Developing Green Logistics to Reduce Carbon Footprints

Riya Vinod
Electronics & Communication Engineering
Rajagiri School of Engineering and Technology (Autonomous), Kochi, 682039.

Abstract

Significant amounts of greenhouse gas emissions are generated by logistics transportation. By implementing sustainable practices, productivity can be increased across a business and the carbon footprint (CFP) can be decreased. Green logistics is the practice of reducing the harmful impacts that delivery and logistics networks have on the environment. This study looks at the measures that can be used to reduce carbon emissions and the total environmental cost of logistical activities.

Keywords

Green logistics; Carbon footprint; Sustainability; Environment; Carbon emissions

1. Introduction

The greenhouse effect, climate change, and global warming are the most pressing environmental concerns. There has been an increase in cumulative carbon dioxide emissions from 9.35 billion tonnes in 1750, at the beginning of the industrial revolution, to 1.44 trillion tonnes in 2021 [2]. Many organizations have endeavored to improve the design of their commodities or implement more energy efficient equipment, facilities, and carbon-reducing methods in response to government regulations on carbon output and concerns regarding the environment from the customers. Due to this, green logistics that represents the study of environmental effects of all activities involved in the transport, storage, and

handling of goods as they travel through supply chains, has gained popularity among people [6].

This research will examine the concept of green logistics and its potential to significantly reduce carbon emissions. It will also explore the importance of reducing carbon footprints and the challenges that may be encountered in implementing green logistics. Case studies of companies that have successfully implemented green logistics practices will be examined in the process. The aim of this research is to provide a comprehensive understanding of the potential and limitations of green logistics as a means of reducing carbon emissions.

2. Green logistics

Logistics refers to the movement of goods from one location to another, and it encompasses all of the activities involved in this process, from production and storage to transportation and delivery. Green logistics is a specific approach to logistics that aims to reduce the environmental impact of these activities. Its goal is to create a more sustainable and efficient transport and distribution system, while also offering high-quality products at an affordable price [5].

To achieve this goal, green logistics relies on a number of strategies and technologies. For example, it may involve the use of eco-friendly materials in handling, packaging, and transportation, such as reusable or recycled materials. It may also involve the adoption of energy-efficient technologies such as electric vehicles or sustainable fuel sources. In addition, green logistics may involve the use of advanced technologies like real-time tracking and predictive analytics to optimize the flow of goods and information, improving efficiency and reducing waste.

3. Carbon emissions

In order to combat climate change, carbon dioxide (CO_2) and other greenhouse gases must be reduced since they trap heat in the Earth's atmosphere, raising average world

temperatures. Fossil fuels including coal, oil, and natural gas combustion are a major contributor to this phenomenon, also known as the greenhouse effect. The majority of human-produced CO_2 emissions are produced by these actions, which support global warming and its adverse effects. These effects include an increase in the frequency and severity of extreme weather events, a rise in sea levels, and a decline in biodiversity.

Carbon emissions must be controlled, and there must be a transition toward a more sustainable, low-carbon economy, in order to offset these effects and avert the worst effects of climate change. This involves moving away from fossil fuels in favor of renewable energy sources, which provide electricity with little or no carbon emissions, such as solar, wind, and hydropower. Besides the generation of electricity using renewable sources, there are a variety of alternative strategies to reduce carbon emissions such as improving the energy efficiency in infrastructure, transportation, and industry; conserving and sustaining trees, which eliminate CO_2 from the atmosphere; and implementing low-carbon farming and land-use practices.

Climate change can be slowed down and the Earth can be safeguarded for the next generation by undertaking measures to decrease carbon emissions. Individuals, communities, and institutions across the world must address this issue and join to initiate change that will allow the world to make the transition toward a more sustainable, low-carbon future.

4. Logistics and emissions

Traditional logistics practices, such as single-occupancy vehicle usage and air freight, tend to have a higher ecological footprint due to their reliance on fossil fuels and the associated greenhouse gas emissions. However, by utilizing economies of scale and minimizing the number of individual journeys necessary, more eco-friendly and sustainable modes of transportation like rail and shipping can lower carbon emissions.

