



Evaluating Sustainable Practices in International Freight Transportation

Effects of Sustainable Freight Practices

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Abstract
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With environmental concerns on the rise, the requirement for sustainable practices in global logistics has come to the forefront of the debates as the current predominant approaches to freight management incur environmental problems. This research, outlines the implementation of green logistics in the international freight transport sector and the consequences that come with greener logistics. Moreover, through a comprehensive theoretical framework and analysis of sustainable approaches, the research addresses the central question on the impact of the implementation of sustainable practices in freight management using green logistics.

The study utilizes a qualitative methodology to explore the complex sphere of sustainable practices within international cargo transportation over the long haul. Conducting interviews is among the research tools that this study used to uncover the complex and deep issues that arise from sustainability in the logistics industry. The reason behind choosing interviews stems from the great benefit of capturing participants' subjective opinions and creating an environment of interaction among themselves. A total of five interviews were carried out during the month of March 2024. In order to get over the practical difficulties that the matter is closely related to, the convenient sampling will be used to make the individuals closely related to the subject of the research as participants.

The research results demonstrate the fact that the key task for the authorities is to stimulate the sustainable investments through the introduction of incentives, tax cuts and the rule making policy. On the one hand, companies are supposed to put priority on sustainability in their operations and building ties with eco-friendly partners and purchasing more clean power technologies. Supply chains can be improved by optimizing routes for ships and trucks, enhancing vehicles' economy, and adopting cutting-edge logistics technological solutions.

Keywords Sustainable Practices, Green Logistics, International Freight Transportation, Environmental Pollution, Carbon Emission Reduction.
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1 Introduction

In the commissioning company, logistics is the heart of current global trade, the underlying support that ensures goods get to where these need to be. Nevertheless, the conventional reliance of oil and gas production on fossil fuels combined with the backwardness of existing processes has provoked critical environmental issues, significantly adding to the air pollution, noise pollution, carbon dioxide emissions and habitat degradation. While the negative effects of such activities keep getting more pronounced, the need for change has fuelled the emergence of green logistics, a paradigm shift that entails blending of sustainable practices to avert environmental degradation while maintaining profitability. At its core green logistics tries to harmonize the apparently clashing goals of economic growth and environmental responsibility through the use of innovative approaches to transportation, warehousing, and supply management. One of the core ideals of this movement is to adopt alternative energy sources for example, renewable fuels and electric cars, as a way to minimize the use of fossil fuels and decrease greenhouse gases. It is possible for organizations to make a great impact on the environment by changing to greener technologies in logistics what will result in a significant decrease in spending on operational expenses (Mohsin et al.,2022). Among these strategies are fuel-effective routing that minimizes fuel consumption and emissions, as well as efficient management of inventory that prevents oversupply and unnecessary transportation. Companies will not only see a reduced environmental footprint but also savour costs and increase competitiveness if processes are streamlined and efficiency is ensured as priority basis.

The commissioning company is an established automotive manufacturer headquartered in Finland, Poland, and Germany. It specializes in electric vehicle solutions and convertible roof systems, offering comprehensive services in engineering, manufacturing, and battery systems. Known for its innovative approach, the company is a key partner to leading car manufacturers globally. It is committed to advancing sustainable mobility with its cutting-edge technology and

production expertise. The study is of much importance to the commissioning company. The study motivates the company to choose green logistics practices thereby reducing its operational costs and building its brand reputation as a responsible organization. In addition to operational changes, green logistics also addresses the overall collaboration and transparency within the supply chain. It comprises of forming alliances with the suppliers and clients that are committed to sustainability target and entails negotiations with policymakers and stakeholders who are driving for positive policies and programs. Through teamwork, stakeholders can collaboratively capitalize on the common wisdom and strengths to bring about a significant impact in the industry. Moreover, green logistics goes beyond the environmental issues to include the social and ethical dimensions. These initiatives include actions aimed at improving the safety and welfare of the workers, observe fair labour practices, and care for communities facing logistics operations. Through the implementation of the triple bottom line, which includes people, planet, and profit, companies show their dedication to responsible corporate citizenship and at the same time earn loyalty from their consumers and investor. Thus, this paper is designed to assess the sustainability practices in the international freight transportation with a reference to the green logistics. Through analysing the effectiveness of various sustainable approaches, this study aims to offer insights into minimizing the negative environmental impacts and improving the operational efficiency in the logistics sector. More important is the understanding that this paper would benefit the commissioning company in the sense that by choosing green logistics practices, the company will be able to put its production in accord with the expectations of the society and legal norms. The company is able to achieve these objectives by implementing fuel-economy routing, efficient inventory management and partnering with fellow sustainable organizations thereby reducing its operational costs and building its brand reputation as a socially responsible organization.

The research question is: What is the impact of the implementation of sustainable practices in freight management in the green logistics?

2 Theoretical framework

Green logistics, also known as sustainable logistics or eco-logistics, is the new way of thinking about the logistics process (Koh et al., 2007). At the centre of green logistics are principles and strategies that are driven by the need to minimize the effect of transporting goods along different stages of the supply chain. These principals include a wide variety of initiatives, all dedicated to creating a more environmentally friendly manner of item supply.

2.1 Optimisation of transportation routes

One of the major areas of work in the green logistics domain is the development of the green route planning for the transportation. Besides having the advanced and analytic tools, businesses have the capacity to economize in a better way, without using much gas or creating more pollution by choosing the shortest ways that use less gas (Hoffert et al. 2002). This equivalent to vice versa minimization of the environmental effects of inland transport reducing the transport time and costs. The building of roads in an optimal manner relative to transport routes results, on the one hand, in the decrease of traffic jams and, on the other, in the diminishing of exhaust fumes created by cars as a consequence which eventually leads to a positive influence on the environment of the cities. Saving energy is the main concern in respect of green logistics. The implementation of energy-efficient vehicles, equipment and infrastructure will also help; in addition to this, efficient driving skills and idle reduction are important. Use of alternative energy sources, like solar power and wind energy, in the logistics side is also another measure that fully agrees with the fossil-fuel reduction and lowering down the greenhouse gas emissions. Assuming this approach, organizations could put the listed measures into practice and obtain cost-saving as well as have less of environmental problems. The limitation of waste generation for environmentally sustainable logistics represents one of the critical measures. This calls for the use of less wasteful packaging which will curb the overuse of packaging materials as well as encourage the recycling and reuse of packing

containers across the supply chain. The system of the material circle that means resources are used more efficiently and waste is minimized, will result in the decrease of the environmental pollution and rise of the costs, related to the purchase of materials and also to the waste processing.

2.2 Promoting the spread of renewable power

Promotion of renewable sources by logistics is a key part of curbing emissions and striving for sustainable energy system. Clean and renewable energy sources provide an opportunity for logistics companies to reduce their carbon footprints significantly and at the same time move towards a sustainable development pattern. Green logistics is a key element of this initiative which is based on the premise of comprehensive supply chain management, striving to reconcile economics with ecology. Green logistics is the method of putting the environment on the front line of logistic procedures and by implementing advanced technologies and innovative practices it promotes a reduction in environmental impact. This multifaceted approach not only helps to decrease carbon emissions but also boosts companies' competitiveness and sustainability within more and more environmentally friendly marketplace (Maack, 2012).

At its heart, the expansion of renewable resources in logistics requires the knowledge of how energy systems and supply chains interact with each other. The companies can move towards renewable energy sources like solar, wind, hydro, and biomass instead of using fossil fuels which are considered the major cause of environmental problems. Solar energy becomes the focus for environmentally friendly energy choices in logistics. The spreading of solar photovoltaic (PV) technology helps logistics facilities to harvest the sun and convert it into electricity thus creating a sustainable and renewable energy resource (Maack, 2012). By setting up solar panels onto warehouse rooftops and parking lots, logistics companies are able to generate onsite renewable energy hence cut their dependency on grid-based energy

sources. This distributed energy generation model not only increases energy resiliency but also it ultimately contributes to the carbon neutralization of logistics operations.

