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THE ROLE OF TRANSPORTATION IN REDUCING SUPPLY CHAIN CARBON EMISSIONS

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"In the name of Allah, the Most Gracious and the Most Merciful"

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ABSTRACT

INTENTION: In today's 21st century, the ever-changing diversity of lifespan and atmosphere has unfortunately increased global warming and greenhouse gas effects. It does not only affect the human lifecycle but aquatic and botanic lives too. It has brought an adverse menace. This is the reason; the world is more concerned about environmental protection attitude than ever before. Many scholars and researchers have claimed green practices are significant to lower greenhouse gas impacts on the environment. The major contributor to increased environmental risks is logistics and transportation activities. Along with people and goods movement, the transportation sector is also responsible for increasing hazardous gasses into the environment in each supply chain process. Logistics and transportation, are observed as the second-highest contributor to climate change and increased greenhouse gas emissions in the environment with a 29% share of total CO_2 emissions. Corporations are committed to reducing carbon emissions keeping their priority due to customer behavior. There are numerous studies found relating logistics operations to green practices, but, unfortunately very few of them included benefits of green practices if implemented into the transportation sector other than reduced greenhouse gas emissions. For this purpose, they need to determine their energy consumption in organizations internally as well as externally. This study discusses the implications of logistics and transportation while turning into environmentally–sustainable logistics practices to reduce carbon emissions. In addition to the primary objective of the study, this research also examines the effects of green supply chain applications that lead to a reduction in carbon emissions and optimal use of resources respectively.

METHODOLOGY: The first-hand realistic data has been collected from Transportation and logistics service providers. The research has been carried out through the primary data collection of a sample size of 300 respondents. Several statistical tests have been run to get substantial results for the study. The collected data have been analyzed through Statistical Package for Social Sciences (SPSS) research software.

FINDINGS: There are optimistic results were found for the research study. A researcher found a positive and high correlation between dependent variables i.e. green practices and independent variables i.e. reduced carbon emissions, optimization, and reduced operating cost. Green practices have a significant positive impact on reduction in carbon emissions and lower operating costs. The transportation sector of Pakistan agrees to adopt green practices and enhance their operational as well as environmental sustainability.

ORIGINALITY: The research paper is categorized into two divisions; initially, it emphasizes the transportation sector's interest in environment-friendly practices. Secondly, it aids the transportation sector to avail the benefits of green logistics like optimized operations and reducing operating costs. Thus contributing empirical facets by addressing the gap in primary first-hand surveys regarding green logistics.

Keywords: Logistics and transportation, Greenhouse Gas Emissions, Carbon Emissions, Green Supply Chain, Optimization, Operating Cost.

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CHAPTER 1:

INTRODUCTION

1.1. BACKGROUND

The corporate world has acknowledged the logistics and transportation industry as a major partner to manage competitive advantage, cost control, and maintain an optimistic quality in their production, suppliers, and customers. It is not only capital intensive but also requires highly skilled and technical human experts to survive in fiercely competitive markets and continuously increase market share. In 2018, it has increased its value to $9.6 trillion which would be maximized in 2023 around $12 trillion or 12% of the entire world's GDP according to cautious survey projections.

It is already known that maximization of profit and minimization of cost is the prior aim of a business. This is done by increasing sales and market share. This traditional war of cost and profits has continued very well until the world diverted its direction towards environmentally sustainable practices. But due to speedy greenhouse gas, especially carbon dioxide emissions into the environment is causing a non-ignorant amount of global warming as a serious threat to the ecosystem and living life on Earth in recent past decades.

Today, the world has been cautiously watching corporations either small, medium, or large enterprises to convert their operations into sustainable applications and become eco–friendly. Annually 40 – 70 % of greenhouse gas emissions needed to be reduced in 2010 – 2050 as per calculations of the Intergovernmental Panel on Climate Change (IPCC) a conference organized in 2014 otherwise average global temperature will surpass 2^{o} which is a moderate climate temperature.

In retaliation to the quick intensity of global warming and a change of biodiversity, has stressed world's scholars, academicians, specialists, and experts to collectively put forward some methods and techniques to uphold ecological sustainability that has increased by unplanned practices of industries (King and Lenox, 2000: Tseng et al., 2019). Investors and consumers also show more interest and attraction towards firms that are environmentally sustainable and follow regulative policies to reduce carbon and other greenhouse gas emissions.

The process of transforming raw materials acquired from suppliers to producers' manufacturing plants and passing through different channels, a finished product is brought to end consumers is referred to as supply chain management (Christopher 2016; Mohtashami et al., 2020). Recent discussions have been focused on an empirical investigation of the effects and relationship of supply chains and environmental issues. A significant amount of wastes and pollution has alerted the obstacles and challenges of production, transport, storage, and consumption of goods within the supply chain during the last 3 decades and arise serious environmental problems worldwide. Thereby, the adoption of environmentally responsible behaviors is impelled on firms by governments, regulators, consumers, etc.

Logistics and transportation is the second contributor approximately 29% as of 2019, following energy consumption sources for the household and industrial sector which are harmful to environmental sustainability. About 15% of total global carbon dioxide emissions are the results of the supply chains' most visible focal point i.e. transportation and logistics.

Except for the logistics industry, every other sector has been gradually decreasing its carbon footprints in each operation. One of the rigid activities to reduce carbon footprints is freight transportation (Guerin et al., 2014). Its total share has increased from 42% to 60% in 2010 – 2050. To the moderate negative impact of transportation, consumers, stakeholder, and legislatures have underlined industries and supply chain partners to restructure their "logistics operations", and become environment-friendly business sectors (Aßmann and Sieber, 2005; Meyer, 2009).

The concept of integration of operation with environmental actions is termed as going green. The significant branch of operations management in the supply chain substantially contributes to the environment like emissions, pollution, and society's health hazards (Tseng et al., 2019). Corporations are now integrating environmental aspects of supply chain management to minimize the greenhouse gas effects. This integration is stated, 'Green Supply Chain Management (GSCM)'.

The function of logistics must play an important role while integrating supply chain management with the strategy of sustainability, due to its cross-functional nature affecting the atmosphere (Dey et al., 2011).

A logistics system is responsible for the environment due to its forward logistics comprising of inbound and outbound activities, as well as waste management, and recycling operations too (Wu and Dunn, 1995). Green packaging according to Curty (2005); Rokka and Uusitalo (2008); Ouyang (2014), benefits organizations to reduce packaging costs, solid wastes management, while maximizing environment-friendliness and offering alternative packaging material and techniques. Likewise, green transportation reimburses reduction in fuel consumption and operating costs, noise pollution, air pollution, and traffic blockings while advancing customers and public relations.

1.2. PROBLEM STATEMENT

Jazairy & von Haartman, (2021) have quantitatively studied and identified the gap of engagements between logistics service providers and logistics buyers of Sweden with the difference in green logistics practices all over the key areas of the logistics procurement procedure. The results support the literature review symbolizing the high engagement in selling green logistics practices as compared to shipper ensures in buying. The researcher concluded that there is fair alignment between logistic suppliers and shippers as far as green logistics practices are concerned.

Aikins (2020) has studied the relationship between key features of carbon footprint in UK food supply chains and suggested that the duo's main key factors are transportation and distribution. Findings proved that transportation increases 10 tons of CO_2 emissions in the U.K. It is increased by the distribution of 1 ton of fruits and 1.3 tons of CO_2 emissions is minimized by the import of vegetables from overseas to the UK due to improved technological operations in logistics.

A research paper by Jamali & Rasti-Barzoki (2019) investigated the increase of third-party logistics sustainability in green versus non-green supply chain production. It also evaluated the implications of over-demand and eco-friendly pointers in third-party logistics and are carbon emissions, customer satisfaction, and the extent of greenness in a product. Another question examined in a study is the earnings and balance variables of supply chain members in a given existence of 3rd party logistics in a competitive supply chain network. It studied the effects of changed constraints on gages of supply chain sustainability and the amount of total supply chain profits and sustainability indicators that affect divergent modest arrangements between producers and 3rd party logistics.

Waterbury (2018) research provided an internal view of the Transportation and Logistics industry instead of external observations. The study aimed to provide a future of the supply chain in 2030 by answering prime questions. After an extensive review of the literature review, it is established that there is a major role of sustainability in business. Delphi technique is utilized to collect professional executives and experts of industry of 20 countries. It is suggested that worldwide an environment-friendly supply chain should be used to lower carbon emissions in the transportation and logistics industry.

