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# GREEN SHIPPING PRACTICES AND ENVIRONMENTAL PERFORMANCE OF MARITIME COMPANIES IN NIGERIA

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***ABSTRACT***

*This study examined green shipping practices and environmental performance of maritime companies in Nigeria. The study employed the cross-sectional survey research design. The target population of this study consisted of managers of the 125 Nigerian maritime companies registered with NIMASA in Nigeria while the accessible population was limited to managers of selected registered maritime companies in South-South Nigeria. The A population of 200 managers who fall under the categories of logistics managers, operational managers, distribution managers and safety managers were identified in 50 selected maritime companies that practice green shipping strategies in South-South Nigeria. The census sampling technique was applied in this study where all the population elements (200 managers) were used as sample for the study. A structured questionnaire was used to elicit data from the respondents. The instrument was validated through face and content analysis while its reliability was determined using the Cronbach Alpha method. The data collected from the field were analyzed statistically while the hypotheses were tested using Spearman Rank Order Correlation Coefficient (rho) which was computed with the aid of SPSS software program version 25. The findings revealed that green shipping policy has significant relationship with carbon emission reduction and waste reduction of maritime companies in South-South Nigeria. The study also found a significant relationship between green shipping design and environmental performance (carbon emission reduction and waste reduction) of maritime companies in South-South Nigeria. The study equally revealed that green shipping facilities have a significant relationship with carbon emission reduction and waste reduction in South-South Nigeria. Based on these findings, it is therefore concluded that green shipping practices such as green shipping policy, green shipping design and green shipping facilities are significant predictors of environmental performance of maritime companies in South-South Nigeria. The study therefore recommended that maritime companies that are yet to embrace green business philosophy in South-South Nigeria should integrate sustainability issue into their shipping practices as it would reduce the amount of waste and carbon emission released into the environment and improve their environmental performance.*

***Keywords: Green shipping practices, environmental performance, green shipping policy, green shipping design, green shipping facilities, waste reduction and carbon emission reduction.***

## INTRODUCTION

In recent times, there has been a growing interest in researching ways to improve the environmental performance of maritime companies. Most of the previous studies conducted in the marketing discipline focused on improving marketing performance of maritime sector

while the environmental performance of this sector has been overlooked by past researchers in the marketing discipline. However, given the increasing environmental challenges in Nigeria and the world at large, much attention have been shifted to the maritime sector recently with a view of improving their environmental performance. The rising environmental problems such as environmental pollution, climate change and global warming have forced world leaders to find a way of saving the planet from further pollution and degradation. Several international conferences have been organized to discuss the issue of environmental pollution, global warming and climate change. The top agenda of these conferences is how to save the planet from further pollution and degradation. It was resolved that business organizations need to integrate sustainability issues into their business practices including their shipping operations. This implies that maritime companies can improve their environmental performance if they practice green shipping strategies.

Green shipping is an environmental management practice undertaken by shipping firms with great emphasis on waste reduction during the operation and resource conservation in handling and distributing cargoes (Lai et al, in Chang & Dunao, 2017). Green shipping practices cover a wide range of activities which start with developing green shipping policy and procedure, green shipping design and compliance, green shipping materials as well as green shipping equipment (Lai et al, 2011; Lun et al, 2012; Chang & Dunao, 2017). Green shipping policy is the commitment of a shipping company to have a vision or culture of sustainability (Chang & Dunao, 2017). Green shipping design connotes the design of the shipping system to minimize the environmental damage of shipping activities by complying with the regulation requirements of governing body (Cheng et al, 2013). The green shipping facilities require the use of shipping equipment and materials that are environmental friendly (Chang & Dunao, 2017). By using green shipping equipment, shipping companies need to avoid the use of refrigerated containers that contains chlorofluorocarbon (CFC) and use eco-friendly equipment and technologies that utilized energy from renewable sources such as sunlight and wind in order to reduce the harmful effect produced during shipping operation (Chang & Dunao, 2017).

