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Green Transportation and Sustainable Supply Chain Performance of Road Transport Companies in Rivers State

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Abstract

This study was conducted to examine the relationship between green transportation and sustainable supply chain performance of road transport companies in Rivers State. The study adopted an explanatory research design and collected primary data in a cross-sectional survey. Primary data was generated through self- administered questionnaire. The study population comprised of the twenty- six (26) road transport companies operating in Rivers State as obtained from the Rivers State ministry of transport. The entire population was adopted as sample size. 2 managers were selected from each of the 26 road transport companies to arrive at a total of 52 respondents. The reliability of the instrument used in the study was ascertained using the Cronbach's Alpha of reliability with a threshold of 0.70. The hypotheses were tested using the Spearman's Rank Order Correlation with the aid of statistical Package of Social Sciences version 25.0. The test was carried out at 95% confidence interval and a 0.05 level of significance. The study showed that there is a positive and significant relationship between green transportation and sustainable supply chain performance (environmental, social and economic) of road transport companies in Rivers State. Thus, the study concluded that green transportation significantly relates with sustainable supply chain performance of road transport companies in Rivers State, Nigeria: and recommended that management of road transport companies in Rivers State should build the company's strategy around the idea of green transportation, provide economic driving classes, and invest in employee education.

Keywords:

Green transportation, Sustainable supply chain performance, Environmental performance, social performance, Economic performance

INTRODUCTION

Transportation plays a crucial role in the supply chain by linking the various actors involved in both the upstream and downstream processes. It is a vital component of effective logistics management. The history of logistics and transportation dates back to the earliest days of human civilisation, yet it has only recently received widespread recognition. Transportation is a crucial aspect of an organisation since it facilitates the movement of goods and passengers, playing a significant role in economic and industrial growth and development (Salimifard et al., 2012). The concept of green mobility has gained significant prominence in recent times and is being employed to enhance the sustainable performance of organisations. Green transportation includes the use of environmentally friendly vehicles, the reduction of CO2 emissions, the use of sustainable carriers, and the optimisation and consolidation of freight. Organisations are embracing environmentally friendly tactics to maintain competitiveness due to the growing awareness among customers and organisations about sustainable practices, which has been driven by the rise of globalisation. Freight transport is responsible for over 90% of the greenhouse gas emissions produced by logistical activities (McKinnon et al., 2015). The type of vehicle utilised for transport greatly influences the environmental impact of each individual activity. The organization's ability to prevent pollution not only minimises the overall environmental impact, but also reduces costs while improving the overall efficiency and effectiveness of the organisation.

The road transport sector in Nigeria plays a significant role in the country's economy by employing the highest number of workers and affecting all aspects of the nation's existence. The transportation of people and products in Nigeria is primarily conducted through road networks. As rural towns become more urbanised, there is a growing demand for interstate road transit to accommodate the large number of people travelling through cities who want efficient transportation. According to the International Transport Forum (2021), the need for goods transportation is expected to more than double by 2050 compared to the level in 2015. This presents issues in dealing with the greater environmental consequences that will come with the increased demand. The transportation industry is responsible for 25% of total worldwide CO2 emissions, with freight transportation alone contributing over 40%. Hence, considering these alarming patterns of escalating pollution, it is imperative to implement decisive measures to mitigate the environmental repercussions of the logistics business and its transportation systems, without compromising efficiency.

Hence, the research results will offer practical and theoretical knowledge to road transport businesses in Rivers State. The focus will be on enhancing their implementation of environmentally friendly logistics practices by promoting the transfer of knowledge and inter-organizational learning in their operations. In addition, the Rivers State government will derive policy implications from the findings of this study to promote green transportation practices in the transportation and other businesses. This publication also acts as a valuable resource for scholars in the field of green transport and other related areas of study who aim to make progress in developing and implementing this theory. This study aimed to examine the correlation between green transport and the sustainable supply chain performance of road transport companies in Rivers State. This study aimed to investigate the correlation between green mobility and the performance of ecologically sustainable supply chains. The relationship between green transportation and social sustainable supply chain performance is the connection or correlation between the use of environmentally friendly transportation methods and the achievement of socially sustainable supply chain performance. The relationship between green transportation and economic sustainable supply chain performance is the connection or correlation between the use of environmentally friendly transportation methods and the ability of a supply chain to achieve long-term economic sustainability.

