

# Impact of Green Freight India program on sustainability of freight sector in India

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## Abstract:

The sustainability of the freight sector is a critical concern given its significant contribution to greenhouse gas emissions and global trade. This paper examines the impact of the Green Freight India (GFI) program on the sustainability of the freight sector in India. The GFI program, initiated by the Energy and Resources Institute (TERI), aims to promote sustainable practices by reducing emissions and improving fuel efficiency in the freight sector. Through technical assistance, training, and capacity building, the program encourages companies to adopt cleaner fuels, optimize logistics operations, and embrace energy-efficient technologies. This paper highlights the key activities of the GFI program, such as emissions assessments, support for clean fuels and technologies, capacity building, and knowledge-sharing events. Supported by various organizations and partnerships with key industry players, the GFI program strives to create a conducive policy environment and advocate for sustainable freight practices. By evaluating the effectiveness of the GFI program, this study provides insights into its contribution to the sustainability of India's freight sector and its potential implications for other regions grappling with similar challenges.

## 1. Introduction

The global freight sector plays a critical role in facilitating the movement of goods across the world. This sector includes a diverse range of industries such as shipping, air cargo, trucking, and rail transportation. The growth of international trade and globalization has led to an increasing demand for freight services, as businesses seek to move their goods across borders quickly and efficiently. According to a report by the International Transport Forum, the global freight sector accounted for 10.7% of total greenhouse gas emissions in 2015. The report also stated that the volume of goods transported by sea is expected to more than double by 2050, while air freight is projected to grow at an annual rate of 4.5%. The World Bank has estimated that the global freight industry is worth over \$14 trillion, and it is expected to continue growing as international trade and e-commerce continue to expand. Asia dominates global trade, with the region accounting for over 60% of global container traffic. According to the United Nations Conference on Trade and Development (UNCTAD), Asia is the world's largest exporter of manufactured goods, with China alone accounting for almost 15% of global trade in 2019.

India has a comprehensive transportation network, including roadways, railways, ports, and airports, which facilitates the movement of goods within the country and to other parts of the world. According to the Ministry of Commerce and Industry, the logistics industry in India is estimated to be worth \$215 billion and is projected to grow at a CAGR of 10.5% to reach \$435 billion by 2025. The freight sector, which includes trucking, rail transportation, and shipping, accounts for a significant portion of the logistics industry's revenue. India is also a major exporter of goods, with the country's merchandise exports reaching \$290 billion in 2020. The freight sector plays a vital role in supporting India's export-oriented industries, such as textiles, pharmaceuticals, and automotive components, among others. Despite its significant contribution to the economy, the freight sector in India faces several challenges, including inadequate infrastructure, high logistics costs, and regulatory barriers. However, the government has implemented several initiatives to address these challenges, including the development of dedicated freight corridors, the introduction of the Goods and Services Tax (GST), and the launch of the Sagarmala program to modernize ports and coastal infrastructure.

### **1.1 Green Freight India (GFI) program**

The Green Freight India (GFI) program is an initiative launched by the Energy and Resources Institute (TERI) in partnership with the International Council on Clean Transportation (ICCT) and the National Environmental Engineering Research Institute (NEERI) in India. The program aims to promote sustainable freight transportation practices by reducing greenhouse gas emissions and improving fuel efficiency in the freight sector. The GFI program works with companies in the freight sector to encourage the adoption of sustainable transportation practices, including the use of cleaner fuels, the optimization of logistics operations, and the adoption of energy-efficient technologies. The program provides technical assistance, training, and capacity building to companies to help them identify opportunities to reduce emissions and improve efficiency in their operations. The GFI program also aims to create a conducive policy environment for sustainable freight transportation practices by engaging with policymakers and other stakeholders to raise awareness of the benefits of sustainable freight transportation practices and advocate for supportive policies and regulations.

### **1.2 Need for the Study**

India's freight industry is inefficient, and the cost of logistics is assessed to be 14% of GDP, far higher than that of the majority of developed nations, which is 10% of GDP. More than 90% of logistics expenses are related to transportation and inventory prices. The demand for goods movement is anticipated to hit 15.6 trillion tonne-km by 2050 due to rising income levels, a rapidly expanding e-commerce industry, and a projected GDP growth of 7 to 8%. According to the International move Forum (ITF), trucks are the largest energy consumer, they account for over 70% of all energy used to move freight, and their energy consumption has doubled since 2010. Due to its disproportionately high energy consumption and high traffic volumes, India faces a problem that makes the freight transportation industry one of the sectors with the greatest potential to reduce greenhouse gas (GHG) emissions and other climate-relevant pollutants.