(El Baz and Laguir 2017) aimed to evaluate the Moroccan sustainability practices of third-party logistics by analyzing qualitative data using an interview guide. The question answered in a research paper is to identify the kinds of green practices and investigate the major challenges and drivers that interfere while the implementation of environment-friendly practices by the third-party logistics of Morocco as a developing country. The researcher suggests the significant positive effects of green practices on third-party logistics market share while green initiatives hold back due to lack of collaboration and involvement of partners in the implementation process and there is no clear strategy for environmental sustainability practices implementations.

Another research paper was studied that in-depth examines the operational relationship between supplier being third party logistics and the buyer being manufacturer's logistics function emergence while company follows environment sustainable changes. Outcomes from evaluating a case study of a Danish company that outsources its logistics function have indicated a clear cross-functional and inter-organizational coordination mechanism needed to effectively manage the relationship between supplier and buyer (Jørsfeldt, Hvolby, and Nguyen 2016).

While reviewing related literature, it has been found out that the gap prevailing in the revolution of logistics operations taking green supply chain practices into account. While green logistics and transportation are helpful to achieve lower carbon emissions, optimum use of resources and the reduction of operating costs in freight management can be achieved. This study focuses on green logistics to fulfill targets of lowering carbon emissions and effective use of supply chain resources in the logistics industry in a represented way.

1.3. RESEARCH QUESTIONS

This study is focused to answer the questions related to green logistics transformation and implementation of environment-friendly practices in the Logistics Corporation of Karachi, Pakistan.

The following questions have been answered:

RQ1. How transportation be improved for environment friendly operations?

RQ2. How does environment-friendly transportation reduce supply chain carbon emissions?

RQ3. Does Green Transportation aid the optimization of resources?

RQ4. Does Green transportation practices reduce operating costs in transportation operations?

1.4. OBJECTIVES OF STUDY

1. Study the revolution of logistics and transportation as an operation as well as an industry with environment-friendly practices
2. Examine the role of green transportation in reducing supply chain carbon emissions
3. Evaluate the importance of implementation of green logistics to optimize resources
4. Assess the role of green transportation in lowering total operating costs

1.5. WORTH OF STUDY

This will assist logistics service providers' techniques to enhance their transportation operations and transform them more environment friendly by optimizing resources and a reduction in carbon emissions. This will benefit to increasing eco-friendly trends within the industry and finding ways to reduce overall supply chain emissions. The research also acts as a motivating agent for traditional logistics practitioners who avoid green practices due to high-cost involvement.

1.6. LIMITATIONS

The limitation of this research includes:

1. The sample selected for the study can only be gathered from the minimum respondents of the transportation industry in Karachi. However, these operations are carried out in overall Pakistan and foreign countries.
2. Another limitation is of time we are only provided with 4 months for completion of the thesis and the level of environment-friendly practices and logistics optimization.
3. The survey carried out in different ways could be considered a half-filled survey.
4. The study involves responses gathered from only a single logistics company while it can be applied to all transportation and logistics operations.
5. This research investigation answers problems only related to transportation organization while research can be extended to analyze the transportation activities of the manufacturing or service industry.
6. The research is focused only on transportation aspects of logistics while it is independent of warehousing and packaging integration with green strategies.

1.7. SCOPE OF RESEARCH

The research is conducted to analyze the level of green logistics implementation through collaboration, technology, and environment-friendly design to decrease carbon emission and optimization of logistics operations. The main focus of the study will be Karachi due to the limitations. The scope of the research contains only the transportation industry and only those consumers will be considered for the research, who will attend any activity in logistics operations.

1.8. OUTLINE OF STUDY

The research paper is divided into 5 sections; the first section includes the introduction to the research topic, context, and the problem statement; the second section comprises of literature review of the past and recent academic papers published that relates to the interest of study, and the conceptual framework; the third section includes methodology includes research design, sampling technique, a time – limit of the study; fourthly, it presents statistical tests run to answer the research question (mentioned in section 1); while the fifth section consists of discussion and conclusions driven from the research thesis.

CHAPTER 2:

LITERATURE REVIEW

2.1. LOGISTICS MANAGEMENT

Logistics was first assumed as only related to military terms like including purchase and maintenance, transportation of military facilities, material and human resources formerly in the 1950s (Ballou, 2016) But with the emergence of transporting right goods at the right place, and at the right time by traditional organizations, logistics, and transportation concept has gained the attraction of several academic researchers (Ballou, 2007).

The Council of Supply Chain Management Professionals (CSMP, 2015) defined logistics as a chunk of supply chain management that involves planning, implementing, and controlling forward and reverse streams of goods and services. It involves all information related to origin towards a destination, including up-stream and down-stream freight, fleet, storage, material supervision, demand execution, system design, and supply/demand scheduling and organization (Hwang et al., 2016).

With the increasing focus on core competency and providing value to customers, firms have started to outsource their logistics function to third-party logistics more efficiently (Baki and Ar, 2009; Stefansson, 2006). 3PL service providers smoothen the association of customer and firm i.e. manufacturing or service provider much more efficiently than a customer itself with supply chain (Zacharia et al., 2011).

Logistics service providers have been a focus of many researchers to identify and analyze benchmarks for selecting third-party logistics and evaluate their performance indicators. For example, (Marasco, 2008) analyzed 152 articles from 1989 – 2006 related to logistics service providers. The common logistics services have been identified by Sahay and Mohan (2006) from an Indian perspective. While Kumar and Singh (2012) considered logistics as a one-stop solution to all issues related to distribution, warehousing, storage, and transportation issues.

The importance of technology is debated concerning the level of entire logistics operations within a supply chain of a firm (Fasanghari et al. (2008). Additionally, (Jayaram and Tan, 2010; Bjorklund and Forslund, 2013) better delivery of logistics services can be attained by integrated collaborative supply chain partners, i.e. suppliers and customers. Busse and Wallenburg, (2011), examined current practices and found that customers prefer those logistics service providers who are innovative and offer customized services to their customers. Based on several factors identified by researchers in their respective contributions with time, Logistics service providers are attempting their services to be best suitable as per their customers' demands.

2.2. TRANSPORTATION OPERATIONS

Transportation is one of the most important areas and is attributed as costly in supply chain and logistics management (Paul et al., 2020). Exchange of people, equipment, and materials with safety and efficiency from origin to a destination place is the prime objective of transportation (Gurtu et al., 2019). The Global Industry Classification Standard (GICS), has demonstrated transportation as a subgrouping sector, including airlines, marine, road and rail, and infrastructure of the industrial sector. The company's profit earning and transportation is highly interrelated with each other. Fuel and labor cost and demand for movement are the main influential factors of transportation services while, in case of a hike in global oil prices, organizations' profit margin adversely affected due to the high dependency on oil as a fuel for engines. The economic condition of a country can also be evaluated with the transportation of goods and people as it has a direct proportion to economic activity (Adam Hayes, 2020).

The shipping industry is dominant in carrying international trade at a much larger perspective, due to the involvement of long distances through sea routes. More than 90% of world trade activities are often entitled to sea transport (e.g. ECSA/ICS, 2008, p. 2; Mitropoulos, 2010, p. 5), especially, when both buyer and seller are scattered around the globe. The shipping industry is playing a prominent role in transporting products demanded by the end consumer. No doubt, several key factors have influenced the world towards shipping transportation, but the low-cost mode of transport per ton – Km and dispersion of wide network is the prime one in adopting sea routes as fright transport (Cullinane, 2016).

Specifically, in the sea transport industry, there are alarms over toxic ecological impacts like contamination produced by oil leaks and the release of solids, liquids, or gases from vessels; turbulence; trembling, and the chromatic interference and land-take related to land-based infrastructures like harbors and vessel-breaking accommodations (Cullinane, 2016). Over 95% of the world's shipping convoy is driven through diesel machines (Deniz, Kilic, & Civkaroglu, 2010). In consequence of the inferior value of oil utilized, the supreme contemporary vessel machines release greater greenhouse gases per power output as compared to controlled on-road oil machines (Corbett & Farrell, 2002). Certainly, the bunker fuel consumed in aquatic vessels has been projected to yield more than 100 times in each unit than the volume of sulfur of on-road diesel (Bailey & Solomon, 2004; California Air Resource Board, 2003; US EPA, 1999).