Likewise, wind power offers good alternative for the logistics companies in their bid to keep their carbon footprint at the minimum level. Wind power, on or off site, provides a flexible and clean power generation technology. The ideal location of wind farms in the areas near distribution centers or transportation hubs supports logistic companies as the abundant energy potential of wind can help to further their sustainability efforts. Hydro-electric power, which is known as pioneer renewable energy technology, can be another successful element of greening logistics operations (Maack, 2012). By means of using hydroelectric turbines, logistics companies can use the kinetic energy of the-fast moving water to produce clean energy. What makes this renewable power resource unique from other types of energy is that it is especially beneficial for businesses located by rivers, streams, or other water bodies as it offers a reliable and uninterrupted power supply with minimal environmental impacts.

In addition to that, biomass energy provides a sustainable alternative to old fossil fuels generally within logistic operations. Biomass created in organic materials like timber, agrowaste, and municipal solid waste can be transformed to either biofuels or used to generate power onsite. Investing in biomass energy infrastructures will help logistic companies reduce greenhouse gases emissions due to transportation and warehousing activities as well as create biological waste management that is sustainable. Along with a growth in energy storage technologies, there is a synergistic effect of renewable energy integration in the logistics sector. Batteries, flywheels and other energy storage systems are key elements in the technique of balancing the ups and downs of the supply and demand that are inherent in renewable generation (Moseley, 2014). Through the energy storage technique during high production and discharge during peak times, the power systems that are based on renewable energy sources are made more robust and reliable in the logistics operations. Not only technological innovations but also policy frameworks and regulatory incentives increases the speed of the

implementation of renewable power among the logistics sector in many countries. Policy makers and regulators may apply policy instruments like renewable energy obligations, feed-in tariffs, and tax credits to support investment in clean energy projects. Through setting up an empowering atmosphere, which will facilitate a smooth transition to the green and resistant logistics sector, policymakers are able to speed up the decarbonisation process.

Moreover, strategic agreements and collaborative work can, in a way, put the promotion of renewable power at the centre of the logistics community. Teaming up of logistics companies with renewable energy developers as well as academics and NGOs can help pave the way for knowledge sharing, transfer of technologies and capacity building efforts. Through tapping into the power of collective experience and resources, stakeholders easily eliminate the barriers to promoting the use of renewable energy and introduce systemic change to the logistics sector. Besides the ecological benefits, renewable energy integration, being a strong financially based opportunity for logistics companies, also brings some other economic benefits with it. The use of renewable energy options helps to avoid extreme dependence on fossil fuels directly contributing to energy price fluctuations and long-term cost reliability (Kalair et al., 2021). In addition to this, investments in renewable energy infrastructure can bring wonderful results in the form of energy savings, government incentives and improved brand reputation alike which tells us that such businesses are environment friendly. To take a wider picture we should make spreading renewable power in logistics emission free. This is the only way to make energy sustainable. Shifting to a clean and renewable energy mix that comprises solar, wind, hydro, and biomass, brings logistic companies tremendous benefits of decreasing carbon emissions and improving efficiency and competitiveness. By implementing technological innovation, governmental policies, and cross-industry partnerships, logistics may be the sector driving the world towards a sort of future that is green and sustainable.

2.3 Sustainable Practices in International Freight Transportation

The adoption of sustainable practices during the freight shipping globally connect industry is paramount to the effective handling of the beloved systemic and transnational issues within the complex freight system. International cargo transportation infrastructure is an intricately interwoven network that reaches more than just vast distances, but also entails varied modes of transportation and complex logistics networks that traverse continents and oceans. Certainly, these challenges are intertwined with intricate controversies and formidable barriers, but still those hurdles of complexity foster creativity and prepare the way for sustainable outcomes. Implementation of sustainable operations is a dual task, it not only helps to address the environmental issues but also encourages resource conservation and supply chain strengthening thus transforming the dimensions of global trading and logistics operations in to a resilient framework (Guang et al., 2012).

The crucial idea embedded in sustainability in global freight transport through means of addressing greenhouse gas emission lies at the core. The transportation industry is responsible for a significantly high percentage of the total worldwide carbon emissions especially considering the growing significance that has recently been attached to freight transportation. Initiatives to reduce emissions by substituting clean fuels, installing energy-efficient equipment, and optimizing transportation routes are core, vital, and necessary at this point. As switching to alternative fuels including LNG (liquefied natural gas), biofuels and hydrogen is being considered, it is clear that these are the most effective ways to reduce the carbon footprint of a freight rail (Guang et al., 2012). Nevertheless, the hybrid and electric vehicles will be one of the paths to sustainability that the alike technologies such as telematics and the real-time tracking will follow. The goods will always be distributed on the continents and cross-boarders without creating unnecessary problems and hindrances.

Besides the emission control, sustainable practices have subdivisions with many activities that are directed towards environmental protection in logistics operations throughout the whole

supply chain. It spans from finding the most optimal packaging materials to minimizing the amount of waste that comes out of the production to recycling and reusing the materials. Through implementing lean logistics concept and, at the same time, adapting just-in-time inventory management methods, businesses are able to improve their operational efficiency, eliminate overall inventory, and lead to less waste within the supply chain (Guang et al., 2012). Moreover, the implementation of reverse logistics facilitate efficient return and recycling of packaging materials and products also which control resources and bring environmental sustainability. This brings also circular economy.

The most crucial strategy to alleviate the environmental impact of the international freight transportation sector is providing wave for more ecological sport modes. Even though road transport continues to be a dominating mode of transport in many regions, a modal shift is being encouraged via switching to rail, waterway and intermodal transport whenever applicable. Rail transport has been well-known to consist of lower emissions and higher energy efficiency per ton-kilometer than long-haul road transport due to that it can provide an eco-friendly alternative can dramatically cut the environmental impact of freight transport operations (Guang et al., 2012). In addition to the earlier effects, air transport, shipping, and land transportation are all crucial for international transportation, but it is very important that greenhouse gas emissions be reduced considerably.

Moreover, the theme of sustainable operations is open-ended, and it covers more than just environmental conservation; rather, it considers the social and financial aspects as well. Such an initiative as improvement of the working conditions for transport workers, promotion of fair labor practices, and support of local communities adversely impacted by the freight transport a have to be an essential part of sustainability. Such programs, like worker training and career development courses, should be supported not only because of their benefits in terms of safety and work performance but also because such programs improve people's physical and mental state (Guang et al., 2012). Moreover, by backing the small and medium-sized enterprises

(SMEs) which work in the freight transport sector, the base for local growth and stability can be strengthened that leads to economic, social and ecologic sustainability and promotes inclusion.