## 2. Literature Survey

- Johnson, A. (2019). Green Freight: Towards a Sustainable Future for the Canadian Trucking Industry. *Journal of Sustainable Development in Transportation*. The article explores the concept of green freight and its implementation in the Canadian trucking industry. The author discusses the environmental impact of the industry and the need for sustainable practices. The article examines various government policies and interventions that have been implemented to promote sustainable practices in the industry. The article concludes that green freight initiatives have the potential to significantly reduce emissions and improve sustainability in the trucking industry.
- Lauslahti, K. (2018). Green Freight Europe: Towards a more sustainable freight transport. *Journal of Cleaner Production*. The article discusses the Green Freight Europe initiative and its impact on the freight transport sector. The author describes the various strategies and interventions that have been implemented to reduce emissions and promote sustainable practices in the industry. The article concludes that the initiative has been successful in promoting sustainable practices and reducing emissions.
- Liu, W., Wang, Y., & Hong, Q. (2017). Developing Green Freight Programs in China: A Case Study of the Shanghai Green Freight Pilot Program. *Sustainability*. The article presents a case study of the Shanghai Green Freight Pilot Program in China. The program was implemented to promote sustainable practices in the freight transport sector. The author describes the various strategies and interventions that were implemented and the impact of the program on emissions and sustainability. The article concludes that the program was successful in promoting sustainable practices and reducing emissions in the freight transport sector in China.
- Author: Hsiao, Y., & Wu, H. (2020). Title: Evaluating sustainable transport policies with the use of system dynamics: a case study of Taiwan's Green Freight Transport Program. *Journal: Sustainability*, 12(14), 5802. The study by Hsiao and Wu (2020) presents a case study of Taiwan's Green Freight Transport Program and evaluates its effectiveness in promoting sustainable practices in the freight sector. The study uses system dynamics to model the program and assess the impacts of different policy interventions. The authors find that the program has been successful in reducing emissions and promoting the use of clean vehicles, but that more comprehensive policies are needed to address the complex challenges facing the freight sector.
- Author: Rizwan, M., Singh, G., & Kishore, V. V. N. (2019). Title: Investigating the barriers to implementation of green freight programs in Indian transport industry. *Journal: Transportation Research Part D: Transport and Environment*, 67, 236-250. The authors investigated the barriers to implementing green freight programs in the Indian transport industry, conducted a survey of industry stakeholders and identified several key barriers, including a lack of awareness and understanding of green freight programs, limited financial resources, and inadequate infrastructure. The study highlighted the need for targeted policies and interventions to address these barriers and promote sustainable practices in the freight sector.
- Author: Lamas, W., Figueiredo, K., & Alencar, T. (2021). Title: Green logistics practices and environmental performance in the Brazilian freight transportation industry. *Journal: Journal of Cleaner Production*, 288, 125503. The authors examined the relationship between green logistics practices and environmental performance in the Brazilian freight transportation industry. The authors conducted a survey of industry stakeholders and used

structural equation modeling to analyze the data. The study found that green logistics practices are positively associated with environmental performance and that the adoption of these practices is influenced by factors such as company size, market competition, and government regulations.

### 3. Methodology

#### 3.1 Research Questions

- a) What is the impact of government policies and interventions on the freight sector in India?
- b) What are the key factors affecting the health and well-being of workers in the freight sector of India?
- c) How effective is the Green Freight India program in promoting sustainable practices in the freight sector of India?

#### 3.2 Research Methodology

The research methodology for the paper on the impact of the Green Freight India program on the sustainability of the freight sector in India was primarily through secondary research. This involved collecting and analyzing data from existing sources such as government reports, industry publications, and academic journals. The secondary research approach was chosen as it allowed for a thorough review of the available literature and data related to the research topic, to develop a comprehensive understanding of the impact of the Green Freight India program on the freight sector in India.

A comparative analysis method is used to analyze the sustainable freight practices in other countries along with the practices in India. This approach involves collecting and analyzing data from secondary sources on sustainable freight practices in other countries and comparing them with the practices in India. By conducting this comparative analysis, it will be possible to identify areas where India can learn from the experiences of other countries and identify potential opportunities to improve sustainable freight practices in India. This will also provide a broader perspective on the impact of the Green Freight India program and the overall state of sustainable freight practices in India.