Transportation is recognized as an important and costly area of the supply chain management of firms. It is the most contributor of greenhouse gas emissions and accounted for 29% in 2017 by the transportation sector of the USA. Van den Berg and De Langen (2017) claimed that the transportation sector emits 25% of worldwide carbon – dioxide. The major donor of CO_2 in the transport sector is passenger cars and buses while 29.4% of emissions are originated from trucks carrying goods. Daly (1991), has suggested reducing the usage of renewable and non – renewable resources and focusing on its regeneration for sustainable development. Fuel efficiency and less harmful emissions measure should be adopted to improve the transportation system in terms of environmental, social, and economic sustainability (Singh, Gurtu, and Singh 2021). The effects of supplier base reduction, supply chain reconfiguration, carrier base consolidation, and change for freight transport demand trends within European logistics and transport operations were identified (Lemoine and Skjoett-Larsen 2004).

2.3. GREEN TRANSPORTATION PRACTICES

Wu & Dunn (1995), have claimed that the largest contributor to negatively impact the environment in logistics operations is freight transport. About 15% of total global greenhouse gas emissions is originating from transportation activities as per OECD (2010). The current trend of increased globalization and trade has projected clearly that these transportation activities will increase with the decrease of depletion of road freight vehicles (European Commission, 2010). Ballou (2007) have also estimated continuous trend in transportation and gross domestic product (GDP) going hand in hand.

Although the shipping industry claims itself as environmentally friendly, due to speedy change in climate, researchers have found out a complex relationship shipping industry and the environment. Studies have identified an alarming global environment to be one of the factors in an arising sea level which could evolve as floods, disrupt supply chains with seaports, increase the cost to refrigerate products for a longer period, augment melting cycles of glaciers, adding remains thus constructing more efforts for searching of essentials (UNCTAD, 2009).

Academics, governments, non – profit organizations, and corporations have shown their interest in emerging models of sustainable green supply chain management, and the triple bottom line consisting of 3P i.e. Profit, People, and Planet (Andersen and Skjoett-Larsen, 2009; Corrêa and Xavier, 2013). Operations that abolish negative impacts on the environment are known as Green practices (Azevedo et al., 2011). In supply chains, implementation of environment-friendly practices is defined as Green Supply Chain Management (Holt, D & Ghobadian 2009; Laosirihongthong et al., 2013), which associates multi-dimensions and approaches (Uygun et al., 2016). The eco-friendly movement is the main target of green transportation employing proper resources. Factors like environmental education to people, awareness to managers and employees, regulatory rules, before governmental bodies, suppliers and producer obligation to improve continuously, efforts to explore efficient opportunities are beyond all in making transportation 'green' (Zahedi 2012).

The transportation system can be much faster be 'green' with the help of people and the government's hard and smart work. Individuals can preserve energy by using walk, bike, or public carriages for conveyance and energy-efficient carriages are good with gas mileage, for home purpose, usage of energy-efficient or hybrid or electric appliances and less reliability on gasoline are useful to make pollution-free environment. As far as governments and corporate measures are concerned, they are recommended to advance sustainable biofuels, like ethanol, biodiesel, and replacement of fossils with renewable powers such as wind and solar (Fraser, 2011).

The practices as shifts in mode, eco–friendly transport management, logistics mechanisms, technological advancements, eco–friendly driving, use of alternative fuels to make the environment more sustainable. While the preservation of natural resources and cautious use of resources is grouped into a concept of sustainability. Resource sustainability has emerged as a prime concern for all industries together with logistics as the reason being continuous degradation of the environment and limitations of resources (Coaffee, 2008; Zhang et al., 2016).

Formerly researchers while studying the logistics industry have acknowledged the significance of sustainable activities (Gandhi et al., 2015; Mangla et al., 2017). Researchers have identified different kinds of green logistics practices based on their diverse nature in their literature review (Cf. Colicchia et al., 2013; Martinsen and Huge-Brodin, 2014; Sureeyatanapas et al., 2018). There is a wide range of literature available regarding the benefits of adopting environmental sustainability by firms. Authors linked environmental sustainability and linked to different aspects of logistics. Like, the prominence of supplier valuation and cooperation has been highlighted to improve sustainability (Wilding et al., 2012), lean practices in supply chain management have been explored with sustainability by Martinez-Jurado et al. (2014), while Marques (2019), have systematically reviewed literature focusing on sustainable supply chain network management. There is a strong relationship found among green practices, profitability, and organizational performance improvement (Perotti et al., 2012; Singh et al., 2016; Ansari & Kant, 2017). Authors also have recognized a high correlation among organizational culture, service quality, and operational performance and execution of green environment sustainable practices (Zhu et al., 2008; Bask et al., 2018; Garcia-Dastugue; Eroglu, 2019; Green, 2019; San-Ong et al., 2019).

Green transportation would be implemented if the knowledge on environmental issues and severity is disseminated to promote innovative efficient modes and options by businesses, governments, NGOs, the corporate world, and common people. The environmental burden can be decreased through the collaboration of all stakeholders as a team and increased efficiency in the transportation system in urban areas.

Green practices have been implemented by various organizations to diminish their business operations' effects on the environment, societal safety, along with retaining efficiency, an advantage over their respective competitors, and accessing new markets by meeting stakeholders' demands (Agyabeng-Mensah et al. 2020). Due to the high pressure of society and stakeholders, though the logistics industry has begun to switch its operations and includes green practices (Ferreira et al., 2015), still this conversion of logistic activities in developing economies is coming at a slower pace (Agrawal and Singh, 2019).

2.4. REDUCTION IN CARBON EMISSIONS

Numerous studies have been published with the focus point to reduce hazardous emissions from the transportation sector while remaining in the overall efficient supply chain of a firm. For example, a model presented to highlight the importance and need to include carbon emission from international trade via marine routes (Gurtu, Searcy, and Jaber 2017), another extensive survey obtained from secondary data bank has been published to suggest economic incentives will be more useful to motivate firms for a reduction in carbon emissions and encourages organizations to invest in technological advancements and find alternative fuels in the shipping industry (Christodoulou et al. 2019).

Environmental sustainable practices are urgently required to be implemented for the reduction of carbon dioxide emissions in freight transportation by organizations and achieve long-term targets (Seuring and Muller, 2008). Third-party Logistics low-carbon commencements have been divided into two macro divisions i.e. Intra–organizations focusing on operations within organizations and inter-organization comprising of teamwork of supply chain members (Colicchia et al., 2013). Evangelista (2014) have studied 3rd party logistics carbon initiatives and explored 5 areas namely, factors affecting the approval of 3rd party logistics low-carbon initiatives; revolution and evidence and communications technology tools reassuring 3rd party logistics low-carbon initiatives; low-carbon initiatives and 3rd party logistics performance; energy proficiency in road freight organizations and clients' perception and alliance with a logistics service provider who is environmentally sustainable and implements low carbon-emitting approaches. Energy-efficient logistics practices and supply chain systems are a requirement to reduce carbon footprints (Halldorsson and Kovacs, 2010), by adopting clean fuel and proper route arrangements. Gupta & Singh (2020), have identified seven practices to be involved in logistics service providers containing; reusable wrapping; clean resources, eco-friendly purchasing, reduction in greenhouse gas secretions, use of CNG or electric fleet, improvement of resources, and decrease in energy intakes.

Low carbon initiatives have been taken by logistics service providers but there is still much more to develop a strategy that could lower CO_2 release from the supply chain to make an environment sustainable (Guiffrida et al., 2011; Tang et al., 2014; Moinuddin et al., 2018). According to Das & Kulkarni (2018), DHL, Damco, and TNT are providing services that are reducing carbon footprints to their customers by various facilities. Economic, value density, transportation, traffic energy, and emission intensity have been used to structure a map and decompose the causes of carbon emissions in freight transportation (McKinnon 2003; Woxenius 2005).

Several countries have been dedicating their efforts to decrease CO_2 release hazardous in their business network operations in concern over widely spreading global warming and increased sea levels. They have started by setting timely reduction targets to lessen carbon emissions from all sectors. This would instigate them to save energy and reduce carbon emissions by taking immediate attractive actions. For instance, the U.S set a target of a 17% reduction in carbon emissions by 2020. On the other hand, some countries have opted to charge a penalty or tax to increase greenhouse gas emissions. Climate Change Levy (CCL) has been formulated that applies a tax on the use of fuels in the supply of specified energy products (S. Tang et al. 2014). The US is also considering likewise strategy and in several states somewhat is under preparation (Doughman 2007; Milne 2008).