Green shipping can be used as a tool to improve the environmental performance of maritime companies. According to Lam and Lai (2015), shipping companies that integrate sustainability practices into their shipping operations would gain a competitive edge over their rivals and consistently improve their environmental performance. Lun et al (2012) noted that shipping companies that have a green shipping policy would perform better environmentally and satisfy customers and stakeholders in their host community. Lai et al (2011) argued that environmental conscious customers would always seek for the services of shipping companies that have green shipping policy. When this segment of market is captured by shipping companies, it will increase their customer base, boost their marketing competitiveness and improve their overall environmental performance. It is against this backdrop that this study examines the relationship between green shipping practices and environmental performance of maritime companies in South-South Nigeria.

## Statement of Problem

The maritime sector in Nigeria is one of the most important sectors of the economy. This sector facilitates international trade by moving goods from one country to another via sea. It generates foreign exchange earnings for the country and contributes to the Gross

Domestic Product of the country. However, in the course of shipping or transporting goods from one destination to another, the huge amount of greenhouse gas emission is released into the atmosphere which causes climate change and global warming. It was estimated that the marine shipping sector accounts for around 3% of global carbon dioxide emissions, and that this emission increases from 3% to 77% between 1990 and 2015 (Hakirevic, 2021). The use of fossil fuels in the marine shipping sector releases large amount of greenhouse gas (GHG) emission into the environment during transportation, causing environmental pollution, climate change, and global warming. It is argued in this study that green shipping practices can help to improve the environmental performance of maritime companies in South-South Nigeria. However, there is no substantial empirical study that examined the relationship between green shipping practices and environmental performance of maritime companies in Nigeria. This has created a vacuum in academic literature which this study intends to fill and contribute to the existing knowledge on the subject matter under investigation.

## Conceptual framework

The operational conceptual framework of green shipping practices and environmental performance of maritime companies is shown in figure 1 below:

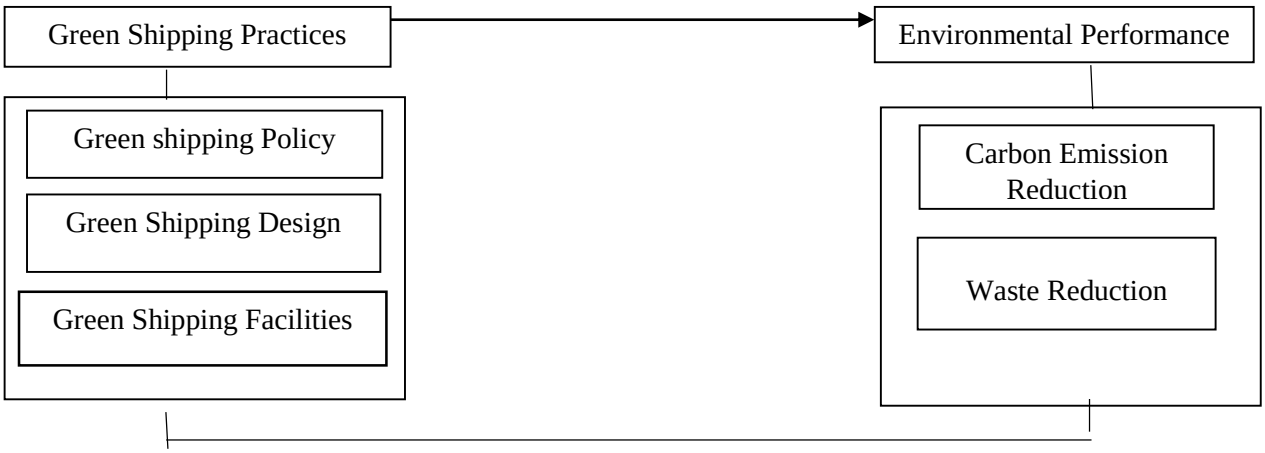


Fig 1: Conceptual framework of green shipping practices and environmental performance of maritime companies

## Aim and Objectives of the Study

The aim of this study is to examine the relationship between green shipping practices and environmental performance of maritime companies in South-South Nigeria. The study intends to:

1. Ascertain the relationship between green shipping policy and carbon emission reduction of maritime companies in South-South Nigeria.
2. Determine the relationship between green shipping policy and waste reduction of maritime companies in South-South Nigeria.
3. Find the relationship between green shipping design and carbon emission reduction of maritime companies in South-South Nigeria.
4 Ascertain the relationship between green shipping design and waste reduction of maritime companies in South-South Nigeria.