2.4 Modal Shift

International freight modal shift is a structural change in logistics systems that is driven by sustainability, cost, and environmental responsibility. The shift in the modal split of freight traffic that is this transformative process includes a drastic complex assessment of the viability of freight across a spectrum of transport modes including roads, rails, sea, and air taking into account multiple factors such as cost, time and environmental impact (Monios & Bergqvist, 2016). The shift of modalities represents the development of a new mindset in urban planning and logistics management. The complexity of the relationships between economic activities, environmental health and societal prosperity is the basis of this. The modal shift agenda aims at using resources wisely, improving environmental performance and making the global supply chain more flexible to the challenges facing the emerging global economy. A comprehensive redesign of freight transportation practices has been propelled by a realization that these economic, environmental and social dimensions are interrelated and complex. Modal shift programs draw attention to the fact that transport choices are complex, as these are interwoven with environmental sustainability, economic efficiency, and social imbalance. By designing modal shift, stakeholders clearly send the message about both strategic and socially responsible decision-making. In addition, the highlighted efforts in resource efficiency and low carbon footprint emphasize the active role of the company in dealing with current global demands like climate change and resource scarcity. Mode shift, basically, is a paradigm shift in transportation management which takes into account both the economic and environmental implications along with social aspects. To achieve a more efficient, adaptable and sustainable global transport system, stakeholders need to implement proper re-alignment of freight and initiate prioritizing sustainable transport modes. A key part of modal shift campaigns is that it

enables the major greenhouse gas emissions to be significantly diminished through the well-thought-out reorientation of freight from air to ship or rail for long-distance travels (Monios & Bergqvist, 2016). This gradual change intentionally marks an essential shift from the present to more environmental friendly freight practices, which is ultimately driven by the realisation of the great threat that greenhouse gases pose to the environment. The emphasis on use of sea and rail transport over air travel demonstrates not only the ecological compulsion but also the financial and operative advantages associated with this particularly adopted approach.

The variables that are considered in import transport decision making are not only environmental sustainability but also economic viability and operational efficiency. Although air transportation is certainly the fastest and the ease of use, there are still great environmental costs associated with it such as emissions, which are mostly abnormal to sea and rail congestion. On top of this environmental harm, the exhaustion of the fuel is exacerbated by the limited supply of the fuel resource followed by the associated geopolitical risk which exists from extraction and the resulting movement of the resource. Compared to air, sea and railway modes are a much more energy efficient and green alternative, with significantly lower carbon footprint per unit of transported freight. Also, shifting freight between air and sea/rail modes are in line with the climate mitigation and sustainable development ambitions. The rise of carbon emissions linked to long-distance freight carries not only does contribute to global ambitions to minimize the effects of global warming but also strengthens the global economy of a more resilient and sustainable nature. Through the availability of alternative transportation modes that emit very low or zero carbon emissions, businesses and policymakers can help lessen environmental consequences of cargo transportation services while simultaneously achieve efficiency and resilience in logistics (Shaheen & Lipman 2007). On the other hand, tactical shifts in the assignments of goods to air, sea or rail transportation channels offer hard economic perks of lower costs and greater efficiency. Although cargo transportation carried via airways is effective in terms of fast delivery, the operational costs that come with it are always high and therefore the freight rates are also high. This further affects the profit margins

and gives unfavorable competition in the market. In contrast, the servicing cost of seaports and rail transport lower, providing good options for companies that intend to maintain optimize supply chain operations by keeping the costs at minimum.

The ecological advantages of modal shift are not limited to just decreases in greenhouse gas output, but has a wide range of implications when considering sustainability throughout the logistical system. The taking up modal shift projects is the direction the stakeholders move with endeavour to change the way goods are transported, understanding that this key act should not degrade the environment or overuse the resources, but rather minimize the ecological degradation and the environment externalities throughout the supply chain lifecycle (Monios & Bergqvist, 2016). This inclusive approach recognizes that transportation decisions are connected together with broader environmental and social consequences, giving a hint of it is to considerate of sustainability awareness in every single aspects among freight logistics. One of the major components of modal shift strategies is the designation of dispatch which is the best for every operations management. Consider one sea transport as a sine qua non of environmentally friendly freight option from the point of shipping bulky and non-perishable goods over far distances. The fact that shipping by sea saves on fuel use for large-scale cargo transport and a subsequent large number of air trips eliminated is a great environmental attainment as it helps in reduction of carbon emissions and environmental impact. Through tapping pooled capacity and volume that is particularly provided by seaborne transportation, companies manage to reduce their greenhouse emissions considerably from their lines while also stay competitive and have lower supply chains costs.

In the same way, rail transport also comes in as a sustainable option providing great efficiencies for shipping of high-volume commodities over long distances. The rail transport sector with its own dedicated rail routes and state of the art infrastructure is able to leverage many advantages over the road-based freight system, including lower fuel consumption, reduced congestion, and lowers per ton-mile emissions. By focusing on rail traffic for long-

distance freight trips, the main actors can take advantage of the environmental benefits of modal shift while also fosters the sustainability and resilience of their supply chains (Monios & Bergqvist, 2016). In addition, the electrification of rail lines and the adoption of alternative fuels are among the features that will make the railways an important element of green-oriented unhindered freight transportation in the coming years. Besides the environmental advantages of the freight transport modes, modal shift initiatives also aims at maximising the overall efficiency and sustainability of the logistics chain. By merging various transport modes continuously and strengthening intermodal connections, stakeholders can reduce empty driving, thus reducing congestion, and maximizing the use of existing infrastructure. Besides, this cooperative way not only shrinks the environmental footprint of freight logistics but also improves operative efficiency and economical effectiveness for businesses, customers, and the society in general.

Furthermore, modal shift programmes make up a significant part of the efforts towards the introduction and implementation of intermodal transport systems, which act as a critical link to smooth the period of handing over cargo from one transport means to another (Monios & Bergqvist, 2016). Among the reasons why intermodal systems are gaining popularity, one reason is that this transport method integrates multiple systems in a single framework, which in turn allows ease and efficiency in cargo transfer, reducing the transit time, and increasing the supply chain resilience. Via the means of standardised interfaces, interoperable protocols and harmonized operational procedures intermodal transportation systems facilitate the smooth intermodal transit, so the jam does not develop, reliability of transport system rises and the resource-use is optimized. Intermodal transportation systems not only offer reduced freight hauling time but also have additional advantages such as goods distribution and freight reliability. Through such systems, journey connections are made more convenient and transportation resilience is enhanced, which improves the ability of enterprises to overcome disruptions and obstacles in the market on time. Furthermore, intermodal systems encourage collaboration and conjunction of all transportation industry players, as well as stimulate new

ideas and keep freight logistics techniques a step ahead. Stakeholders can capture the potential of modal shift initiatives by making strategic infrastructure investments and adopting various modes of transportation through the promotion of new technology and automation. This will pave the way for cleaner, less congested, and more reliable freight transportation systems.

The incorporation of intermodal transportation systems into modal change programs involves a wide variety of benefits within the economic, environmental, and operational spheres, therefore introducing a new kind of eco-friendly logistics system. From an economic point of view intermodal systems can boost savings and efficiencies. It is achieved by using economy scale, algorithms for optimizing routes, and modal adaptability. Diversification of transport routes and modes will help business entities curtail risk in case of supply chain disruptions, become less dependent on single transport modes and strengthen their competitiveness in the global arena (Suryawanshi & Dutta 2022). Also, the deployment of cutting-edge technologies, like live tracking vehicles, predictive analytics and automation, provide stakeholders with the ability to monitor cargo movements, forecast possible threats and route properly decisions, in real time. The use of data-driven insights reduces idle times and maximizes asset utilization pushing for domestic economies which is in touch with the environmental sustainability objectives. Such merging of technology and logistics is not only a great source of operational efficiency but also make possible both to cut cost drastically and to boost supply chain performance.