As researches have been published covering some major areas of logistics and transportation about green practices, organizations should now implement environmentally friendly practices into their organization and fill up the gaps between transportation and efficient emissions through technology (Leonardi and Baumgartner, 2004).

2.5. OPTIMIZATION

It is established in some studies that transportation activities are the major contributor to polluting the environment by emitting harmful greenhouse gases (Khan 2019) of about 8% of the world's CO_2 emissions (Khan et al., 2007). These undesirable effects on the environment and society are added through logistics and transportation activities. So, there is an urgency to optimize these activities and reduce the harmfulness of life and safeguard environmental sustainability (Agyabeng-Mensah et al., 2020 a, b, c, d). The implementation of reverse logistics, teamwork, and clean fuel usage should be considered while optimizing logistics operations (Neto et al., 2008; Boix et al., 2015). Additionally, it is suggested to build storage warehouses that enable environment-friendly freight transportation modes and advance supply chain sustainability (J. Tang, Ji, and Jiang 2016).

An innovative structure has been identified as 'Smart, Green and Integrated transport' by the European Commission to tackle the challenges of society (European Commission: Horizon 2020). In recent years, companies found an idea of a trade-off in transportation activities between efficiency and effectiveness concerning the environment. Value-added green practices have been acknowledged by companies to avail competitive advantage. In the Urban freight transport system, collaborative strategies are confirmed by these solutions to get economic efficiency (Stefansson et al., 2006; Paché et al., 2008; Feliu et al., 2012).

A green solution of courier bike is recommended to a courier service provider who uses vans running from the combustion of fossils. This will not only enable efficient cost and optimized services with environmental sustainability but also facilitate last-mile segment and timely delivery of parcels through cargo bikes. This will eliminate mobility restrictions, inadequate infrastructure, limited use of loading and unloading zones (Perboli et al., 2016). A stochastic programming model of 'Genetic Algorithm' has been developed for simultaneous pickups and delivery time has been proposed (Hou and Hong, 2010) to improve uncertain demand and travel time by optimizing route networks. A twofold optimization model is provided which minimizes cost and carbon emissions to construct a network design of environment friendly (Wang, Li, and Wang 2018). Location, network routing, and inventory are the three major operations of the supply chain network. Ahmadi-Javid and Azad (2008), formulated a model to study decisions taken in all three operations at the same time, three – a folded study conducted to integrate difficulties in these three factors while designing a multi-supplier distribution network (Ahmadi-Javid & Seddighi, 2012). A study examined financial factors about logistics network design and suggested a multi-objective optimization model (Neto et al., 2008). A multi-objective optimization model was presented to engage green practices in the supply chain and reduce inherent risk, greenhouse gases emissions, and economic cost (Zhao et al., 2017). Paper designed a network by engaging various types of manufactured goods and competency parameters for the cost of carbon emissions to the improvement of multi-model coordinated freight transportation networks (Bauer et al., 2010). Borumand and

Beheshtinia (2018) recommended an integrated decision-making model that minimizes the total delivery delays, production cost, vehicles carbon emissions, and enhances production scheduling quality.

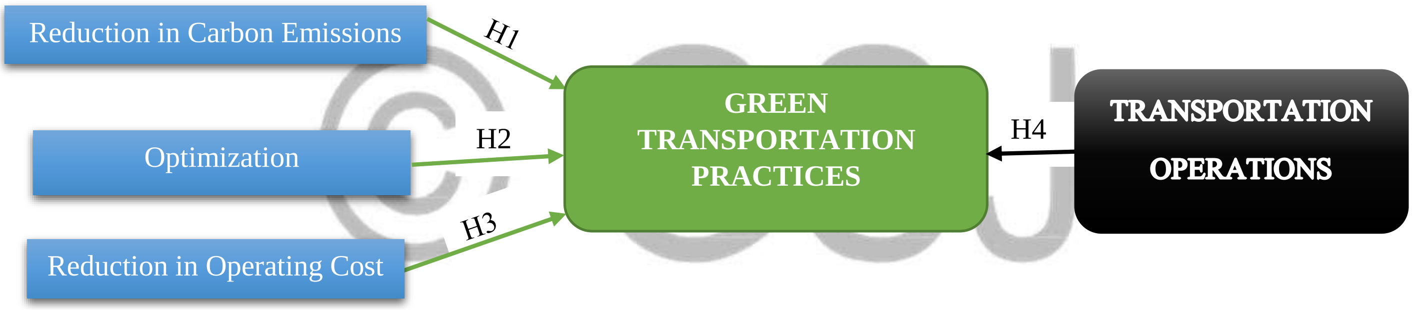
2.6. REDUCTION OF OPERATING COST

The supply chain of a firm is addressed as an utmost prospect to decrease emissions of greenhouse gases. (Da Silveira and Cagliano, 2006; Hill, 2005; Narasimhan and Jayaram, 1998; Slack et al., 2004) have agreed that if minor things are kept aside, the amalgamation of price, worth, elasticity, conveyance, and novelty can be taken into account, to increase operational performance. The interesting results have been derived based on technological involvement in obtaining environment-friendly practices and competitive advantage in the logistics evolving industry (Gonzalez and Trujillo, 2008). Gilman, (2003) Explicitly, global competition can be faced by involving green innovations through acknowledging general cost and risk reductions, towards an enhanced supply chain while sustainable distribution systems additionally are developed (De Martino and Morvillo, 2008). Economic and inputs (resources, clean and marginal energy, subtle vehicles) can be boosted to focus on environmentally advanced logistics operations (Hart, 2007).

Transportation cost and environmental risks can simultaneously be reduced through advancements of quality in supply chain processes. This can easily be enforced by adopting inter and multimodal transportation systems for the pickup and delivery of materials. Here, inter-modality is defined as a combination of freight modes such as air, road, ocean, pipeline, etc. utilized for a singular trip to deliver goods from origin to destination places in a container (Macharis and Bontekoning, 2004). These containers are traveled and transshipped between numbers of suitable freight modes to achieve economies of scale (European Commission, 1997). A deep concentration showed by corporations to adopt inter-modal transportation to facilitate rail efficiency and road flexibility. The prime aim of intermodal transportation has diminished carbon emissions and overall freight cost, and amended road bottlenecks (Dettmer, Nations, and Food 2018). It has successfully decreased 57% of greenhouse gas emissions when compared to a single modal transportation system (Rodrigue et al., 2018). A freight mode that connects numerous modes, likewise intermodal through a single service provider is known as multimodal transportation. This transportation model similarly certifies cost efficiency with the movement of goods from the door–to–door delivery (Arias et al., 2017). Forbes Magazine, (2018) has identified only a difference in the number of units laden for consignments. Another model namely, synchro-modal has recently aroused that links multimodal transportation (e.g., Verweij, 2011; Roth et al., 2013; Tavasszy et al., 2015). A category that allows the consignee to shift from one mode to another freely while in transit, is defined as synchro-modality (Verweij, 2011). It benefits in reducing operational costs while meeting service level requirements. An efficient and responsive collaborative scheduling is the utmost requirement of Synchromodal transportation modes (Dong et al. 2018).

Green transportation practices thus, be implemented to reduce costs, upgrade movement of consignments, appointment of efficient freight modes, and preservation of natural and human resources. Additionally, it strengthens the product's brand image, the advantage to customer retention rate as green products have been gaining due importance by them too. There is an opportunity to adopt environmentally sustainable transportation operations to attract masses in a large number of firms (Dettmer, Nations, and Food 2018).

2.7. CONCEPTUAL FRAMEWORK



CHAPTER 3:

RESEARCH METHODOLOGY

3.1. RESEARCH DESIGN

The main objective of this paper is to examine **transportation operations of the 3rd party logistics industry to green practices and analyze potential benefits while adopting environment-friendly efforts into their operations**. A conclusive research design is chosen. It is defined by Creswell (2007) as a design that benefits valuable findings and aids in driving substantial results. Quantitative methods are more often applied to a conclusive research design to gather research-related data. An absolute study is crucial for authentication of hypothesis and relationship among variables (Creswell, 2009).