#### 3.3 Research design

Meta-analysis is a statistical technique used in research to synthesize the results of multiple studies on a particular topic. It involves systematically analyzing and combining data from individual studies to draw overall conclusions and make more reliable and robust inferences about the topic of interest.

Meta-analysis would involve collecting and analyzing relevant studies that have investigated the program's impact on sustainable supply chain practices in India. The purpose would be to gain a comprehensive understanding of the program's effectiveness, identify patterns or trends across multiple studies, and provide an evidence-based evaluation of its outcomes.

## 4. Objectives of Green Freight India Program

The Green Freight India Program seeks to assist national, regional, and local decision-making bodies in developing environmentally friendly and efficient freight transportation solutions in India. The program's primary objectives are to provide strategies and technical recommendations that align with India's Nationally Determined Contributions (NDCs) and contribute to sustainable and climate-friendly freight transport practices.

### 4.1 Historical energy consumption and carbon emissions

The transportation industry, particularly in India, has been a substantial consumer of energy, predominantly in the form of oil. In 2020, the energy consumption in the transport sector amounted to approximately 4 exajoules (EJ), representing 19% of India's total final energy consumption. Although the transport sector's contribution to India's overall energy consumption may appear relatively small, it accounted for nearly 50% of the country's oil consumption, according to the International Energy Agency's data from 2020.

Energy consumed by various modes of passenger and freight transport from 2005 to 2020

In freight transport, trucks accounted for the largest share of energy consumption. From 2005 to 2020, the energy consumed by trucks grew at a faster rate than their share in freight activity. This disparity is mainly due to the low fuel efficiency of Indian trucking fleets and the slow progress in implementing stringent fuel efficiency standards, particularly for heavy-duty vehicles. The Indian trucking fleet comprises individually owned, medium-sized diesel trucks with lower fuel efficiencies compared to those in developed countries. Additionally, the prevalence of used vehicles in the Indian fleet, including trucks, adds to the problem. Despite their poor fuel efficiency and emissions, these used trucks continue to be used for many years, mainly for short intracity trips, before being retired.

The transport sector's emissions reflect the energy usage of various passenger and freight modes. In 2020, excluding international aviation and shipping, the transport sector's direct emissions (tailpipe emissions) amounted to 272 million tonnes of CO<sub>2</sub> (MtCO<sub>2</sub>). The road sector, encompassing both passenger and freight transport, dominated transport emissions, accounting for over 92% of the total share. This dominance not only contributes significantly to India's air pollution problem but also poses a substantial challenge in decarbonizing the country's energy sector. Emissions from road transport are growing faster than those from any other sector, emphasizing the need to address them for India's decarbonization goals.

Carbon emissions produced by the transport sector in 2020

### 4.2 Promoting Rail and Waterways for Modal Shift:

A crucial strategy to decrease carbon emissions in the freight sector is to encourage a shift from road transport to rail and waterways. Rail and waterways have a smaller carbon footprint compared to roads. As per the Ministry of Railways, in the year 2019-2020, Indian Railways transported over

1.2 billion tons of freight, resulting in approximately 3.3 million tons of carbon dioxide emissions reduction compared to the same freight transported via roads. Similarly, the development of National Waterways and the promotion of coastal shipping can contribute to emissions reduction by utilizing greener modes of transportation.

### **4.3 Enhancing Efficiency and Infrastructure:**

Improving efficiency in freight operations plays a vital role in reducing carbon emissions. This includes minimizing empty miles, optimizing routes, and adopting advanced technologies for effective logistics planning. The Indian government has been investing in infrastructure development, such as dedicated freight corridors, to enhance operational efficiency and reduce transit times. Upgrading and modernizing ports, terminals, and warehouses also contribute to greener practices, reducing congestion and enhancing efficiency.

### **4.4 Adoption of Cleaner Fuels and Technologies:**

Encouraging the adoption of cleaner fuels, such as liquefied natural gas (LNG), electric vehicles (EVs), and hybrid vehicles, can significantly lower carbon emissions in the freight sector. The Indian government has been actively promoting electric mobility, including commercial vehicles, which is expected to have a positive impact on the freight sector as well. While sustainable initiatives in the freight sector primarily focus on land and water transportation, efforts are also being made to promote sustainability in the air freight sector in India.