2.5 Route optimization

The other green way of the shipping of international freight by air is optimization of the routes. Technologies such as, GPS tracking, real time data analytics and route planning software, can be used by companies to be efficient in planning, monitoring, and execution of supply chain. When these are able to do that human will see reduction in costs and the negative impact on

the environment for goods' transportation. First of all it saves fuel, is not letting out harmful emission, cuts the travel time and helps in releasing lessened transportation cost. In addition, route optimization, one of the goals that are set in order to reduce the quantitative number of vehicles on the roads significantly, the harmful effects of too long traffic queues and traffic jams which are also one of the main factors that influence the environment in a rather negative way. However, technologies of the vehicles is so important because of the fact it is connected to the economy of the world. The harmony of the world depends on the relations of all spheres of the life. Among the cars like diesel and electric vehicles that are fuel-efficient and release less emissions, improving air quality is certainly one of the things that can be contributed to as well as cut down the emissions that happen during the transportation process. Though, high-end tachograph and fleet management systems enable businesses to monitor and adjust fuel consumption, vehicle performance and emissions in real time mode, as a result, cost less for fuel and less pollutant. Intermodality that relates to environmentally sound mode of transport helps to move between one mode of transport of the different types of transport when freight is moved in a given supply chain. Businesses can also utilize the service of the transport and logistics provider that acts as a one-stop-shop by managing both the sending and the receiving sides of goods traffic. All it takes is transporting the goods in containers or standard loading units that can be transported easily by rail, road and sea cargo services without any need for manual loading or re-packing (Hakala, 2008). However, by reducing inventory holding and transport costs at the same time, it does a favour to the nature and solves the issues rising out from cargo operation and transporting.

A change in alternative fuels used is one of the most important parts of common green sea transport. Renewables such as biodiesel, renewable natural gas, and hydrogen with super low carbon footprint are able to claim being healthier alternatives to the use of fossil fuels in general. Besides, the production of SAFs may as well lead to the decrease in carbon impact of airfreight ops among the transport modes that are considered to be quite carbon-intensive. Through the direct funding of research and development investments, the facilitation of

alternative fuel adoption as well as insisting on fuel savings across the board, international freight transportation is able to lower its carbon print and support worldwide climate change mitigation efforts (Hasan et al., 2021). Holding the balance of interests between different stakeholders could be a crucial feature in creating a sustainable international freight transportation. Enabling the government authorities, industry associations, logistics providers, shippers as well as consumers to get together can be the foundation for the sharing of knowledge, practice exchange and permanent endeavour of mono-issue on the sustainability problems (Gonzalez, et al., 2023). For instance, the CDP could encourage enterprises to reduce their carbon emissions voluntarily via sector-wide sustainability standards and certifications, partnerships between public and private sectors for environmental infrastructure and technology.

2.6 Environmental Impacts and Operational Efficiency

Adhering to sustainability programs in relation to international cargo transport by the logistics worldwide industry is of a significant importance because it helps in mitigating environmental problems. Sustainability has its role not only to nurture environmental sustainability for organizations but also it helps move towards a greener environment and at the same time gain higher benefits such reduction of greenhouse gas emissions, improvement of air quality, lesser natural resource consumption, increase in operational efficiency and compliance with the environment requirements and standards. Almost certainly, cutting greenhouse gas pollution is the key ecological benefit of integrating sustainable practices in super haulage (Santos et al., 2010). The transportation sector is one of the major greenhouse gases contributors and logistics transport weighs in a certain way into the large volume of these gases. Moreover, Brew Review report indicates that shipping is a major emitter of GHG. Infact, 3 % of global CO₂ emissions comes from maritime transport.

Improved air quality is one other significant environmental advantage of sustainable freight transportation practices. Diesel engines, especially in trucks and ships, exhaust poisonous substances such as nitrogen oxides (NO_x), particulate matter (PM), and sulfur dioxide (SO₂) that are harmful to human health and the environment. Through the use of cleaner technologies and fuels, such as electric vehicles, low-emission engines and renewable fuels, companies can assist in controlling air pollution and the quality of air in communities adjacent to transportation corridors (Shah et al., 2021). In addition to improving health of the public. It also eliminates environment degradation and ecosystem destruction that are caused by air pollutants. The protection of natural resources is an important environmental outcome of sustainable freight transportation. Logistics industry heavily depends on finite resources such as fossil fuels, minerals and water for fuel, infrastructure and overall operations. Through optimizing transport routes, improving vehicle efficiency and promoting intermodal transportation, companies are able to reduce resource consumption and minimize the environmental impact of freight transportation. Moreover, using eco-friendly packaging materials and methods can result in the preservation of natural resources and less waste along the whole supply chain, thus adding to the concept of environmental sustainability.

In addition to environmental benefits, the green initiatives such as route optimization and intermodal transport can more also increase operational efficiency of international freight carrier. This is achieved through the application of the advanced technologies and data analytics which enables the generation of the recoverable routes for goods transportation and consequent cost reduction. Besides the fact that companies decrease fuel consumption, there is also the consideration that scheduled delivery can be run in such a way that there is less nightmare. The short delivery time which in turn allows the other participants in supply chain catch up. Similarly, intermodal transport goes with switch of cargo from one mode of transport to another without human hand or similar reworks. This also reduces transit times and transportation expenditure and makes supply chain management more flexible and reliable. The consequence is to create general efficiency in the supply chain. On the other hand, there

should be no compromise on the part of the freight transport sector that operates internationally on the topics of environmental standards and regulations. Owing to their commitments to climate concerns, governments in the global arena have established a rulebook that sets limits on emissions, raises the quality of air and protects natural resources (Baumert et al., 2002). Next rule would be that companies will be left out of the benefits of free trade if these rules and standards are not followed. This will result to the avoidance of such companies from incurring financial penalties as well as loss of reputation due to non-compliance. While that, the organization also needs to respond in an immediate manner to the mistakes, or the risks, on environment, and keep the perception of its being environmentally friendly. This action will result in increase of brand credibility, target new conscious clean consumers and create sustainable business ties.

Another obstacle to the international freight sustainability implementation is regulatory uncertainty. Countries globally endeavour to legislate different laws and regulations geared towards the promotion of environmental sustainability. Nevertheless, this landscape is confusing and makes it difficult for businesses to meet these requirements. In addition, ever changing regulations and different regulations within different jurisdictions will pose an issue of compliance and raise compliance costs of businesses that operate in more than one market. Missing cooperation of stakeholders is one of the strongest factors that prevent the use of sustainable approaches in international freight transportation (Ballantyne et al., 2013). Significant efforts towards sustainability demand concerted action of varied participants which includes governments, businesses, society associations, amongst many others spread across the entire supply chain. Nevertheless, there are many difficulties for collaboration, including competing interests, conflicting priorities and lack of transparency and information sharing. The stakeholders of international freight transportation usually have their own and different goals and objectives which can lead to diverse efforts of sustainability implementation. Such as, governments might put eco-protection and greenhouse gas reduction first whereas businesses may prefer to save costs and optimize their operations. Just as an industry association can

advocate for policies that benefit its members, an environmental organisation could push for stricter sustainability goals.

Another key issue is basically the restricted sharing of information between participants that partly increases the barriers for cooperation in international freight transportation. When the information is not comprehensive and up to date on the environmental performance, supply chain performance, and the general performance of the industry, the stakeholders might fail to take informed decisions and develop sustainable strategies. Additional factors such as intellectual property rights, proprietary information, and competitiveness also contribute to information being held close to chest and the cooperation of sustainability initiatives to be challenged. The joint work on the limitation of barriers to stakeholder collaboration in international freight transportation is hard and requires efforts in building the culture of openness and trust among all the operators (Graci, 2016). Such, for instance, may be platforms where all stakeholders come together and exchange their experience, approaches and tell their stories thus making an input in problem solving. Medium that can form a common board for communication and cooperation among stakeholders, vision and, therefore, stimulate collaboration can be provided by the platforms.