5. Find the relationship between green shipping facilities and carbon emission reduction of maritime companies in South-South Nigeria.
6. Determine the relationship between green shipping facilities and carbon emission reduction of maritime companies in South-South Nigeria.

## Research Questions

The following research questions are developed to address the objectives of the study:

1. To what extent does green shipping policy ensure carbon emission reduction of maritime companies in South-South Nigeria?
2. To what extent does green shipping policy relate to waste reduction of maritime companies in South-South Nigeria?
3. To what extent does green shipping design relate to carbon emission reduction of maritime companies in South-South Nigeria?
4. To what extent does green shipping design relate to waste reduction of maritime companies in South-South Nigeria?
5. To what extent does green shipping facilities relate to carbon emission reduction of maritime companies in South-South Nigeria?
6. To what extent does green shipping facilities relate to waste reduction of maritime companies in South-South Nigeria?

## Research Hypotheses

The following hypotheses are postulated to guide this study:

$Ho_1$: There is no significant relationship between green shipping policy and carbon emission reduction of maritime companies in South-South Nigeria.

$Ho_2$: There is no significant relationship between green shipping policy and waste reduction of maritime companies in South-South Nigeria.

$Ho_3$: There is no significant relationship between green shipping design and carbon emission reduction of maritime companies in South-South Nigeria.

$Ho_4$: There is no significant relationship between green shipping design and waste reduction of maritime companies in South-South Nigeria.

$Ho_5$: There is no significant relationship between green shipping facilities and carbon emission reduction of maritime companies in South-South Nigeria.

$Ho_6$: There is no significant relationship between green shipping facilities and waste reduction of maritime companies in South-South Nigeria.

## Review of Related Literature

### Concept of Green Shipping Practices

Green shipping has taken center stage of many environmental discussions. Quertani (2022) noted that green shipping involves the implementation of the principles of sustainable development in the shipping sector. It defines how shipping firms go about their environmental responsibility in the course of rendering their shipping services (Poi & Moko, 2023). Lam and Lai (2015) defined green shipping practices as environmental responsive practices embarked upon by shipping companies to reduce the amount of greenhouse gas emission released into the atmosphere and other wastes substances during the moving of cargo from one destination to another. Lai et al in Chang and Dunao (2017) described green shipping practice as an environmental management practice undertaken by shipping firms with great emphasis on waste reduction during the operation and resource conservation in

handling and distributing cargoes. Venus Lun (2013) stated that green shipping involves the movement of goods by vessels in an environmental responsible way. Considering the increasing environmental problems facing the planet, world leaders have appealed to shipping companies to integrate sustainability issues into their shipping operations. Some marine shipping companies have integrated sustainability issues into their shipping practices with a view of improving their environmental performance. This includes developing green shipping policy, green shipping design and purchasing green shipping equipment. These practices are expected to improve their environmental performance (Notteboom, 2004).

## Dimensions of Green Shipping Practices

Since green shipping practices take the form of developing green shipping policy, green shipping design and purchasing green shipping facilities, these practices therefore constitute the dimensions of green shipping practices of maritime companies.

## Green Shipping Policy

Green shipping policy is the commitment of a shipping company to have a vision or culture of sustainability (Chang & Dunao, 2017). Here, top management of the company sets the laid down rules and procedures to be followed in carrying out the company's operations in a sustainable manner. Lam and Lai in Pang et al (2021) stated that internal practices such as company policy and procedures are crucial to successful implementation of green shipping practices. Pang et al (2021) noted that some maritime companies have began to adopt more environmental-friendly policies to improve their operational performance. Maersk Shipping Company, is a good example of companies that have a green shipping policy. Here, the Managing Director, Yang Ming, established an Energy Conservation and Carbon Reduction Committee to demonstrate the company's commitment to green shipping activities. (Lam & Lai, 2015).

