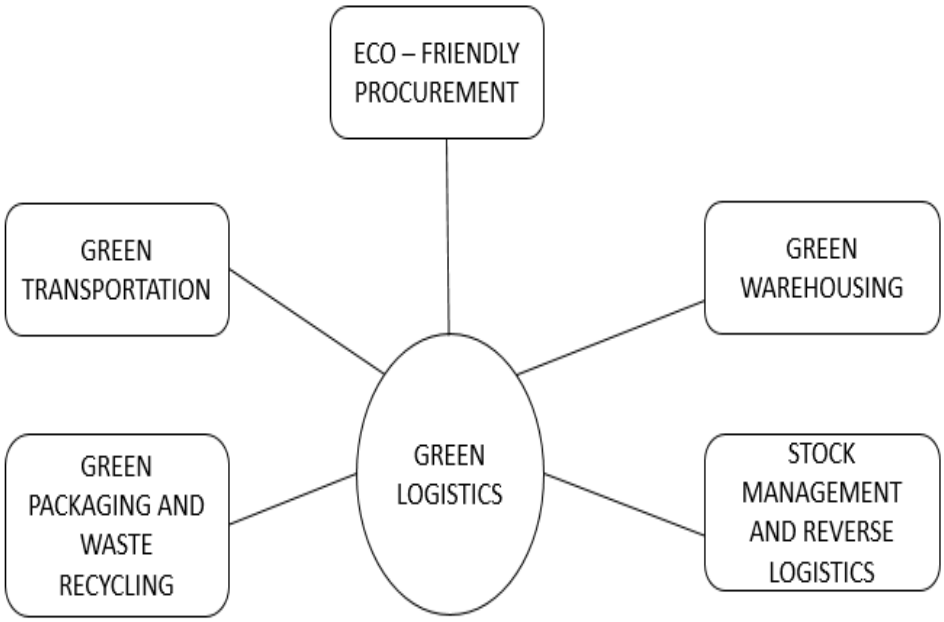
Attaining a more efficient storage facility results in one of eco-logistics core principles - reducing waste throughout overall process improvement. Some measures to achieve this are:

- *Scale down movements within your warehouse* through a combination of good storage location management and optimised picking plans.
- *Prevent stock damage* due to manual handling of goods. Deploying automated systems and robots in warehouse resolves this issue.
- In the case of perishable goods, precisely manage the FIFO benchmarks to control expirations and *prevent goods from spoiling.*

- Establish *quality control systems for returned products* that influence reverse logistics management.

Based on the above discussion, a conceptual model for implementing these five green logistic strategies is given below:

Figure 6.1: A model for green logistics strategies



(Source: Authors' compilation)

By embracing these strategies (Figure 6.1), and aligning a green orientation in the whole production processes and supply chain activities, business firms could transform their logistics operations to become more sustainable.

7. Conclusion

The research paper concludes that because of the tremendous increase in the public and government concern for the environment, there has been a significant amount of pressure on Indian business firms to cut down the environmental impact of their logistics operations. Transportation of goods has a negative effect on the quality of air, creates noise pollution, leads to accidents and, in totality, makes a remarkable input to global warming. The impact of logistics on weather changes has invited increasing attention in recent years, mainly because growing controls on pollution and road safety improvements have alleviated the other environmental issues. The Indian business organizations need to understand the concept of green logistics and need to rethink and redesign their logistics operation in order to protect the environment through green logistics initiatives. More importantly, a massive transformation in mind-sets, policies, and business practices are needed for India to be looked upon as a truly eco-friendly and green business economy, with GSCM and Green Logistics being its backbone, in its journey towards a sustainable future.

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