3.2. RESEARCH APPROACH

The approach for a study is classified into two types; inductive and deductive approach. Inductive reasoning or approach is used to drive a theory by proposing conclusive results. After observing a pattern, a hypothetic observation is given for a theory. Whereas, deductive approach is adopted to examine the hypothetic observations provided by an inductive approach. It necessarily requires any theory, to begin with, construction of a hypothesis, assembles the data related to observation, assesses the hypothesis based on collected data, and investigates to accept or reject the hypothesis.

Particularly, in this research, the **deductive approach** is followed to test the hypothesis as a research question and conclude some reliable results based on sample data.

3.3. RESEARCH METHODOLOGY

The quantitative research approach is opted to conduct research. Analysis that deals with facts and figures, referred to as the quantitative approach (Creswell, 2009), While results are based on some substantial and authentic findings. A quantitative analysis of green transportation operations and their benefits on environment and logistics operations are done. An investigative study is performed using a statistical tool i.e. Statistical Package for the Social Sciences (SPSS). Absolute results will be given, after testing the hypothesis whether to accept or reject. The core objective of a study is to examine transportation operations of the 3rd party logistics industry concerning green practices and analyze potential benefits like optimization of resources, and reduction in operating costs while adopting environment-friendly efforts into their operations. Quantitative Analysis is therefore used to analyze the relationship of dependent and independent variables with a mediating role of green practices.

3.4. DATA COLLECTION

In this research, a primary source of the method is used to collect data through the questionnaire survey. To get the appropriate responses for each variable of the study, the questionnaire is circulated among the selected sample.

3.5. SAMPLE POPULATION

To get authentic and valid results, I have included respondents who are engaged in working with 3rd party logistics. The technique used to reach these customers is by online survey form circulated through email and by meeting them collectively. The target population for this research is 300 respondents. It must be kept in mind that my research is only applicable to Karachi. Keep in mind that our research variables were explicitly aimed at Karachi 3rd party logistics working employees.

3.6. SAMPLE AND SAMPLING METHOD

For this analysis, a simple, probability sampling technique is used. Grounded with the objective of the study, it is the target of the researcher to examine the role of green transportation to reduce carbon emissions and optimize resources with operating costs. Thus, unambiguously, subjects (selectedbased on the availability and accessibility of the researcher) for study are working individuals in the transportation industry. For this purpose, it is needed to define a collective view of individuals and hence the simple probability sampling is utilized. The researcher calculated a 5-percent error margin when choosing the sample size, so the sample size will be 290 respondents for the study at a 95-percent confidence interval for a population of 300 respondents.

3.7. RESEARCH INSTRUMENT

The study method used for this analysis is a questionnaire. The data collection tool for this study is primary and the survey methodology is used to collect responses from the sample of 3rd party logistics working employees. However, the questionnaire is structured with the aid of the Likert scale; 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree with the statement related to subject matter.

3.8. RESEARCH VARIABLES

The variables for this analysis are related to defining green transportation operations through a reduction in carbon emissions, optimization of resources, and reduction in operating costs. While, green practices also taken to define transportation operations. The research variables are as follows:

- Independent variable (IV – 1) = Reduction in Carbon Emissions
- Independent variable (IV – 2) = Optimization
- Independent variable (IV – 3) = Reduction in Operating Costs
- Independent Variable (IV – 4) = Green Practices
- Dependent variable (DV – 1) = Transportation Operations

3.9. RESEARCH HYPOTHESIS

H_1 = There is a significant positive impact of green practices on reduced carbon emissions

H_2 = There is a significant positive impact of green practices on optimization

H_3 = There is a significant positive impact of green practices and reduced operating costs

H_4 = There is a significant positive impact of green practices on transportation operations

3.10. DATA ANALYSIS METHOD

To evaluate the research hypothesis, the data obtained from the analysis were analyzed with the aid of a statistical test. The study involves Cronbach's Alpha tests to verify reliability and validity, while the regression tests are used to assess the intensity and importance of the variable at the end of the study to precisely define the relationship between the independent variable (Carbon emissions, Optimization, and operating costs) and dependent variable (green practices) as well as Green practices (independent Variable) is also analyzed with transport operations (Dependent Variable).

CHAPTER 4:

DATA ANALYSIS

This section includes data exploration tests applied to either approve or dismiss the assumptions. These particular tests are applied to 300 responses collected through the probability sampling technique. These collected responses are examined through the following five statistical tests in SPSS, as stated in early chapters.

A) Demographic Analysis

B) Frequency Analysis

C) Descriptive Statistic

D) Measures Cronbach's Alpha Reliability Testing

E) Kaiser–Meyer–Olkin (KMO) test and Bartlett test

F) Exploratory Factor (EFA) Analysis

G) Regression Testing

H) Pearson Moment Correlation Testing

4.1. RELIABILITY & VALIDITY

The most initial and common practice in a statistical test is to authenticate the reliability of variables is 'Cronbach's Alpha'. This test evaluates the validity of focused variables of study (Thomas, 2003). The results demonstrate that either variable is accurate to run the test or it may need to do some changes. Cronbach's Alpha values superior to 70% is very good but, some researchers have also accepted alpha of 60% or even 50% respectively (Sekaran et al., 2003). It is necessary to analyze the data from reliability analysis (Nunnally, 1978). This research investigates the relationship of 4 focus variables like Green transportation practices, carbon emissions, optimization of resources, operating costs. These variables are analyzed for accuracy and reliability for the study.

4.1.1. *Analysis – Reliability, and Validity*

Table 4.1.1. Reliability Analysis of Focus Variables

Reliability Statistics		
Focus Study	Cronbach's Alpha	Number of Items
Transportation Operations	.795	5
Green Practices	.693	5
Carbon Emissions Reduction	.731	5
Optimization	.613	5
Operating Cost Reduction	.535	5
Overall	**.924**	**25**

The above figure 1 shows the reliability statistics for all 5 variables i.e. Transportation Operations, Green Transportation Practices, Reduction in Carbon Emissions, Optimization, and Reduction in Operating Cost individually as well as overall. Here, alpha values of Transportation Operations, green practices and reduced carbon emissions are 0.795, 0.693 and 0.731 and according to the interpretation of Sekaran (2003), the results are reliable around 70% and 73.1% respectively. While alpha values of Optimization and Operating Cost reduction are 0.613 and 0.535 and unable to fulfill base criteria of 70%. Though, it is allowed by a few researchers' criteria of 50% or 60% (Sekaran et al., 2003). The results are reliable around 61.3% and 53.5% respectively and valid to use.

Moreover, in this case, reliability of the all five variables together is more than 70% that is acceptable. The value of Cronbach's alpha (α) (from 1 dependent and 4 independent variables) that is based on 25 items is 0.924 i.e. almost 92% this shows the consistency of the items.

4.2. DEMOGRAPHIC ANALYSIS

The below-mentioned demographic tables determine respondents at a glance demographic analysis of some of the demographic personal and corporate information. All the demographic tables are based on the variables of research to determine respondents' personalities.

4.2.1. *Demographic Analysis*

The demographics of the study consist of given items through which the study survey was conducted from the target population.

Table 4.2.1. Frequency Analysis of Respondents Gender

Gender			
		Frequency	Percentage
Valid	Male	193	64 %
	Female	107	36 %
	Total	300	100 %

The demographics of the study consist of the following items through which the study survey was conducted from the target population of transportation service providers and employees both genders were selected for a survey. Male respondents' frequency is (193) and their percentile is 64%. While female respondents' frequency is (107) and their percentile is 36%.

Table 4.2.2. Frequency Analysis of Respondents Age (in years)

Age (in Years)			
		Frequency	Percent
Valid	18 - 25	66	22%
	26 - 33	133	44%
	34 - 40	96	32%
	40 and above	5	2%
	Total	300	100%

The demographics of the study consist of employees' average age differences are accordingly from (18 – 40 and above). Respondents with an age limit of 18 – 25 were 66 and its percentile was 22%. An age limit of 26 – 33 respondents were 133 and its percentile was 44%. An age limit of 34 – 40 respondents were 96 and the percentile was 32%. An age limit of 40 and above respondents were only 5 and its percentile was 2%.

Table 4.2.3. Frequency Analysis of Respondents Educational Level

Education			
		Frequency	Percentage
Valid	Undergraduate	47	16%
	Graduate	148	49%
	Postgraduate	105	35%
	Total	300	100%

Knowledge levels were categorized as undergraduate respondents were 47 with a percentile of 16%. Graduate respondents were 148 with a percentile of 49%. Postgraduate respondents who were Masters, M.Phil./PHD was 105 with a percentile of 35%.