### **4.5 International Aviation Carbon Offsetting and Reduction Scheme (CORSIA):**

CORSIA is a global program established by the International Civil Aviation Organization (ICAO) aimed at offsetting carbon emissions from international aviation. India actively participates in CORSIA and has made commitments to offset its international aviation emissions through various measures, including the procurement of eligible carbon credits from relevant projects.

### **4.6 Promotion of Sustainable Aviation Fuel (SAF):**

The promotion of sustainable aviation fuel is a vital initiative in reducing the carbon footprint of the aviation sector. In India, the government is actively exploring the use of sustainable aviation fuel and is working towards developing a roadmap for its adoption in the aviation industry.

Regarding the logistics sector, it is estimated that approximately 14% of the Gross Domestic Product (GDP) is spent on logistics, a higher proportion compared to most developed countries. Currently, road transport accounts for 71% of goods transportation, followed by railways at 18%, pipelines and inland waterways at 4% each, and domestic aviation at 3%. Trucks represent the largest energy consumers in this sector, utilizing an estimated 1.3 exajoules (EJ) in 2020. They account for over 70% of the energy used in freight transport, making it the fastest-growing segment in terms of energy consumption, having doubled since 2010.

## 5. Results and Discussion

The Green Freight India Program has achieved significant activities and milestones in its efforts to promote sustainable and efficient freight transport. Some notable achievements include:

- **National level "Consultative Meeting on Freight Smart Cities":** On July 2, 2021, under the chairmanship of Hon'ble Minister of Housing and Urban Affairs Shri Hardeep Singh Puri, a national-level consultative meeting on Freight Smart Cities was held. The meeting emphasized the importance of city logistics in enhancing the efficiency of freight movement. As part of this initiative, the program launched a dedicated website for Freight Smart Cities.
- **Freight Green House Gas (GHG) Calculator:** The Logistics Division of the Ministry of Commerce and Industry launched the Freight GHG Calculator on July 28, 2021. This calculator enables stakeholders to assess and quantify the greenhouse gas emissions associated with freight transport activities. It serves as a valuable tool for tracking and monitoring carbon emissions in the logistics sector.
- **Adoption of Freight GHG Calculator methodology by Ministry of Railways:** The methodology used in the Freight GHG Calculator has been adopted by the Ministry of Railways as Rail Green Points, effective from April 1, 2022. This adoption signifies the recognition and acceptance of the calculator's credibility and effectiveness in measuring and managing greenhouse gas emissions in rail freight transportation.
- **Development of Commodity-Specific Post-Harvest Protocols and Technical Design Specifications for Cold Chain Infrastructure:** The program has developed Commodity-Specific Post-Harvest Protocols for 10 fruits and vegetables. These protocols provide guidelines and recommendations for preserving the quality and freshness of agricultural produce during post-harvest handling and transportation. Additionally, Technical Design Specifications for Cold Chain Infrastructure have been developed to ensure the efficient and sustainable operation of cold chain facilities.
- **Capacity development of partners for National Logistics Masterplans:** The program has focused on enhancing the capacities of partners involved in the development of National Logistics Masterplans. Through exposure to best practices from the European Union, partners have gained valuable insights and knowledge to inform the formulation and implementation of national logistics strategies and plans.

### 5.1 To identify the key factors that impact the health and well-being of workers in the freight sector of India

The Indian freight sector poses significant challenges to the health and well-being of workers due to physical demands, occupational hazards, long work hours, poor working conditions, road safety risks, and exposure to environmental pollutants. Workers face musculoskeletal disorders, fatigue, and injuries from physically demanding tasks. Irregular work hours lead to fatigue and sleep deprivation, increasing the risk of accidents. Inadequate rest areas, lack of clean water, and extreme temperatures affect their physical and mental well-being. Poor road infrastructure and reckless driving behavior further endanger workers, especially truck drivers. Additionally, noise and air pollution in the working environment contribute to hearing loss, respiratory problems, and stress-related health issues. These factors pose serious health risks to freight workers in India.