On top of that, government can be very influential through creation of policies which would enable different parties to work together, by creating schemes that encourage better relationships and by offering initiatives for joint efforts bringing together public and private sector. In this context, an approach for the governments should be fostering collaboration through subsidies, tax exemptions and operations that inspire businesses to work together to align their goals so that the objective of sustainability can be supported (Willard, 2012). Another type of restrictions that ensures openness and disclosure of information can be positives in term of cooperation, because precisely this openness will assure that every participant have all the data and resources needed to develop good decisions and collaborate in a joint action. Achieving this purpose requires stakeholder collaboration which is the prerequisite of getting

the maximum sustainability benefit in transport freight operations at the international level. Through the creation of a collaborative culture, the promotion of transparency and the sharing of information, and the motivation of cooperation, stakeholders in a Eco-friendly and resilient logistics sector can work together to handle the challenges, encourage innovation as well as last importantly, attained sustainable and resilient goals. Collaboration and partnership are ways of the industry to get over the hurdles and build a path to a green, efficient, and sustainable future.

3 Methodology

3.1 Research Method

This study utilizes the qualitative research method which is specifically the best among the others because it has the ability to venture deep into the stakeholders' perspectives and experiences in regards to sustainable practices in rail transportation. Qualitative research excels in this dimension by laying a broad foundation for the complex questions, and thus, making it possible to get acquainted with the multifaceted sustainability issues in the haulage sector. By employing qualitative research techniques, scientists can delve deep into the layers of meaning, the social circumstances, behavioral patterns and contextual matters that form the stakeholders' perception of environmental responsibility. Constructively involving with main players, this process works to make a contextual fabric of insight real and lasting. The research ensures that direct dialog with these stakeholders give a better understanding of many and different ideas which can subsequently be used to shape programs that are sustainable. Such an active approach not only highlights the sophistication of sustainable problems but also values the need for including the diverse opinions and expertise in finding more effective remedies.

On the other hand, qualitative research enables the researcher to present an adaptable and flexible framework that is capable of exploring theme perceptions and diving deeper into unanticipated areas. It is the intention of the study to conduct the analysis both in qualitative and quantitative approaches so that the findings may explore unidentified ideas and views which may not be obtained by quantitative approaches. Through qualitative approach comprised of in-depth interviews, the investigation aims to unearth the reasons for the environmentally responsible behavior, challenges, and opportunities that the enterprises encounter.

3.2 Data collection instruments

In this study, primary data will be obtained by interviews being the most important method of obtaining information. These techniques are chosen for their capability to elicit the exact feelings that arise from the implementation process of a global zero waste program in transportation industry. In interviews, people have a chance to speak up and give their opinions; this makes possible collection of a lot of qualitative data that can reflect the variation in perspectives present among the entire industry. Interviews make it possible to cover personal events and meanwhile reveal the depth of personal experience and insights of the person being interviewed. Participants will be able to take pen to paper and give voice to their ideas, emotions, and experiences in their own language and this will play a crucial part in achieving a precise understanding of the topic.

Interviews assist in collecting the data in this research project with the aim of ensuring that the data addresses the research objectives. As a result, these methods try to keep the realness of participants' own words, which protect from the distortion of participants' opinions. With approach including the participant thesis, the study hopes to bring not only the relevant but actionable insights that could be of great help in the future of sustainable practices in the sector of the freight transportation..

3.3 Method of data collection

The qualitative approach was purposefully selected to ensure that the whole process of sustainable practices in international freight transportation are well explored. Instead, different from numerical analysis which puts stress on data, qualitative research studies the hidden contexts, social interactions and culture guiding the stakeholders towards sustainable life. Qualitative research has very distinct goals and it is achieved through open-ended questions, discussions and that which quantitative methods fail to reveal. By emphasizing on the subtle

details concerning this matter, this approach provides a profound knowledge that enlightens the researchers to focus on the inner complexities and dynamics of freight industry. The qualitative research gives a powerful opportunity to go deeper in the understanding of the stakeholders' opinion about the environment, their driving forces, and obstacles related to the sustainability. The researcher can capture these core points through rich, qualitative data which would help to identify the patterns and trends as well as the emerging themes that are helpful to the more effective strategies. The approach aims for the recognition of a wide variety of narratives, opinions, and perspectives, thereby allowing for direct communication between different stakeholders. Correspondingly, qualitative methodology which is applied in the given research study will look into factors which lie beyond the shallow analysis. The process of meticulous investigation and careful analysis through which qualitative research is carried out is intended to make it possible for insightful transformations and innovations to take shape that lead the way forward.

3.4 Rationale for using this Approach

The need to apply interviews as core data acquisition tool rests in the efficiency of their capacity to trigger subjective feelings, opinions, and views among the participants concerning sustainability in freight transportation. Such approach leads to the set up a platform where ending with the participants and the researcher as well, there is mutual discussion (Chilton et al., 1999). Interviews involve a direct approach which allows for in-depth dives into various individual view points and experiences. Providing free platform for participants to express their positions helps gives the necessary depth of the concept allowing to see sustainability in freight from different perspectives. Through emphasizing qualitative research methods, this study aims to go deeper into the subject and enhance our knowledge of the sustainability in transport sector that reflects different points of view of transport stakeholders. The qualitative research approach employs intensive inquiry and interactive participation which aim to disclose multi-

faceted insights that can subsequently be used in the umbrella of finding more complex and organized solutions to overcome the issue of sustainability in the area of freight shipment.

3.5 Time and Date of Interviews

Interviews were arranged at times that are suitable for both the participants and the researcher. Scheduling flexibility is critical in order to accommodate the availability of busy stakeholders within the international freight transportation industry. The scheduling of interviews also take into account time zone variation for the participants who are in different parts of the globe.