LITERATURE REVIEW

Green Transportation

Green transport, as defined by Mckinnon (2010), refers to the process of decreasing the amount of energy used in freight transport by shifting freight to modes of transportation that produce less carbon emissions, optimising vehicle usage, and reducing the energy intensity of freight transport operations. Wan-Ming (2019) defines green transportation as a system that encompasses various sustainable modes of transportation, with a focus on resource efficiency, enhancing transportation infrastructure, and promoting eco-friendly options like carpooling, public transportation, cycling, and walking. Transportation is a significant aspect of green logistics management, because activities associated to transportation have a considerable negative influence on the environment, such as pollution and noise. The net present value has a significant influence on transportation, while the many aspects of logistics are governed by the time it takes for transit. Green logistics management involves implementing suggested practices such as reducing transportation emissions by selecting alternative modes of transportation and improving transportation networks, as this has a substantial impact on reducing logistics emissions. Electric vehicles have gained significant attention as a crucial technological innovation in the automotive industry. They have the potential to promote sustainable growth by minimising air pollution, greenhouse gas emissions, and creating new job possibilities (Trivellas et al., 2020). Implementing environmentally-friendly logistics techniques can improve the financial performance of the company and provide a notable competitive advantage (Khan et al., 2019). Employing fuel-efficient vehicle fleets can be an appealing and ecologically conscious approach. Implementing eco-driving tactics, utilising alternative fuels, and adhering to proper car maintenance practices will enhance fuel efficiency. Transportation systems can be made more environmentally friendly by transitioning to eco-friendly and efficient fuels. Liquefied natural gas (LNG) and compressed natural gas (CNG) are more cost-effective than petrol, with a price difference of 40 percent. Additionally, they offer superior environmental cleanliness and safety compared to petrol (Mutie et al., 2020). Alternative fuel refers to the use of fuel alternatives that are more ecologically sustainable than traditional petroleum-based fuels such as petrol and diesel. It is possible to modify an existing group of vehicles by installing alternative fuel options like biofuels or biogas instead of relying on crude oil-based alternatives (Leonardi et al., 2015). Additional possibilities for implementing alternative fuel involve acquiring new vehicles equipped with alternative fuel technology or retrofitting current vehicles to operate on alternative fuel, such as hybrid or electric vehicles (Anderhofstadt& Spinler, 2019; Perotti et al., 2012). Greenhouse gas emissions can be decreased by utilising fuel-efficient automobiles and other alternative energy sources (Lau, 2011).

Implementing eco driving strategies, which focus on minimising fuel usage, is an additional strategy for enhancing fuel efficiency. Eco driving entails the act of regulating and sustaining a consistent velocity for vehicles (Colicchia et al., 2013; Goes et al., 2020), with the objective of utilising higher gears and minimising idling during traffic congestion and pauses (Huang et al., 2018). Eco-driving encompasses not only vehicle operation, but also considerations for route selection and vehicle maintenance (McKinnon, 2010; Huang et al., 2018). Eco-driving has the dual impact of providing ongoing feedback to drivers and promoting the use of GPS devices, smartphones, and other comparable technology (Huang et al., 2018). Vehicle technology encompasses operations aimed at mitigating the environmental impact of transportation by either reducing vehicle operating or decreasing cargo volume. Modern automobiles can be engineered to optimise vehicle technology for vehicle operation (Colicchia et al., 2013), as well as incorporate low friction tires into current vehicles (Holmberg et al., 2014). Another facet of vehicle technology is to the optimisation of the cargo area.

According to Madhusudhanan et al. (2021), the use of aerodynamic trailers or double-decker trailers enhances the fill rates in vehicles by increasing their aerodynamics.