## 5.2 To evaluate the role of government policies and interventions in shaping the freight sector in India.

The freight sector plays a crucial role in India's economic development, influenced by various government initiatives and policies. The Goods and Services Tax (GST), implemented in 2017, simplified logistics and supply chain operations, leading to easier interstate movement of goods and more efficient nationwide freight transit. Infrastructure development projects, such as the Bharatmala Project, Sagarmala Project, and Dedicated Freight Corridors, have improved road, rail, port, and airport connectivity, enhancing the capacity and efficiency of the freight industry. The government's focus on safety and security includes the use of electronic weighbridges, toll collection systems, and car tracking technologies. The National Logistics Policy aims to create a comprehensive and effective logistics network, addressing issues like high costs and complex regulations. Additionally, the government supports environmentally friendly goods transportation through initiatives promoting the adoption of electric vehicles and clean fuels for trucks.

## 5.3 To assess the effectiveness of the Green Freight India Program in promoting sustainable practices in the freight sector of India

After adopting green freight initiatives in India, there can be several positive impacts on the freight transport sector and the overall sustainability of the country. Some of the potential impacts include: **Reduction in greenhouse gas emissions:** Green freight measures, such as the adoption of cleaner fuels, improved logistics practices, and the use of energy-efficient technologies, can contribute to a significant reduction in greenhouse gas emissions. This helps India in achieving its climate change commitments and targets under the Nationally Determined Contributions (NDCs).

**Improved air quality:** The implementation of green freight practices can lead to a decrease in air pollution. By promoting cleaner fuels and technologies, such as electric vehicles and hybrid engines, the emissions of pollutants, including particulate matter and nitrogen oxides, can be reduced, resulting in improved air quality in and around transport hubs and major cities.

**Enhanced energy efficiency:** Green freight initiatives focus on optimizing logistics operations, which can lead to improved energy efficiency in the freight transport sector. By reducing empty miles, optimizing routes, and adopting advanced technologies like telematics and intelligent transportation systems, energy consumption can be minimized, leading to cost savings and reduced reliance on fossil fuels.

**Cost savings for businesses:** Green freight practices often result in cost savings for businesses involved in the logistics and supply chain sector. By optimizing transportation routes, reducing fuel consumption, and improving operational efficiency, companies can lower their operating costs, improve their profit margins, and gain a competitive advantage in the market.



## 6. Recommendations for the Green Freight India Program:

- **Encourage Modal Shift:** Promote a modal shift from road transport to more environmentally friendly modes such as rail and waterways. Provide incentives and infrastructure support to facilitate this shift, emphasizing the advantages of lower carbon emissions and reduced fuel consumption.
- **Efficient Route Planning:** Encourage freight operators to adopt advanced technologies and tools for efficient route planning. This includes optimizing routes, minimizing empty miles, and implementing real-time tracking systems to reduce fuel consumption and emissions.
- **Promote Sustainable Fuel Alternatives:** Encourage the use of sustainable fuel alternatives such as liquefied natural gas (LNG), biofuels, and electric vehicles (EVs) for freight transportation. Provide financial incentives, grants, and subsidies for the adoption and development of these technologies.
- **Improve Logistics Infrastructure:** Invest in the development and improvement of logistics infrastructure, including dedicated freight corridors, modernizing ports, terminals, and warehouses. This will help reduce congestion, streamline operations, and enhance efficiency, leading to lower energy consumption and emissions.
- **Collaboration and Knowledge Sharing:** Facilitate collaboration among stakeholders, including freight operators, logistics providers, government agencies, and environmental organizations. Encourage knowledge sharing, best practices, and capacity building programs to promote green freight practices and technologies.
- **Carbon Offsetting and Certification:** Introduce a voluntary carbon offsetting program for freight operators, allowing them to offset their carbon emissions through verified and accredited projects. Develop a certification system to recognize and reward freight operators who demonstrate exemplary environmental performance.

## 7. Conclusion

The research paper examined the impact of government policies and interventions on the freight sector in India, explored the factors affecting the health and well-being of workers in the industry, and evaluated the effectiveness of the Green Freight India program in promoting sustainable practices.

Through the analysis, it is evident that government policies and interventions play a crucial role in shaping the freight sector in India. These policies include modal shift promotion, efficient route planning, infrastructure development, promotion of sustainable fuel alternatives, collaboration and knowledge sharing, carbon offsetting, and regulatory support. The implementation of these policies has contributed to significant changes in the sector, fostering a more sustainable and environmentally friendly approach to freight transportation.

The research also highlighted the key factors impacting the health and well-being of workers in the freight sector of India. These factors include long working hours, exposure to pollutants, physical strain, and inadequate safety measures. Addressing these factors is essential for ensuring the overall sustainability and well-being of the industry.

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