Table 4.2.4. Frequency Analysis of Respondents Average Monthly Income (in PKRs.)

Average Monthly Income (in PKRs.)			
		Frequency	Percentage
Valid	20,000 - 30,000	42	14%
	30,001 - 40,000	120	40%
	40,001 - 50,000	85	28%
	50,001 - 60,000	53	18%
	Total	300	100%

The income level of the selected population was, respondents with an income limit of 20,000–30,000 were 42 with a percentile of 14%. The income limit of 31,000–40,000 was 120 with a percentile of 40%. The income limit of 41,000–50,000 was 85 with a percentile of 28%. The income limit of 50,001–60,000 was 53 with a percentile of 18%.

Table 4.2.5. Frequency Analysis of Respondents Associated with Business Ownership

Business Ownership			
		Frequency	Percentage
Valid	State - owned	41	14%

	Private Company	158	53%
	Joint Venture	73	24%
	Foreign Funded	28	9%
	Total	300	100%

Section 2 of the questionnaire survey consists of business or company-related items of respondents through which the study survey was conducted from the target population. Respondents from state-owned businesses were 41 and its percentile was 14%. Private-owned businesses were 158 and its percentile was 53%. Joint venture businesses were 73 and its percentile was 24%. Foreign-funded businesses were 28 and its percentile was 9%.

Table 4.2.6. Frequency Analysis of Respondents Associated with Business Origin

Business Origin			
		Frequency	Percentage
Valid	Transportation - Based	70	23%
	Warehouse - Based	82	27%
	Integrated	148	49%
	Total	300	100%

We have selected respondents working in 3 types of businesses are included in the survey. Business origin consists of respondents from the transportation sector were 70 and its percentile was 23%. Warehouse-based sector respondents were 82 with a usage percentile of 27%. Integrated transportation and warehouse sector respondents were 148 and the percentile was 49%.

Table 4.2.7. Frequency Analysis of Respondents Associated with Business No. of Employees

No. of Employees			
		Frequency	Percentage
Valid	Less than 100	49	16%
	101 - 200	94	31%

	201 - 500	72	24%
	More than 500	85	28%
	Total	300	100%

Businesses with less than 100 employees were 49 with a percentile of 16%. Businesses with 101 – 200 employees were 94 with a percentile of 31%. Businesses with 201 – 500 employees were 72 with a percentile of 24%. Businesses with more than 500 employees were 85 with a percentile of 28%.

Table 4.2.8. Frequency Analysis of Respondents Associated with Business Annual Turnover (in Millions)

Annual Turnover (in Millions)			
		Frequency	Percentage
Valid	Less than 5	36	12%
	5 – 10	71	24%
	11 – 20	41	14%
	21 – 50	55	18%
	51 - 100	35	12%
	More than 100	62	21%
	Total	300	100%

Average Annual Turnover of businesses working in transport service providers in millions less than 5 were 36 with a percentile of 12%. Turnover between 5 – 10 million was 71 with a percentile of 24%. Turnover with 11 – 20 million was 41 with a percentile of 14%. Turnover between 21 – 50 million were 55 with a percentile of 18%. Turnover between 51 – 100 million was 35 and its percentile was 12%. Turnover with More than 100 million was 62 and its percentile was 21%.

4.3. DESCRIPTIVE STATISTICS

Table 4.3.1. Descriptive Analysis of Focus Study

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Transportation	300	1.60	5.00	3.4800	.81179
Green Practices	300	1.40	4.80	3.6027	.67144
Carbon Emissions	300	1.00	5.00	3.4313	.78477
Optimization	300	1.80	5.00	3.5847	.73108
Operating Cost	300	1.00	5.00	3.4980	.71064
Valid N (list-wise)	300				

4.3.1. Descriptive Statistics Analysis

The above descriptive statistic table determines that all focus study variables i.e. Reduced Carbon Emissions, Optimization, Reduced Operating Cost, Green Practices and transportation range between 1 – 5 or Strongly Disagree to Strongly Agree. While strongly disagree indicates that respondents showed disapproval to the statement while strongly agree indicates respondent's approval to the statement. According to the above table, transport operations have been widely dispersed with 0.81179 and 3.4800 as mean indicating, 3rd party logistics are neutral to green initiatives. Green practices have 3.6027 showing near to agree with the statement of 'green practices shall reduce greenhouse gas emissions. This identifies that most respondents accepted green practices while, the Reduced Carbon Emissions, Optimization, and Reduced Operating Cost have a mean value of 3.4287, 3.6653 & 3.6240 respectively.

4.4. AN INFERENTIAL STATISTIC

This section contains KMO and Bartlett's test, Exploratory Factor Analysis (E.F.A), and Regression executed to define whether there exists substantial positive association among focus study constructs as well as, to highlight the strength of the correlation among the focus study.

4.4.1. KMO and Bartlett's Test

Kaiser Meyer Olkin is a way to analyze the appropriateness of responses for Exploratory Factor Analysis (EFA). This investigates sampling compatibility for the individual variable of study as well as for an overall model. Kaiser Meyer Okine (KMO) values range between 0.8 and 1.0 means sampling is adequate. This can also be said as there is an adequate proportion of variance among variables of the study.

On the other hand, Bartlett's test defined (Snedecor & Cochran, 1983) as to measure the homogeneity of variances. It analyzes the assumption of a null hypothesis stating equal variance across samples. It tests the normality of sample distribution. If the p-value is inferior to 0.05, reject the null hypothesis and the researcher can say that variance of at least one variable is different as compared to others.

4.4.1.2. KMO and Bartlett's Analysis

Table 4.4.1.2. KMO Analysis of Overall Variables of Study

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.740
Bartlett's Test of Sphericity	Approx. Chi-Square	1411.564
	Df	10
	Sig.	.000

In the above table shown, the KMO esteem is 0.740 fulfilling the basic criteria as recommended (Kaiser, 1974) and is considered as a great example. In other words, it successfully rejects a null hypothesis of equal variance between variables. Furthermore, Bartlett's trial of Sphericity value of probability is 0.000 (which is under 0.05). It demonstrates the relationship between the things at the 5-percent level of importance is adequate and is satisfactory for further examination.

4.4.2. *Exploratory Factor Analysis (EFA)*

Exploratory Factor Analysis (EFA) or Maximum Likelihood Method is a measurement model extracted to analyze dependent and independent variables assumed at the interval. It is performed to reduce data and distinguish the loaded items which are appointed on the same build. It can depreciate the large data into small data. Emory and Cooper (1991), claims that the factor analysis can help scholars in determining the resources of the factors. Extracted initial loadings for each construct of a variable must be greater than 0.6 to accept the item for study focus.

4.5.2.1. Exploratory Factor Analysis

Table 4.5.2.1: Maximum Likelihood Factor Analysis

Items	Transport Operations	Green Practices	Reduced Carbon Emissions	Optimization	Reduced Operating Cost
T1	.784				
T2	.975				

T3	.985				
T4	.952				
T5	.478				
GP 1		.716			
GP 2		.981			
GP 3		.743			
GP 4		.865			
GP 5		.865			
CE 1			.536		
CE 2			.447		
CE 3			.983		
CE 4			.865		
CE 5			.637		
O 1				.983	
O 2				.698	
O 3				.725	
O 4				.983	
O 5				.486	
OP 1					.926
OP 2					.926
OP 3					.983
OP 4					.698
OP 5					.393

4.5.2.2. Exploratory Factor Analysis

This table shows the outer variables result in the analysis of factors that demonstrates the 20 items of five factors. The first factor Transport operations has five items with the loadings i.e. T1 is .784, T2 is .975, T3 is .985, T4 is .952 and T5 is .478. The second factor in our study is Green Transportation Practices has five items with the loadings i.e. GP1 is 0.716, GP2 is 0.981, GP3 is 0.743, GP4 is 0.865 and GP5 is 0.865. The third factor in our study is Reduced Carbon Emissions also has five items with the loadings i.e. CE1 is 0.536, CE2 is 0.447, CE3 is 0.865, CE4 is 0.637 and CE5 is 0.983. The forth factor is Optimization of Operations with five items as well. Here the loading of each item is that O1 is 0.698, O2 0.725, O3 is 0.983, O4 is 0.486 and O5 is 0.926. The fifth factor is Reduced Operating Cost, it also has five items with the loading i.e. OP1 is 0.926, OP2 is 0.983, OP3 is 0.698, OP4 is 0.981 and OP5 is 0.393.