## Green Shipping Design

Green shipping design connotes the design of the shipping system to minimize the environmental damage of shipping activities by complying with the regulation requirements of governing body (Cheng et al, 2013). This includes the use of design and equipment that can help to reduce the consumption of energy and materials, as well as reusing, recycling and recovering steel shipping materials to reduce excessive waste and costs (Cheng et al, 2013). Zhu and Sarkis in Chang & Dunao (2017) stated that eco-design of shipping operations help to increase cost savings due to the increase of cost for energy consumption, waste treatment and discharge fee. The International Maritime Organization (IMO) sets the standards on construction, design, equipment and manning (CDEM) and carry out inspections to ensure that shipping companies comply with CDEM standards (Van Leeuwen, 2015). Some maritime companies have redesign their shipping operations to incorporate some elements of environmental friendliness. NYK Group is a good example of companies that have developed green shipping design as the company has introduced the Innovative Bunker and Idle-time Daving (IBIS) project on their containerships (NYK Line, in Pang et al, 2021). By implementing this green shipping design, maritime companies demonstrate that they are concentrating on their improving their environmental and operational performance (PortNews, 2016).

## Green Shipping Facilities

The green shipping facilities requires the use of shipping materials and equipment that are environmental friendly (Chang & Dunao, 2017). By using green shipping equipment, shipping companies need to avoid the use of refrigerated containers that contains chlorofluorocarbon (CFC) and use eco-friendly equipment and technologies that utilized energy from renewable sources such as sunlight and wind in order to reduce the harmful effect produced during shipping operation. When it comes to green shipping materials, shipping companies are required to reuse and recycle their used shipping resources to minimize costs and improve shipping operations. This includes the collecting the used oil, and sell all the excess and unrecyclable shipping materials such as steel materials, packaging cartons, etc. instead of considering them as garbage (Chang & Dunao, 2017). Some maritime companies have purchased some green shipping facilities to incorporate some elements of environmental friendliness NYK Group is a good example of companies that have developed green shipping facilities as the company uses the Internet of Things (IoT) and Big Data Analysis to monitor their on-board modification of their bulbous bow and energy- saving of their ship (PortNews, 2016).

## Concept of Environmental Performance

Environmental performance is defined as the result obtained by an organization in reducing waste, pollution and increasing material efficiency (Vanalle & Santos, 2014). Every company is expected to improve and reports their environmental performance (Saeed et al, 2018). Maritime companies need to limit carbon emissions, minimize solid and water waste while decreasing the use of toxic and hazardous raw materials to prove their progress in environmental performance (Zhu et al in Saeed et al, 2018). The increasing awareness of environmental disasters during the 1970 and 1980s has made many countries including the United States to make it mandatory for companies to disclose their environmental performance. The Federal Legislation in the United States provides the Environmental Protection Agency (EPA) with the authority to clean up wastes across the country and charged the company responsible for generating such wastes with the clean-up costs. The cost incurred by a company to clean up a toxic site is important and such as the Securities and Exchange Commission in the United States urged companies to disclose such cost and related ones in the annual reports (Kieso et al, 2012).

Improving environmental performance will go a long way in minimizing environmental related problems, thereby promoting good public image for the company (Yu & Ramanthan, 2015). Esfahbodi et al (2017) argued that reducing pollution, solid and water wastes, and use of hazardous materials are not the only way of improving environmental performance of industrial firms; it also involves the optimization (minimization) and reuse of packaging materials to cut down cost. DeGiovanni (2012) posited that improvement in environmental performance does not only help companies to cut down costs associated with environmental incidents and accidents but also improve their green image, which will impact positively on their market share and profit margin. This implies that improving environmental performance could lead to the improvement in economic performance. To improve environmental performance while keeping economic targets in check, information regarding design specifications, process enhancement techniques and specific raw material requirements need to be shared among suppliers and customers of a firm i.e. the supply chain partners (Saeed et al, 2018). Alshura and Awawdeh (2016) noted that environmental

performance of industrial firms can be improved through the implementation of green supply chain management.