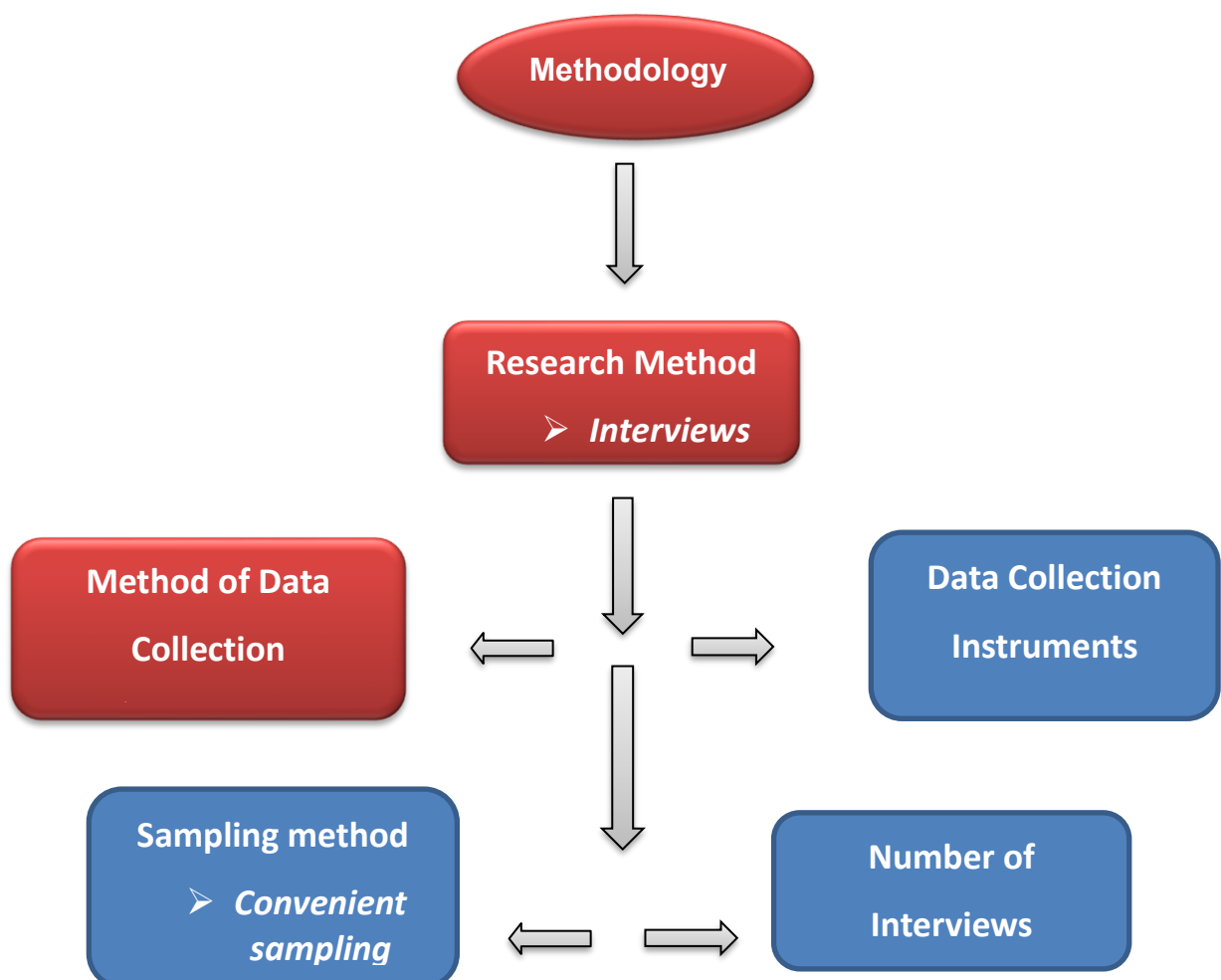
3.6 Number of Interviews

The main goal of the research is to conduct a sufficient number of interviews to achieve the point of saturation – the moment at which no new information or insights emerge from additional interviews. The number of interviews may vary based on the nature of the problem and the different participants, but initially, 5 interviews were planned. Nevertheless, the number can go up or down, depending on the discovery of more themes or the gravity of the insights.

3.7 Sampling Method

Considering the complexity and the practical barriers posed by the international freight industry, this study concentrates on convenience sampling, which is deemed sufficient and such that the results will still be valid and reliable. This method considers the challenges of informing and inviting stakeholders in this sector, which is influenced by a lack of resources and competitive pressure. The participants will be selected by using the criteria of availability, willingness to engage in the research and the fact of looking fit their research area. Sampling is made efficient which helps to bypass logistical challenges. The study uses the most convenient approaches and still gets the representation of diverse opinions. Therefore flexibility regarding study participants enrolment is achieved eliminating time-consuming

processes. This method in fact suits well the freight industry's representatives with their busy timetables and broad territories. Moreover, basis is built on particular experts' advice, which ensures that the advice and conclusions are valid and useful for achieving research objectives. As the study determines to explore the stakeholder group which is tightly involved in freight transportation, the researcher would have the opportunity to capture the personal views and experiences of the industry which are more relevant to the present state of the industry. On balance, the convenient sampling approach enables to tide down the practical constraints of reaching stakeholders in the international freight sector yet ensures a wide ranged insight into radical practices. This way is possible to look at the view of different perspectives that can be used to make result more comprehensive and broad.



Reference: Author's own work (2024)

The qualitative research methodology which is based on case studies, surveys, and interviews is a primary tool of such undertaking that provides a comprehensive view of sustainability in international freight transportation. This approach is important because it has several beneficial reasons. To start with, surveys, interviews, and focus groups provide an indispensable means of acquiring a wide range of opinions and information on sustainable approaches, rules, and limitations regarding freight transportation (Clifton & Handy 2003). Unlike quantitative techniques, which usually concentrate only on numerical data, the qualitative approaches permit researchers to explore all aspects, including the deep reasons, attitudes, and experiences of people, related to sustainability. Additionally, qualitative studies are another level to uncover the element of humanity in the discussions of sustainability issues, thereby leaving the discussions lively and interactive. Researchers obtain much more detailed information, which surveys alone cannot provide, during discussions in which participants' views, opinions, and questions can be seen. The subjective feelings and interpretations of stakeholders are nevertheless the fountains of knowledge for knowing the multi-dimensional nature of sustainability challenges among businesses, governments, and other stakeholders of international development.

Furthermore, qualitative research methods facilitate the integration of ecological practices into varying geographical, cultural, and organizational settings from a broader perspective. By engaging with participants, researchers can determine that the findings derived from sustainability initiatives align with the socio-cultural, political, and environmental contexts in which these initiatives are implemented. It is this strategic understanding that gives the basis of the recognition of the richness of the factors that forms the stakeholders' attitude and behaviours towards sustainability, which therefore informs the relevant interventions and policy measures developed to suit a particular context. The qualitative research approach is also flexible such that the research methods and instruments can be adapted in response to change by the researcher or the emergence of patterns (Tracy, 2019). The size of interviews can be variables, which are set up keeping the research objectives in mind. There is always a scope

of implicating participant dynamics that are in a flux, specifically considering the prevailing circumstances. This flexibility can make room for indigenous themes that emerge during data collection, dig deeper into areas of interest, and help catch a variety of aspects by covering the whole study population, which in its turn leads to more realistic and meaningful results.

4 Results

Before discussing comprehensively in reference to existing literature, following interview responses present a subjective analysis of perspectives gathered from five diverse participants regarding key issues and strategies related to sustainability and global traffic within the freight transportation industry. The interviews were taken on 24th of April, 2024. Through a series of structured interviews conducted via various modes including Skype, face-to-face meeting, LinkedIn chats, and phone call, participants shared their insights on a range of critical questions in following ways.

1. What issues related to sustainability and global traffic motivated you to work on them?

Participant 1 (Skype): For me, environmental degradation caused by emissions from freight transportation motivated to work particularly.

Participant 2 (Face to Face): The need for increased operational efficiency in the logistics sector drives my intention to work.

Participant 3 (LinkedIn Chat): There are growing concerns about the long-term viability of current transportation practices and these are the key motivator for me.

Participant 4 (Phone Call): Recognition of the role of international freight in contributing to climate change is what motivates me well to work on sustainability and global traffic.

Participant 5 (LinkedIn Chat): There is a potentiality of collaborative efforts that can address sustainability challenges and I want to contribute in this.

2. How do governments support sustainable investments in freight transportation?

Participant 1 (Skype): By tax exemptions, governments incentivize the adoption of clean technologies.

Participant 2 (Face to Face): There are grants by governments to assist companies in transitioning to sustainable practices.

Participant 3 (LinkedIn Chat): There are subsidies for the development and use of alternative fuel vehicles.

Participant 4 (Phone Call): Regulatory frameworks by governments mandate compliance with sustainability standards.

Participant 5 (LinkedIn Chat): Fiscal incentives by governments offset the initial high costs of transitioning to clean energy.

3. What are the roles of businesses in the field of sustainability in international freight shipping, and what practices do they engage in to improve the environment?

Participant 1 (Skype): Businesses in the field of sustainability in international freight shipping prioritize integrating environmentally friendly practices into

Participant 2 (Face to Face): Businesses invest in clean energy technologies for transportation.

Participant 3 (LinkedIn Chat): Optimization of supply chain operations help minimize environmental impacts.

Participant 4 (Phone Call): Procuring materials from suppliers help promote with sustainable practices.

Participant 5 (LinkedIn Chat): Participating in programs like the European Green Freight Program contribute in addressing sustainability issues collaboratively.

4. Can you give examples of companies or programs that have proven leadership in cutting down negative environmental effects of global freight transport?

Participant 1 (Skype): There are numerous examples. For example, Maersk Line invested in fuel-efficient vessels and energy-saving technologies.

Participant 2 (Face to Face): UPS's utilization of cutting-edge technologies is an example of the programs that reduce fuel consumption.