Traditional logistics methods can be improved in a number of ways to limit their adverse effects on the environment, including:

1. Using automobiles that are more fuel-efficient and operate on alternative fuels, such as biodiesel or compressed natural gas. This can also include using electric or hybrid vehicles.
2. Using sustainable packaging can cut down the amount of energy needed for transit by using reusable, lightweight packaging and reducing material waste.
3. Employing more than one mode of transportation: Combining several modes of transportation such as using trucks for shorter, local deliveries and trains or ships for longer distances, can be more cost-effective and environmentally friendly.
4. Route and schedule optimization: Logistics firms can cut down the distance travelled as well as the carbon emissions produced by using information and software analytics to make better decisions about routes and schedules.
5. Using intermodal shipping: Intermodal shipping is the process of moving goods from one point to another by using a variety of modes of transportation, including trucks, trains, and ships. Relatively speaking, this may be more effective and less harmful to the environment than using only one method of transportation [4].

In general, the logistics sector is crucial to lowering carbon output and lessening the effects of climate change. Logistics providers can lessen their ecological effect and help to foster a more environmentally friendly future by using more responsible strategies.

5. Green logistics strategies

Green logistics refers to strategies and procedures that are intended to lessen how damaging moving goods is to the environment. These can involve utilizing non-renewable energy-saving technology, such as switching to hybrid cars or using recyclable packaging, as well as bettering transportation administration and planning to boost the effectiveness of goods movement and lower GHG emissions. In addition, green logistics can encompass more significant commercial objectives, like expanding reverse logistics activities, which

involve bringing products back to their original location or reusing them as opposed to discarding them.

There are a variety of ways to apply eco-friendly practices of logistics in businesses, such as using environmentally friendly packaging materials and reducing plastic usage, adhering to production procedures that prioritizes environmental management (such ISO 14001), optimizing transportation fleet management to boost efficiency and reduce emissions, using vehicles with fewer emissions, implementing efficient delivery route planning and load sharing, and maintaining sustainable practices. In order to reduce waste overall, these techniques can also improve stock management and reverse logistics procedures, reduce paper usage through the application of IT solutions, and recycle garbage in warehouses through sorting and recycling operations [3].

Some strategies of green logistics are:

- Green manufacturing: It refers to the use of industrial techniques that reduce resource use, waste, and pollution. This can entail adopting eco-friendly materials and cutting-edge manufacturing techniques to lessen the impact of production on the environment, which will lead to lower costs for raw materials, lower environmental costs, and an enhanced public image. Green manufacturing aims to develop a more ecologically responsible and sustainable industrial method.
- Green distribution: It involves factoring environmental concerns into the logistics, packaging, and shipping of products. In order to cut waste and expenses, this may entail employing ecologically friendly packaging materials and methods, such as recycled content and enhanced designs. Implementing strategies like order consolidation and route optimization that conserve energy and lower CO_2 emissions in transportation is another possibility. Green distribution aims to diminish the effects of commodities movement on the environment.
- Reverse logistics: It is the retrieval of goods for reuse, recycling, or remanufacturing. The collecting, examination, cleaning, sorting, and recycling or

redistribution of unwanted goods and packaging are all considered reverse logistics techniques. These processes can happen in places where the products are repaired, reused, reconditioned, reassembled, or repackaged. Reverse logistics seeks to reduce waste by identifying uses for products and materials that may be reused or recycled [3].

6. Case Studies

There are many examples of successful green logistics initiatives that have helped to reduce carbon emissions. Here are a few examples:

1. DHL's GoGreen programme: DHL is a global logistics corporation that uses carbon-neutral shipping and has put in place a variety of green initiatives, including the GoGreen programme. Through a variety of strategies, including route and schedule optimization, the use of alternative-fuel vehicles, and financial investments in renewable energy sources, this initiative seeks to lower the company's carbon emissions. Through these approaches, DHL has significantly reduced its emissions and saved money in the process [1].

2. UPS: In June of 2021, UPS declared its intention to become carbon neutral in all of its international operations by 2050. Additionally, using 2020 as the baseline year, the corporation promised to cut its CO_2 emissions by 50% for each parcel delivered by 2035. However, UPS intends to have a significant influence by 2025 through the use of alternatively fueled cars. The corporation has spent more than 20 years investing in alternative fuels to power its fleet, and it currently runs more than 13,300 cars that use alternative fuels.