Sustainable Supply Chain Performance

Sustainability is a paramount concern in the current business landscape and is a crucial element for numerous firms to enhance their competitiveness in the market. Supply chain sustainability involves three aspects: environmental, social, and economic. These aspects are integrated into the triple bottom line (TBL) methodologies, as discussed by Purvis et al. (2019) and Svensson and Wagner (2015). Schaltegger and Burritt (2014) argue that integrating sustainability principles into supply chains entails reducing detrimental environmental effects on the natural environment, such as resource consumption and the impact of operational processes. Additionally, it involves avoiding negative impacts on society as a whole, while simultaneously ensuring the profitability of organisations and the supply chain economy (Jiang et al., 2019). Supply chain sustainability aims to continuously enhance the balance of the triple bottom line (TBL) aspects. Therefore, any enhancements in sustainable supply chain performance can be seen as advances in environmental, social, and economic performance. Globalisation has impacted the economy and the demand for sustainable development. This includes the recognition that businesses have a responsibility for the triple bottom line. As a result, new standards have been introduced for supply chain management performance. These standards require that supply chain management not only focus on economic performance, but also consider social and environmental performance. Supply chain management should be conducted with sustainability in mind. Having a robust system in place to oversee and manage the performance of supply chain operations is essential for achieving sustainable objectives. The objective of incorporating environmental, social, and economic goals into the supply chain organization's primary business processes is to effectively oversee the flow of capital, information, and logistics. This includes coordinating the procurement, production, and distribution of goods and services to meet the needs of stakeholders and enhance the organization's profitability and competitive edge in both the short and long term. The citation "Ahi & Searcy 2013" refers to a publication. Formentini and Taticchi (2016) argue that in order to enhance sustainable performance, organisations need to build robust integration with their supply chain partners. In order to maintain a sustainable supply chain, it is necessary for all members to meet specific social and environmental standards. Additionally, the ability to meet customer demands and economic requirements is crucial for ensuring competitiveness within the supply chain. This study presented environmental, social, and economic performance as the indicators of sustainable supply chain performance.

A. Environmental Performance: According to Longoni and Cagliano (2018),sustainable supply chain managements environmental performance is often times associated with green supply chain management. Environmental performance of the supply chain is necessary for the achievement of green cycle growth mode with low energy consumption as well as low pollution.Environmental performance encompasses practices employed to reduce adverse environmental impacts. Environmental performance measures an organizations capacity to minimize waste pollution, air pollution and degradation of the soil, as well as its ability to implement appropriate waste management practices and reduce or eliminate the use of hazardous and toxic materials. It also includes the capacity to use any advancements aimed at lessening the frequency of environmental disaster and achieving energy savings. For Hong, Zhang and Ding (2018), The ability to achieve the minimum amount of adverse environmental impact on supply chain operations is the objective of the environmental dimension of sustainable supply chain performance. The performance of sustainable environmental supply chain is based on the company’s ability to reduce the use of energy, water and materials as well as to find more environmentally friendly solution. (Jabbour *et al.,* 2015).

B. Social Performance: The social bottom line or social performance is the accomplishment of the social mission of the organization in terms of societal interests through the integration of recognized social values and the fulfillment of social obligation. A supply chain that is socially sustainable is aimed at preserving and enhancing social factors while also taking necessary precaution to protect the larger society and various stakeholders in the supply chain (Adesanya *et al.,* 2020; Das, 2017). Das (2017) categorized practices of social performance into employee-centered social performance (ESP) and community-centered social performance (CSP) practices. The ESP is concentrated on activities that enhances employee working conditions in a particular organization. Pursuing both ESP and CSP at the organizational and supply chain level can stimulate a stronger SSCP and simultaneously enhance the Drivers of Business Case for Sustainability (Schaltegger*et al.,* 2012) and this provides a more holistic and encompassing measure of corporate performance.