Participant 3 (LinkedIn Chat): The European Green Freight Program's collaborative efforts can be considered as a proven leadership in cutting down negative environmental effects of global freight transport.

Participant 4 (Phone Call): Media Line commits in investing in environment-friendly vessels and vehicles.

Participant 5 (LinkedIn Chat): The introduction of sustainable practices by companies like Maersk Line and UPS are the notable examples.

5. What difficulties do businesses endure with the transformation of clean technologies, especially in terms of finance and technical problems?

Participant 1 (Skype): High capital investment is required for the transformation of clean technologies, especially for small and medium-sized enterprises.

Participant 2 (Face to Face): There are technical barriers such as limited range and charging infrastructure for electric vehicles.

Participant 3 (LinkedIn Chat): Retrofitting infrastructure and updating equipment to meet sustainability standards poses remarkable challenges.

Participant 4 (Phone Call): For companies operating with tight budgets, there are financial constraints.

Participant 5 (LinkedIn Chat): Logistical challenges are notable, particularly for long-haul transportation where charging infrastructure may be lacking.

Corresponding with the interviews, the assessment of sustainable practices in international freight transport suggests a high possibility to curb environmental effects as well as increases the efficiency of operations through the logistic sector. Nevertheless, these positive effects need to be brought up with concerted efforts directed toward tackling the problems emanating from implementation. As already mentioned by respondents, governments, businesses, and other stakeholders must work together to create a sustainability-friendly environment that both encourages sustainable investments and pushing forward innovative technologies for scaling up clean solutions and building a more sustainable logistics ecosystem (Wu et al., 2019).

Governments are the crucial factor in encouraging sustainable investments in freight transportation of international transport with the use of instrument policies such as tax exemption, grants, subsidies, and regulatory frameworks. Through the means of mandatory compliance solutions, fiscal incentives and regulatory support governments can take charge of business that would implement clean technologies, alternative fuels, and sustainable facilities for freight transportation (Shah et al., 2021)). Financial instruments like tax credit programs and grants may become useful tools in offsetting the primary high cost of the transition to sustainable practices, indirectly increasing the financial feasibility of these companies' investments in clean energy and infrastructure. On the other end, vehicle subsidies likewise play a critical role in the promotion of renewable fuels and energy-efficient vehicles which may help lower operating costs and encourage their application in freight transportation operations. Moreover, throughout the implementation of rules and standards of sustainability into an international freight transportation, governments can manage to enforce certain rules and standards, including a limit of emissions, fuel efficiency and environmental reporting, among others.

Companies also carry out an essential function in ensuring that sustainability in international freight shipping continues. Organizations tend to focus on sustainability in the supply sides and operational strategies by integrating environment friendly practices, investing in clean energy technologies, and optimizing supply chain operations to eliminate or minimize environmental impacts, at the same time. For example, businesses can procure products and materials from suppliers that undertake sustainable practices and meet the standards, such as the utilization of renewable materials, reduction of excess packaging, and controlling of carbon emissions in the production process. Besides, companies can put the money into more efficient cars, better fuels and energy technologies that will improve energy efficiency and reduce carbon emissions in freight transportation activities (Abolhosseini et al., 2014).

Example of good practice in global cargo transportation show how one can overcome the challenges pertaining sustainability policies and the implementation strategies within transportation industry. There are cases of Media Line which have exhibited unparalleled leadership in this area through the way investment was done in fuel efficient vessels and alternative fuel vehicles that are environment-friendly reducing carbon emissions and programs like the European Green Fleet Program that have promoted stakeholders to collaborate in the way operation is done transport to reduce environmental impact. However, Maersk Line, the world's biggest container shipping company by far, has proved to be a leader in the field of container shipping and environmental protection with the introduction of sustainable practices (Reinhardt et al., 2012). In the last few years, the money to build energy efficient vessels had been raised and innovations to cut the fuel consumption and reduce emission had been introduced. An example is Maersk's triple-E class container ships which are among the largest and most fuel-efficient vessels employing state-of-the-art propulsion systems, efficient hull designs, and energy-saving technologies, respectively, all of which contribute to reduced fuel consumption and greenhouse gases emission per container transported.

Furthermore, UPS consistently applies cutting edge technologies and methods to bridge the gap between planed routes, utilized vehicles and reduced fuel consumption. This ultimately leads to lower emissions by the international fleet. Besides, one more example refers to the European Green Freight Program which unites the shippers, the carriers and logistics providers into a group in order to address sustainability issues and to ask for greener freight transportation systems (Lister, 2015). The European Green Freight Program by European Commission in collaboration with industrial leaders is designed to reduce carbon emissions and improve transport sector efficiency through sharing of knowledge and efforts for joint resolution.

The European Green Freight Program mainly emphasizes on voluntary commitments and best practices related to eco-driving training for truck drivers, shippers' favourable shift, and carriers' fleet optimization strategies. If these steps are implemented, it will cause the number of carbon emissions decrease, transport costs decrease, and supply chain efficiency overall rise, which all will help an environmental sustainability. Furthermore, the European Green Freight Program equips organizations with the essentials needed to evaluate and track their energy use and emissions which in turn can be used to measure how close the organizations are to the goals set and point out areas where there is a need for improvement (Zaman & Shamsuddin 2017). The objective is to provide competent support to companies to eliminate the barriers toward sustainability and at the same time, to accelerate the uptake of cleaner freight transport which is spread over European locations.

Global freight transportation brings into view the significance of leadership, innovation and partnership in making progress with environmental sustainability in the logistics sector. For instance, some firms, like Maersk Line, in their turn, have proved that it is possible to lower carbon emissions, enhance business effectiveness and, eventually, achieve sustainability targets through the application of fuel-efficient ships, alternative fuel vehicles and cutting-edge technologies. In a similar way, projects such as the European Green Freight Program emphasize the strength that is possessed by collaborative efforts and collective action. Such projects demonstrate that the responsibility to solve sustainability problems and improve transport practices among freighters spreads across the board (Lai et al., 2011). Through ongoing efforts and cooperation among governments, business, and other trade partners the logistics industry can take up the responsibility of building on a sustainable future of international freight transportation.

The transition to a cleaner technology for example, electric vehicles and renewable energy infrastructure is capital intensive investment for most businesses especially small and medium-sized enterprise (SME) (Chien et al., 2021). Although in addition to the costs associated with

retrofitting infrastructure and updating equipment to suit sustainability standards, it may present a financial problem for companies operating on a tight budget. Technical barriers composed another obstacle that is encountered when international shipping practice would be made sustainable. One of the issues is the deficiency of the range of electric vehicles and inadequate charging infrastructure, which could reduce the utilization of electric vehicles such as during long-haul transportation. The spread of electric vehicles is impeded by their limited range in the case of long haulage, where vehicles drive many tens or even hundreds of miles between charging site. EV technology has advanced a lot recently; it provides a longer driving range and faster recharge times, but the range of electric trucks is less than that of traditional diesel pickups. This restriction would result into logistical challenges mainly for carriers, since these organizations often have to travel long hauls between the charging stations.

In a similar fashion, the lack of intermodal terminals, which enable smooth movement of goods during intermodal transportation, offers difficulties to those businesses that goal is to optimize their supply chains through intermodal mobility. Intermodal terminals operate as crucial shipment centres, where cargo can be switched between different modes of transportation-maritime, railway and highway/road- without going through tedious manual re-handling or repacking processes. For example, mainstream freight facilities and delivery centres might have to re-equip with charge and service stations due to the specialty needs of electric trucks and vans (Flynn, 2007). To that end, too, the rail yards along with ports will probably need to be updated with electric tracks and shore power units in order to back up the rail and maritime transportation programs.