4.4.3. Regression Analysis

A reliable technique to detect a noteworthy effect of focused variables of study is known as regression analysis. It allows a researcher to demonstrate significant factors or variables and identify unimportant variables. This technique also explains the impact of study variables on each other.

Below given tables are explained dependent variables i.e. Green Practices by independent factors, i.e. reduced carbon emissions, optimization, and reduced operating cost. Another table 4.4.3.2 indicates the results of green practices (independent variable) if involved in transport operations (dependent variable).

4.4.3.1. Hypothesis Summary

Table 4.4.3.1: Beta of Coefficient of Independent Variables

Coefficients'								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	R - Square	.699				.000		
	(Constant)	.560	.126		4.429	.000	.311	.808
	Carbon Emissions	.420	.042	.490	10.006	.000	.337	.502
	Optimization	.205	.043	.224	4.788	.040	.121	.290
	Operating Cost	.248	.035	.262	7.065	.000	.1790	.317
a. Dependent Variable: Green Practices								

Equation:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \mathcal{E}$$

Y = Green Practices
X_1 = Reduced Carbon Emissions
X_2 = Optimization
X_3 = Reduced Operating Cost
$\mathcal{E}$ = Standard Error

$$\text{Green Practices} = \text{Reduced Carbon Emissions} + \text{Optimization} + \text{Operating Cost Reduction} + \mathcal{E}$$

$$\textit{Green Practices} = .560 + \textit{Reduced Carbon Emissions}\ (.420) + \textit{Optimization}\ (.205) + \textit{Operating Cost Reduction}\ (.248) + \mathcal{E}$$

As indicated in the above table, R-square is 0.699 (70%) which means our independent variables, i.e. Reduced Carbon Emissions, Optimization, and Reduced Operating Cost cause 0.699 change in the dependent variable i.e. green practices. The coefficient results are also indicated that the beta value is 0.490, 0.224, and 0.262 means that the change in reduced Carbon Emission, Optimization, and Reduced Operating Cost by 0.560 units will bring about the change in thedependent variable i.e. Green Practices. Furthermore, the positive beta value indicates the positive relationship between green transportation, reduced carbon emission, optimization, and reduced operating cost. In other words, when green practices increase by one unit, it reduces carbon emissions, optimization and operating costs by 0.490, 0.224 and 0.262 respectively.

Table 4.4.3.2: Beta of Coefficient of Independent Variables

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	R – square	.575				.000		
	(Constant)	.178	.167		1.065	.288	-.151	.508
	Transport	.916	.046	.758	20.062	.000	.827	1.006
a. Dependent Variable: Transport								

The above table 4.4.3.2 shows the coefficient results. As indicated in the above table, R-square is 0.575 (57.5%) which means our independent variables, i.e. Green practices causes 0.575 change in the dependent variable i.e. transport operations. While, beta value is 0.758 means that the change in green practices by 0.178 units will bring about the change in the dependent variable i.e. transport operations. Furthermore, the positive beta value indicates the positive relationship between green practices and Transport operations. In other words, when green practices increase by one unit, it increases by 0.758.

***Equation**:*

$$Y = \beta_0 + \beta_1 X_1 + \mathcal{E}$$

Y = Transport Operations
X_1 = Green Practices
$\mathcal{E}$ = Standard Error

$$\text{Transportation} = \beta_0 + \text{Green Practices} + \mathcal{E}$$

$$\text{Transportation} = \mathbf{.575} + \text{Green Practices } (\mathbf{.758}) + \mathcal{E}$$

4.4.4. <u>Pearson Correlation Analysis</u>

Pearson Correlation is a parametric normality measure to define the power and path of linear associations between pairs of continuous focus of study. It identifies a statistically significant linear relationship within and between observed continuous variables.

Table 4.4.4.1: Correlation Matrix between Green Transportation and Reduced Carbon Emissions

		Transportation	Green Practices	Carbon Emissions	Optimization	Operating Cost
Transportation	Pearson Correlation	1	.758**	.843**	.916**	.388**
	Sig. (2-tailed)		.000	.000	.000	.000
	N		300	300	300	300
Green Practices	Pearson Correlation		1	.786**	.693**	.606**
	Sig. (2-tailed)			.000	.000	.000
	N			300	300	300
Carbon Emissions	Pearson Correlation			1	.728**	.507**
	Sig. (2-tailed)				.000	.000
	N				300	300
Optimization	Pearson Correlation				1	.426**
	Sig. (2-tailed)					.000
	N					300
Operating Cost	Pearson Correlation					1
	Sig. (2-tailed)					
	N					
**. Correlation is significant at the 0.01 level (2-tailed).						

There exists a noteworthy correlation between green practices and transportation at 0.758 at 95% confidence interval with 0.05 (2 – tailed) significant alpha level. In other words, green practices and transportation is 75.8% correlated with each other. There exists a noteworthy correlation between green practices and carbon emissions at 0.786 at 95% confidence interval with 0.05 (2 – tailed) significant alpha level. In other words, green practices and carbon emissions reduction is 78.6% correlated with each other. There exists a noteworthy correlation at 0.606 at 95% confidence interval with 0.05 (2 – tailed) significant alpha level. In other words, green practices and optimization is 60.6% correlated with each other. There exists a noteworthy correlation at 0.693 at 95% confidence interval with 0.05 (2 – tailed) significant alpha level. In other words, green practices and operating cost reduction is 69.3% correlated with each other.

4.5. HYPOTHESIS TESITING RESULTS

H_1= There is a significant positive impact of green practices on reduced carbon emissions

4.5.1. <u>Transportation Operations and Green Practices</u>

Green Practices

Green Practices comprises of efforts that reduces greenhouse gases effect in the environment and makes ozone layer stronger. It is assumed that green practices if implemented in different areas of business's supply chain processes, it benefits the environment as well human being lives on earth.

Transportation Operations

It plays a vital role in supply chain process as it refers to movement of goods and services and people from one place to another. If green practices are implemented, it would surely improve transportation operations and environment be more sustainable. Above statistical results approve the face that if transportation be converted to green transport operations, it would evidently, improve operations overall as well as environment would be more sustainable.

H_2= There is a significant positive impact of green practices on Carbon Emission

4.5.2. <u>Green Transportation Practices and Carbon Emission Reduction</u>

Carbon Emissions

Current environmental situations and serious concerns over living lives on Earth has grabbed world to focus on identification and implementation of remedial measures to eliminate or lower these gas emissions and improve environment sustainability. The foremost and significant method to enhance life sustainability is to implement green practices and reduce carbon emissions. This study has been conducted to prove the green practices impact on reducing supply chain carbon emissions with statistical evidence. The result shows 0.49 or 49% impact of carbon emissions can be reduced by execution of green practices.

H_3= There is a significant positive impact of green practices on optimization

4.5.2. <u>Green Transportation Practices and Optimization</u>

Optimization

While implementing green practices in supply chain's noteworthy area i.e. transportation to reduce overall supply chain carbon emissions is only single benefit identified yet. Surprisingly, it also improves the total transportation maneuvers and helps to optimize the tasks. It does so by, reducing wastes, choosing the right voyage carrier, consolidation of shipments, while improving efficiency and transit route time. This study has been conducted to prove the green practices impact on improving optimization of transportation processes with statistical evidence. The result shows 0.224 or 22.4% impact of optimization can be improved by execution of green practices.

H_3= There is a significant positive impact of green practices on operating cost reduction

4.5.3. Green Transportation Practices and Reduced Operating Cost

Operating Cost Reduction

It has also been realized that many businesses or more precisely, 3rd party logistics are reluctant to adopt environment friendly measures due to increase in cost. Operating cost has been defined by transportation, warehousing, inventory, total logistics and administration cost. This study has also taken operating cost into account to provide statistical evidence to green practices impact on reducing operating cost of transportation operations with statistical evidence. The result shows 0.262 or 26.2% impact of operating cost reduction can be improved by execution of green practices.