3. IKEA: They have introduced numerous eco-friendly measures, such as switching its supply chain's hardwood pallets for paper/cardboard ones and using plastic legs instead of metal ones. This method has considerably decreased the requirement for transportation, CO_2 emissions, and packing space. IKEA encourages its transportation partners to utilize low-CO_2 equipment by using its IWAY monitoring system. The

objectives of IKEA's green logistics programmes include switching to non-wooden pallets for 60% of its overall flow by 2012, 100% of its overall flow by 2014, and guaranteeing that all transport partners satisfy IWAY standards by 2015.

The deployment of a variety of emission-reduction strategies, the use of cutting-edge technologies and analytics to optimize operations, and the companies' dedication to sustainability were the major elements that made each of these green logistics efforts successful.

7. Limitations

When adopting green logistics projects, businesses may run into a number of difficulties and restrictions. These may consist of:

- Financial obstacles: Putting green logistics into practice frequently necessitates expensive investments in new technology and equipment. If businesses are unsure of the financial return on investment or are operating on a tight budget, they may be reluctant to make these investments.
- Logistical obstacles: Making the switch to green logistics might be difficult logistically because it may require altering current procedures and systems. For large businesses with intricate supply chains, this can be particularly challenging.
- Limited accessibility to eco-friendly technologies: In some circumstances, the tools and technology required to execute green logistics may not be widely accessible or may not yet be in their final stages of development. Companies may find it challenging to implement these technologies as a result.
- Reliability: The paramount significance of service reliability is at the core of logistics. While the least polluting modes are typically seen as being the least reliable in terms of on-time delivery, lack of breakage, and safety, its success is founded on its capacity to convey freight with the least chance of breakage or damage. The logistics sector is based on air and truck shipments, the two least eco-friendly modes of transportation, while ships and railways have a history of low customer satisfaction.

In conclusion, it is critical for businesses to carefully weigh the costs and advantages of green logistics projects and to build plans for overcoming any potential logistical or financial challenges.

Conclusions

Green logistics is a viable tactic for decreasing the negative environmental effects of shipping and distributing while simultaneously enhancing effectiveness. Businesses may drastically lower their carbon emissions and increase the sustainability of their supply chain by using eco-friendly practices and materials, utilizing cutting-edge technologies, and optimizing operations. However, implementing green logistics also comes with a variety of difficulties and restrictions such as logistical and financial obstacles. Overall, adopting green logistics methods can have a positive impact on the environment and the bottom line, making it an essential area of focus for enterprises and logistics professionals.

References

1. Assoune, Alex. “DHL Gogreen Carbon Neutral Shipping.” *Panaprium*, Panaprium, 23 Mar. 2020, https://www.panaprium.com/blogs/i/dhl-gogreen-carbon-neutral-shipping
2. Friedlingstein, P., O'sullivan, M., Jones, M.W., Andrew, R.M., Gregor, L., Hauck, J., Le Quéré, C., Luijkx, I.T., Olsen, A., Peters, G.P. and Peters, W., 2022. Global carbon budget 2022. Earth System Science Data Discussions, 2022, pp.1-159.
3. Kohli, Rajive. “Unit-11 Green Logistics.” *EGyanKosh*, Indira Gandhi National Open University, New Delhi, 1 Jan. 1970,
4. Krekhovetska, Sofiia. “Multimodal Transport: What Is Multimodal Shipping?” PLS Logistic Services, 7 Nov. 2022. https://www.plslogistics.com/blog/multimodal-transport-what-is-multimodal-shipping/
5. Mahnken, Daniel. “What Is Logistics? Origins, Present and Future Scenarios: Saloodo! Blog.” Saloodo!, 2 Aug. 2020, https://www.saloodo.com/blog/logistics-meaning/.
6. McKinnon, A., Browne, M., Whiteing, A. and Piecyk, M. eds., 2015. Green logistics: Improving the environmental sustainability of logistics. Kogan Page Publishers.