C. Economic Performance: Reducing supply chain cost and improving responsiveness are two major goals of supply chain management that ensures the achievement of increase in profit.From an economic perspective, the primary areas of interest are how businesses manage their cash flow and how goods and services are produced and distributed in relation to needs and desires. (Juan *et al.,* 2019). Sandeepa (2018) stated that elements such as flexibility, reliability, cost of transportation and selection of routes are the important basis for achieving economic profit and customer demand, and they are more closely linked to realizing sustainable development. Also, Fan *et al.* (2016) stated that the emphasis on generating and maintaining long term profits are the main aspects of the economic dimension of sustainable supply chain.

GREEN TRANSPORTATION AND SUSTAINABLE SUPPLY CHAIN PERFORMANCE

Rugasira, Agaba, Jotham, Rita, Kyatuheire, and Asiimwe (2022) conducted a study to determine the empirical relationship between green mobility and environmental sustainability in the Kampala district. The sample size consisted of 675 manufacturing entities. The study employed the purposive sampling technique to select a sample size of 248. A total of 186 questionnaires were collected and deemed valid for analysis. The results indicated a minimal yet positive association between green mobility and environmental sustainability. The data suggest that any enhancements made in green mobility in Kampala have a positive association with environmental sustainability. In their study, Adu, Dorasamy, and Keelson (2023) investigated how road safety compliance acts as a mediator in the connection between road transport infrastructure and supply chain performance in manufacturing companies located in emerging economies. Survey data was collected from 359 managers of beverage manufacturing enterprises in Ghana. The findings demonstrated a clear and statistically significant correlation between the quality of road transport infrastructure, adherence to road safety regulations, and the effectiveness of supply chain operations. The study's findings demonstrated that while road transport infrastructure remains essential for promoting sustainable consumption and production (SCP), the presence of road safety compliance can lead to even better SCP outcomes. Onputtha, Phophan, Iamsomboon, Bhumkittipich, and Sathiankomsorakrai (2023) conducted a study to examine how a green organisational culture affects green transportation and sustainable performance. The samples consisted of 400 personnel from the Thai automobile sector who held jobs in transportation management at both the managerial and operational levels. The findings demonstrated that green mobility directly enhances sustainable performance. In their study, Nwaulune, Ajike, and Bamidele (2023) investigated the social sustainability and environmentally conscious logistical practices of specific FMCG companies in Lagos State, Nigeria. The study's population consisted of 13,782 management staff from eight FMCG companies listed in Lagos State, Nigeria. The sample size of 519 was determined using the Taro Yamane formula. The results indicated that the use of green logistics methods had a substantial impact on the social sustainability of the chosen FMCG companies in

Lagos State, Nigeria. Eltayeb, Zailani, and Ramayah (2017) investigated the influence of green supply chain management methods, namely green eco-design practices, on business performance. The study was done by sending a questionnaire by mail to 551 Malaysian manufacturing organisations that were accredited with ISO 14001. The study found that Green Supply Chain Management (GSCM) practices had a significant impact on the outcome of organisational performance. Specifically, it was determined that eco-design directly affected the internal performance of the firm. Zawadi (2018) examined the relationship between green practices and their impact on performance, with a specific emphasis on the automotive industry. There were 230 companies that were the focus of attention. The study employed questionnaires to collect primary data, which indicated that the implementation of green innovation and green practices, such as green transport, has a beneficial impact on environmental performance. The implementation of green infrastructure has enabled automotive practitioners to enhance their environmental performance. This study determined the relationship between green transportation and sustainable supply chain performance of road transport companies in Rivers State, Nigeria, and on this premise, three hypotheses were formulated:

$H_{01:}$ Green transportation does not significantly relate with environmentally sustainable supply chain performance

$H_{02:}$ Green transportation does not significantly relate with social sustainable supply chain performance.

. $H_{02:}$ Green transportation does not significantly relate with economic sustainable supply chain performance.