Table 4.5.1 Hypothesis Testing Analysis Summary

Hypothesis	Accept / Reject
H_1= There is a significant positive impact of green practices on reduced carbon emissions.	**Accepted**
H_2= There is a significant positive impact of green practices on optimization	**Accepted**
H_3= There is a significant positive impact of green practices and reduced operating costs.	**Accepted**
H_4= There is a significant positive impact of green practices on transport operations.	**Accepted**

CHAPTER 5:

CONCLUSION AND RECOMMENDATIONS

5.1. FINDINGS

- The study's main aim was to investigate the overall transportation operations and green practices at third-party logistics, as well as to look into the effect of different benefits of adopting green practices on transportation operations. Hypothesis were also built in this study to look at how transportation creates a reduction in greenhouse gas emissions, optimization, and reduction in operating costs through green practices.

- To achieve this goal, a quantitative research approach was used, and quantitative data from third-party logistics employees was collected using a probabilistic sampling technique with a random sampling method.

- Descriptive statistics, such as frequency, mean, and correlation analysis techniques, were used to evaluate respondents' context information, their perceptions of transport operations and green practices, and the relationship between reduced carbon emissions, optimization, and reduced operating cost, and overall transport operations. In addition, inferential methods such as regression analysis, KMO and Bartlett's test, and Factor Analysis were also used.

- Employees' green practices, reduced carbon emissions, optimization of operations, and reduced operating cost were also measured using a mean score comparison.

- The findings have revealed that independent variables have a widespread relationship (reduced carbon emissions, optimization, and reduced operating cost). The impact between green practices and carbon emissions is especially stronger.

- Even though their depth varies, all independent variables have a substantial relationship with dependent variables at $p = 0.01$.

- The impact of every independent variable on the dependent variable was investigated using regression analysis.

- Finally, the theories established were put to the test, and the effects show that all green practices have an important and high-quality impact on transport operations. Furthermore, all three benefits of green practices have a direct and optimistic effect on green transportation practices.

5.2. CONCLUSION

At concluding the analysis, it is now seen that the world has been cautiously watching corporations either small, medium, or large enterprises to convert their operations into sustainable applications and become eco–friendly. Annually 40 – 70 % of greenhouse gas emissions needed to be reduced in 2010 – 2050 as per calculations of the Intergovernmental Panel on Climate Change (IPCC) a conference organized in 2014 otherwise average global temperature will surpass 2^{o} which is a moderate climate temperature.

The transportation sector comprises companies that offer the service of transportation of people and goods and the related infrastructure therein. Industries in this sector include airlines, marine, rail and road, air freights, and logistics and transportation infrastructure. The concept of integration of operation with environmental actions is termed as going 'green'. Corporations are now integrating environmental aspects of supply chain management to minimize the greenhouse gas effects. This integration is stated, 'Green Supply Chain Management (GSCM)'.

The study's main aim was to investigate green practices and transport operations in third-party logistics, as well as to investigate the benefits of green practices created on transport operations through green practices, and to identify important green practices that have a greater impact on transport operations. Good transport operations are a fundamental source of value creation in the logistics and supply chain of any business and now every business goal is to sustain the market by creating value.

Exchange of people, equipment, and materials with safety and efficiency from origin to a destination place is the prime objective of transportation. In consequence of the inferior value of oil utilized, the supreme contemporary vessel machines release greater greenhouse gases per power output as compared to controlled on-road oil machines (Corbett & Farrell, 2002). Operations that abolish negative impacts on the environment are known as Green practices (Azevedo et al., 2011). The eco-friendly movement is the main target of green transportation by employing proper resources. The practices as shifts in mode, eco–friendly transport management, logistics mechanisms, technological advancements, eco–friendly driving, use of alternative fuels to make the environment more sustainable. Green practices have been implemented by various organizations to diminish their business operations' effects on the environment, societal safety, along with retaining efficiency, an advantage over their respective competitors, and accessing new markets by meeting stakeholders' demands.

The researchers' are confident to say that green practices significantly impact overall transportation operations to reduce carbon emissions, optimize the processes, and reduce operating costs. There is a high association between dependent focus i.e. green practices and independent focuses i.e. carbon emissions, optimization and operating cost. Green transportation practices thus, be implemented to reduce costs, upgrade movement of consignments, the appointment of efficient freight modes, and preservation of natural and human resources.

5.3. FUTURE RECOMMENDATIONS

There is a great scope for future researchers in this area, including:

1. The sample size can be extended for the study and can include more variables like fixed cost reduction, customer preference to green transporters', reverse logistics and green logistics, etc. defining transport and logistics of any business supply chain.
2. Another recommendation is to maximize the time limit and include other cities of Pakistan or any other state logistics and transportation services, as the logistics suppliers are working worldwide on a greater scale.
3. The study is conducted through quantitative data, while more specified results can be obtained by using qualitative tools as it will get in-depth perception of transportation providers on green practices implementation.
4. This research is only limited to implementing green practices in transport operations, while logistics includes 2 other areas i.e. warehousing and packaging activities. It is suggested to investigate the overall benefits of logistics operations when green practices were involved.

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APPENDIX – I

Section 1: Demographics

Gender:

Male ☐ Female ☐

Education:

Under Graduates ☐ Graduate ☐ Post Graduate ☐

Income:

20,000 - 30,000 ☐ 30,001 - 40,000 ☐ 40,001 - 50,000 ☐
50,001 - 60,000 ☐

Age:

18-25 ☐
26- 33 ☐
33-40 ☐

45 and above ☐

Section 2: Company Profile

Business Origin

Transportation based ☐ Warehouse – Based ☐ Integrated ☐

Ownership Type:

State-Owned ☐ Private Company ☐ Joint – Venture ☐ Foreign-funded ☐

Number of Employees

Less than 100 ☐ 100 – 200 ☐ 201 – 500 ☐ More than 500 ☐

Annual Turnover (in Million)

Less than 5 ☐ 5 – 10 ☐ 11 – 20 ☐ 21 – 50 ☐

51 – 100 ☐ More than 100 ☐

Section 3:

Note: Please fill out your questionnaire as per your company logistics and transportation operations.

Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)

Logistics and Transportation	**1 Strongly Disagree**	**2 Disagree**	**3 Neutral**	**4 Agree**	**5 Strongly Agree**
Our firm logistics capabilities are suitably integrated at its supply chain level.					
Our firm's supply chain logistics are suitably integrated with suppliers; logistics activities.					
Our integrated supply chain logistics capabilities are characterized by excellent distribution, transportation, and/or warehousing facilities.					
Our inter–organizational logistic activities are closely coordinated.					
Our firms' logistics is continuously improving with environment sustainability.					
Source: *(Mandal et al., 2016)*					

Green Practices in Logistics Function	**1 Very Low**	**2 Low**	**3 Moderate**	**4 High**	**5 Very High**
To what extent does your company implement the following green logistics practices in collaboration with this					

environmentally conscious logistics buyer?					
Transportation Management for the environment (e.g. Increase fill rate, rout optimization)					
Logistics system design for the environment (e.g. reduced transport through better choice of distribution centers, urban consolidation centers)					
Vehicle Technologies (e.g. more efficient engines less polluting vehicles, less air resistance)					
Alternative fuels (e.g. biofuels, electric trucks)					
Source: *(Jazairy et al., 2021)*					

Reduction in Carbon Emissions	**1 Strongly Disagree**	**2 Disagree**	**3 Neutral**	**4 Agree**	**5 Strongly Agree**
Our Company:					
Has an explicit greenhouse gas emissions reduction strategy.					
Educate employees on environmental issues.					
Performs life cycle assessments of our product.					
Includes environmental performance criteria in the evaluation of employees.					
Publishes an environment report.					
Source: *(Pazirandeh & Jafri, 2013)*					

1. **Logistics Optimization**	**1**	**2**	**3**	**4**	**5**
We collect used products for recycling.					
We recall used products for proper disposal.					
We work with distributors to build an optimized transportation network.					
Our firm uses route optimization software to ensure efficiency.					
We Cooperate with suppliers and customers to develop route networks.					
Source: (Nikolaou et al., 2013, Vijayan 2014, Boix et al., 2015)					

1. **Reduction in Operating Cost**	**1**	**2**	**3**	**4**	**5**
Over the past three years, our transport has experienced improvements in:					
Transportation cost					
Inventory cost					
Warehousing cost					
Administration cost					
Total logistics cost					
Source: (*Pazirandeh & Jafri, 2013)*					

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