Governments encourage sustainable investments through various policy instruments such as tax exemptions, grants, subsidies, and regulatory frameworks. Companies play an essential role in ensuring sustainability in international freight shipping by integrating environmentally friendly practices into their supply chains and operations. Investments in fuel-efficient vessels, alternative fuel vehicles, and the development of energy-saving technologies are some

examples of best practices for operational efficiency in the logistics sector. Continued cooperation among governments, businesses, and other trade partners is essential for building a sustainable future for international freight transportation.

5 Recommendations

Stakeholder collaboration is the cornerstone for boosting innovation levels, expanding effective projects, and build a more resilient and sustainable logistics ecosystem. The governments, business enterprises, industry associations, research institutions and non-governmental organizations (NGOs) should cooperate to identify the shared sustainable development challenges and develop the strategies together and share knowledge and good practices. Hence, an association of industry bodies can allow partners to work together and share the knowledge, while the studies of research institutions can determine new technologies and methods for an environment friendly freight transport. In addition, partnerships between public and private sector can use the expertise and resources of the government and the industries to invest in sustainable infrastructure projects and develop sustainable transportation solutions (Koppenjan & Enserink 2009). Through bringing together their resources, sharing risks and setting a common objective, public-private partnerships are able to impart impetus to the progress of sustainability goals as well as bring about a positive dynamism in the logistics industry.

Besides the partnership efforts of stakeholders, innovation is vital for the international freight transportation to get probity. To innovate new technologies, processes and sales models that diminish carbon emissions and promote operational efficiency and sustainability through the supply chain, the owners of businesses need to continue investing in research and development (Dey et al., 2019). The range of autonomous vehicles, blockchain technology, and predictive analytics capable of digitalizing freight transportation is visible in order to improve performance, integrity, and traceability as well as lower the environmental footprint. In addition, innovation in clean technologies for renewable energy, like solar, wind, and hydrogen power, can aid in freight transport decarbonization by supplying vessels, vehicles, and warehouses with green and sustainable sources of energy. With the utilization of innovation, the prominent figures in the field can find the new ways to achieve sustainability,

reduce the costs and be competitive on the global market as well. Looking globally, the assessment of sustainable practices in international freight transportation stimulates to the idea of big benefits in the sphere of reducing environmental impacts and increasing asset utilization for a whole logistics industry. Nevertheless, such advantages can only be obtained if the factors related to their use are addressed by governments as well as industries and other members of society. Governments can encourage sustainable investments by means of giving tax breaks, grants, and subsidies in the sphere of business, while businesses can stress sustainability in their acquisition and operational strategies. Collaboration between the key players is vital to involve innovations, increase successful projects to scale up and build a friendlier logistics environment. Through collaboration the key players can handle the problems, catch up with the opportunities and create a better, more robust, and efficient world for international freight transportation.

6 Conclusion

In conclusion, a sustainable practice in international freight transportation is not something that should be done as an exception, it is crucial because these cargo logistics will not cause environmental damage together with improving the operational efficacy. It is the implementation of sustainable logistics principles and measures that embodies the way for companies in addition to the reduction of their carbon impact in addition to enhancing resource effectiveness and in the end to ensure that the companies are playing by the standard that is set by the environmental regulators. Consequently, sustainability can lead to significant decrease in the environmental footprint by business as whole which will consequently lead to the global efforts to battle climate changes and may even contribute in preserving the natural resources. These emissions can be mitigated by implementing actions such as mode conversion, route optimization, and adoption of cleaner fuels and technologies, thus leaving a lesser burden on air pollution and habitat destruction related with freight transportation. On the other hand, through enhancing supply chain operations and cutting down on resources waste management, companies are able to save more and make their operations cost effective. This in turn can make the companies competitive.

For the commissioning company, embracing sustainable practices in international freight transport becomes inevitable for businesses as there are regulatory requirements and expectations of consumers, investors as well as other stakeholders. Worldwide governmental authorities are at present more and more introducing measures and standards in order to foster ecological sustainability in logistics sphere, for instance, emissions restrictions, fuel efficiency rules and waste management standards. Through incorporating green logistics methods, businesses can stay compliant with these rules and decrease the threat of penalties, legal liabilities and reputational damages which are likely to result from the absence of compliance. But indeed, putting the sustainable logistics to use is not only about the opportunities that it brings alongside, it also includes addressing the challenges for its implementation. The high

initial cost of investment, unavailability of certain technologies, the constraints to the infrastructure, the regulatory uncertainty, and the lack of stakeholder collaboration are all among the challenges that have been faced by the transportation systems of freight. Overcoming these obstacles requires a comprehensive approach from the governments, the private sector, the banks and other segments to put in place a supporting environment that awards investments and projects that are sustainable and innovative to growth of the companies. Therefore, the collaborative environment and innovation as crucial elements of the green transport and logistics are not just a dream but a clear indicator for the transition of the industry in the environmentally friendly, withstanding state. Furthermore, with the engagement of various stakeholders, sustainable green logistics can be created, developed, and implemented. Thus, the efficiency of operations can be improved, and robust logistics system can be built. Sharing the same interest in sustainability and getting positioned to act as a catalyst to the creation of a suitable environment for future generations, logistics industry is the best bet for a sustainable and prosperous future.

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Appendix 1. Interview Questions

I'll now share vital survey information with you. The study has undergone review and obtained ethical clearance from the International Business degree programme at HAMK: Häme University of Applied Sciences. If you have any comments or concerns about your participation in this study, feel free to contact for verification. Your personal information, such as your name, address, and survey responses, will remain completely confidential and will not be shared with anyone outside of this study. Your participation is voluntary, and you have the right to decline any questions you don't feel comfortable answering. Individual identities will remain anonymous in the summarized study results. When quoting answers, the person's identity will remain anonymous. Thank you.

1. What issues related the sustainability and global traffic motivated you to work on them?
2. Would you mind if it is possible to elaborate on the procedure of governments and their support in the field of sustainable investments in freight transportation through policy instruments such as tax exemptions and subsidies?
3. What are the roles of businesses in the field of sustainability in international freight shipping as well as the various practices they engage in for the purpose of improving the environment?
4. Can you give me examples of companies or programs that have successfully proven leadership in cutting down negative environmental effects of global freight transport?
5. What difficulty do business endure with the transformation of clean technologies especially in terms of finance and technical problems?

6. How do projects such as the European Green Freight Program foster a cooperative environment among the different stakeholders in the logistics industry that aim to curb environmental degradation?
7. From your perspective, what do you consider to be the main factors that influence the progress towards sustainable activities in worldwide freight transportation, and why do innovation and partnership matter in the process?
8. Can you tell me more about the role of intermodal terminals in effective supply chain coordination and how their absence or their development matters for the industry in terms of sustainability?
9. What methods or ways do you prefer for working with logistical barriers arising in the process of the switch to electric vehicles including, but not limited to reduced range and charging infrastructure?
10. To what extent do you think that the future of international freight can be greener, and what actions in your opinion be the main focus in order to achieve long term environmental goals in the industry?

Appendix 2. Thesis data management plan_Hammat

Ensuring the integrity of the data and safeguarding the interviewees, among other factors, necessitates proper management and storage of all the data used in the thesis. One of the key research methods utilized in the thesis, which requires a higher level of data management, center around interviewing the participants. The reason behind this is that interviews involve individuals who possess their own data and information that requires protection. This was done by the fact their names are not mentioned, their information was not polished to outside users, and the interviews were not recorded. The author also obtained consent and discussed the steps that would be taken in the interview. The author did lead any question during interviews. Another data management concern pertains to the contact details of interviewees, including their names, phone numbers, and email addresses. This thesis does not include any sensitive information of interviewees, nor does it include any contact information or names of the interviewees.