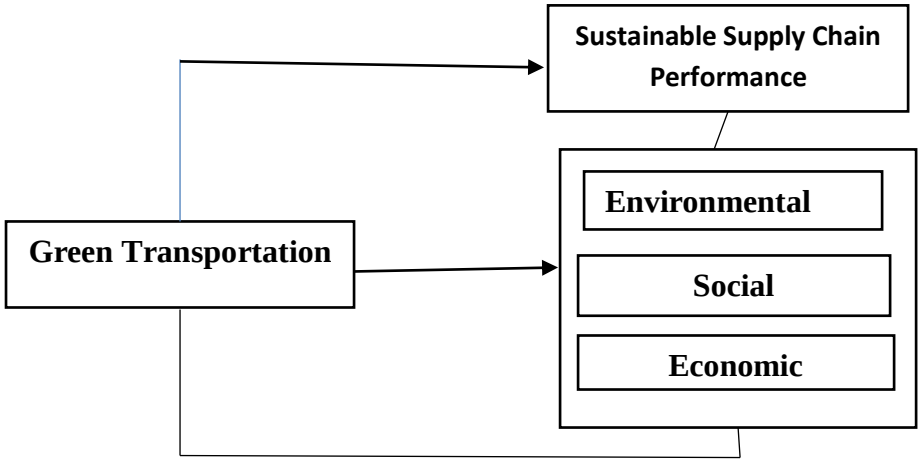

Figure. 1. Conceptual Framework

THEORETICAL FRAMEWORK

This studywas predicated on the natural resource-based view theory The natural resource-based view (NRBV) which is an extension of the resource base view (RBV) is widely used to explain the reason why organizations take up green efforts and Barney and Griffin (1992) have long used it to explain variations in performance within and among businesses as cited in Mutie (2023). According to the NRBV, competitive strategies and advantages can be crafted from capabilities that support economic activities that are ecologically friendly (Hart, 1995) as cited in Mutie (2023). It is a competitive advantage theory that suggests that the growth of a company and its ability to stay ahead depend on its

relationship with the natural environment. Mutie (2023), posits that for a resource to be rare, valuable, no substitutable and inimitable, it has to be firm-specific, socially complex and causally ambiguous. The inimitability of an organization's strategic resource gives the firm protective machinery from the acquisition of similar resources by competitors. With this view, the theory is made up of three interlinked strategies: pollution prevention, product management, and sustainable development.

This theory posits that the impact of collaboration between organizations and their natural environment results in the possession of resources that could be converted into organizational capabilities. The reason for this is that such resources are causally ambiguous as they are established over a duration of time through continuous experience and learning. Regardless of the geographical location of the company, the ability of the company to maximize its valuable resources can result in performance improvement of the company.

METHODOLOGY

The quantitative research approach was employed for this study. This study was conducted to examine the relationship between green transportation and sustainable supply chain performance of road transport companies operating in Rivers State. The population of the study comprised of the twenty- six (26) registered interstate road transport companies operating in Rivers State, obtained from the Rivers State ministry of transport.A census study was adopted by using the entire population as the sample size. However, two (2) copies of structured questionnaire were distributed to two managers in each of the 26 companies that made up the study population. These managers include the customer service managers, and transport managers., as they are knowledgeable about the issues discussed in this study. Therefore, the total respondents for the study will be fifty- two (52) managers. This study used a well-structured, self-administered questionnaire to collect primary data. Cronbach Alpha reliability test was carried out to ascertain the reliability of the study instrument. A threshold of 0.70 established by Nunally (1978) was adopted in determining the reliability of the research instrument. Furthermore, the Spearman Rank Correlation Coefficient was used to test the three hypotheses stated in the study with a critical value of 0.05. All the analyses were done with the aid of statistical package for social sciences (SPSS) version 25.

RESULTS

This section of the study, presents the result for the data generated from the field. All distributed questionnaire copies (100%) were successfully retrieved from the field. The results presented, addressed the descriptive distributions for the variables and the assessment of the bivariate relationship between the variables. The table 1 illustrates the descriptive result for the variables of the study.

Table 1.1: Summary for the univariate distribution for the variables

	N	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Green Transportation	30	4.0667	.60268	-2.570	.427	8.834	.833
Environmental Performance	30	4.0667	.77509	-2.375	.427	4.949	.833

Social Performance	30	4.0889	.80674	-2.086	.427	4.132	.833
Economic Performance	30	3.9111	.77278	-2.179	.427	4.457	.833
Valid N (listwise)	30						

Source: Survey Data (2024)

The summary for the descriptive analysis for the variables points to the substantiality of the variables, demonstrating the manifestation of the variables in the transport companies. The distribution for green transportation (x = 4.0667) affirms to the organizations adoption and engagement of green transportation activities; the distribution for environmental performance (x = 4.0670) shows that the transportation companies are conscious and considerate of the impact of their activities on their environment; the distribution for social performance (x = 4.0889) shows that the transport companies are considerate of the underlying social values of their host communities; and the distribution for economic performance (x = 3.9111) points to the transport companies consideration of their actions in line with economic interests, ensuring that such are not designed to impoverish or exploit their host communities. The result showed that the target transport organizations, evidently engage and express behavior in the area of green transportation, environmental performance, social performance, and economic performance.

Table 1.2: Correlation result

			Green Transportation	Environmental Performance	Social Performance	Economic Performance
Spearman's rho	Green Transportation	Correlation Coefficient	1.000	.617**	.499**	.512**
		Sig. (2-tailed)	.	.000	.005	.004
		N	30	30	30	30
	Environmental Performance	Correlation Coefficient	.617**	1.000	.572**	.400*
		Sig. (2-tailed)	.000	.	.001	.028
		N	30	30	30	30
	Social Performance	Correlation Coefficient	.499**	.572**	1.000	.396*
		Sig. (2-tailed)	.005	.001	.	.030
		N	30	30	30	30
	Economic Performance	Correlation Coefficient	.512**	.400*	.396*	1.000
		Sig. (2-tailed)	.004	.028	.030	.
		N	30	30	30	30

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

The result for the correlation tests for the relationship between green transportation and the measures of sustainable supply chain performance shows that green transportation positively influences the outcomes of environmental performance (Rho = 0.617 and *P* = 0.000), social performance (Rho = 0.499 and *P* = 0.005), and economic performance (Rho = 0.512 and *P* = 0.004). The results from the tests affirmed to the significance of the relationship between the variables, indicating that green transportation significantly impacts on sustainable supply chain performance, thus, green transportation can be considered as predicting the extent to which the transport companies engage and express outcomes of sustainable supply chain performance.

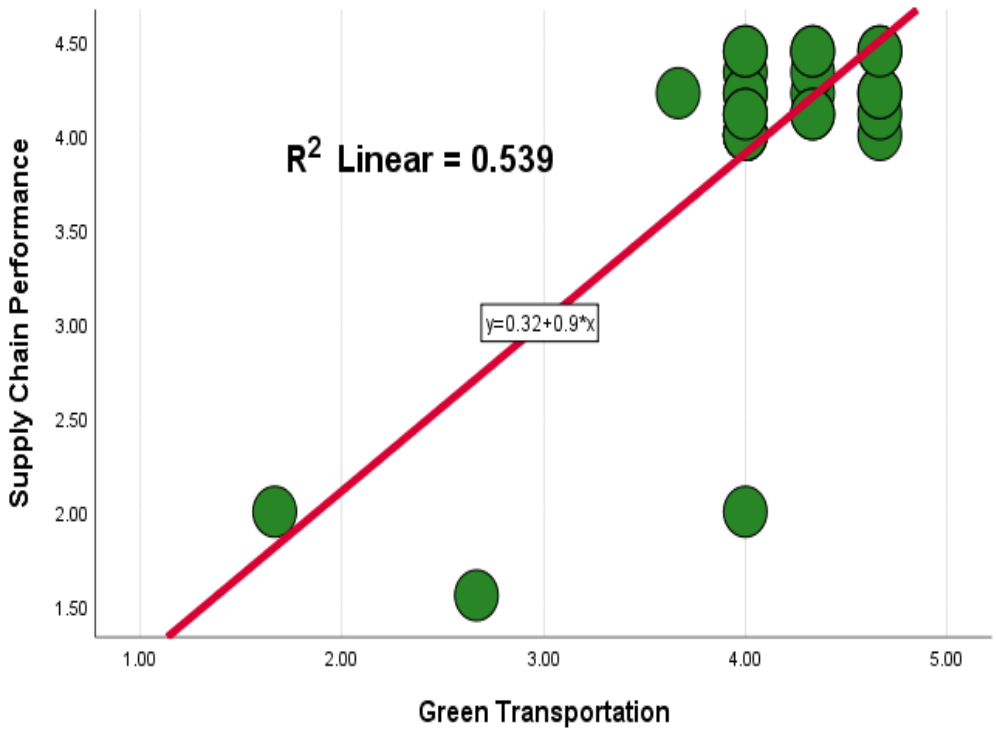

Figure 4.1: Scatter diagram for the relationship between green transportation and sustainable supply chain performance

The scatter diagram demonstrates the extent to which changes in sustainable supply chain performance is accounted for or explained by the green transportation activities of the transport companies. Evidence indicates an R = 0.539, showing a significant but moderate impact of green transportation on the outcome of sustainable supply chain performance in the transport companies.

DISCUSSION OF FINDINGS

The study investigated the correlation between green transport via road transport and the performance of a sustainable supply chain, including environmental, social, and economic aspects. The correlation study showed a modest positive and statistically significant link between the variables. The association between the outcomes was clearly demonstrated by the correlation coefficient and probability value. The results corroborate the conclusions of Onputtha et al., (2023) that green transport has a direct and beneficial influence on sustainable performance. The results of the study led to the rejection of the null hypotheses and the acceptance of the alternate hypotheses about the correlation between green transport and sustainable supply chain performance of interstate transport businesses in Rivers State.

The correlation study results indicate a robust, positive, and statistically significant association between green transportation and environmentally sustainable supply chain performance. The association was apparent in the correlation coefficient and probability value of the findings. These findings align with the results of Rugasira et al., (2022) which shown that any enhancements in green mobility are positively linked to environmental sustainability. The findings are consistent with Zawadi's (2018) report, which indicates that green mobility has a beneficial impact on environmental performance.

The correlation analysis results indicate a moderate positive and statistically significant association between green transportation and social supply chain performance. The study's results align with those of Adu et al. (2023), indicating that adhering to road safety regulations can lead to improved supply chain performance. The present study further supports the empirical stance of Nwaulune et al., (2023) that the use of green logistics methods has a substantial impact on the social sustainability of chosen FMCG companies in Lagos State, Nigeria.

The correlation analysis showed a modest positive and statistically significant association between green transportation and economic supply chain performance. The association was apparent in the correlation coefficient and probability value of the data. The present results are consistent with the findings of Eltayeb et al. (2017), which indicate that Green Supply Chain Management (GSCM) practices have an impact on organisational performance. Specifically, the study found that eco-design directly affects the internal performance of firms.

CONCLUSION AND RECOMMENDATIONS

Based on the results of the empirical analyses and the discussion of findings, the study concludes that green transportation enhances sustainable supply chain performance in terms of environmental performance, social performance and economic performance of road transport companies in Rivers State. Thus, road transport companies in Rivers State that seek improved sustainable supply chain performance in terms of environmental, social and economic performance, should adopts green transportation. It is therefore recommended that managers of the road transport companies in Rivers State should build the company’s strategy around the idea of green transportation, provide economic driving classes, and invest in employee education.It is also recommended that the mangers of road transport companies in Rivers State should use the study's findings to create more effective sustainability policies that put emphasis on eco-friendly transportation practices. Future studies could replicate this research in other contexts or industries to determine whether the findings are generalizable.

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