## Measures of Environmental Performance

Environmental performance can be measured using various indicators. However, in this study, environmental performance can be measured using carbon emission reduction and waste reduction.

## Carbon Emission Reduction

Carbon emission reduction refers to an organizational effort aimed at minimizing the amount of carbon emission released into the air during production and distribution processes (Bellassen, 2015). Maritime companies usually release large amount of emission into the air during their shipping of goods to end-users. In fact, maritime companies are the major contributors to the increasing environmental challenges facing Nigeria and the world today due to the large amount of carbon footprint released into the environment during transportation of their products. It was estimated that the marine shipping sector accounts for around 3% of global carbon dioxide emissions, and that this emission increases from 3% to 77% between 1990 and 2015 (Hakirevic, 2021). The amount of emission released into the atmosphere causes health challenges to the people in their host communities (Yu & Ramanthan, 2015). Esfahbodi et al (2017) noted that carbon emissions released into the atmosphere are dangerous to human health, causing all sorts of health problems including cancers. Given the large amount of GHG emission released into the environment by maritime companies which cause climate change and global warming, it becomes imperative for these maritime sector to find a way of reducing the level of carbon emission released into the environment and improve their environmental performance. The International Maritime Organization (IMO) in April 2018 signed an agreement and announced to the world for the first time, its desire to tackle the problem of climate change in the global shipping sector. The organization projected that the shipping sector will cut down greenhouse gas emissions by 50% by the year 2050 (Hakirevic, 2021).

## Waste Reduction

Waste reduction refers to the extent to which business organizations are able to minimize the amount of solid and water wastes deposited into the environment in the process of carrying out their business activities (Yu & Ramanthan, 2015). Waste reduction has been emphasized by environmentalists, stakeholders and government since it is a sure way of achieving environmental sanity (Bernache, 2003). Naila et al (2007) noted that companies in the maritime sector generate a large amount of waste during the process of production, packaging and distribution of goods to end-users. They further stated that these wastes which take the form of solid and liquid wastes litigate the environment and make it unsuitable for healthy living. A recent study conducted by Pullen (2014) revealed that 50-60% of environmental degradation occur as a result of the poor waste management. Excessive dumping of waste pollutes the nature environment and makes it unsuitable for the future generations to use to meet their needs. Cheng (2011) stated that excessive waste disposal causes more harm to the natural ecosystem and limits its capability to support human life. It makes the environment unconducive and irritating, thereby making it unproductive for future generations to use to meet their needs. In supporting this notion, Muma et al (2014) stated that excessive waste in the environment leads to health challenges

which threaten human existence. For this reason, environmental activists, stakeholders and the government are calling on companies to develop strategies to reduce the amount of wastes generated as a result of their marketing activities and improve their environmental performance (Sarkis et al, 2010).

## Theoretical Framework

This study is anchored on the Industrial ecology theory was developed by Robert Frosch and Nicholas E. Gallopoulos in 1989. The theory emphasizes the design and management of human production, distribution, transportation and consumption system in such a way that the system can interact with the natural system to form a single integrated ecosystem that has an ecological integrity, and supply human beings with a sustainable livelihood. The theory of industrial ecology tends to imagine what the environmental impact of unsustainable production, distribution and consumption would be in the next three to four decades considering the growing world population. The theory argues that the amount of natural resources needed to meet the consumption level would probably not be available in the planet since the levels of wastes generated and pollution would exceed the world's regenerated capacity (Frosch & Gallopoulos, in Hond, 2001). This argument has gained widespread support as Schmidheiny in Duchine & Levine (2014) and Von Weizsacker in Korhonen (2005) called for a sustainability approach to production, distribution, transportation and consumption.

Industrial ecology theory is a perspective that tries to provide solutions to the environmental problems by emphasizing the notion that industrial system ought to be modified so as to mimic the natural ecosystem in its overall operations (Frosch & Gallopoulos, in Hond, 2001). Considering this view, industrial ecology theory provides the basis for radical transformation of industrial society (Ehrenfeld, in Hond, 2001). In an industrial ecosystem, materials and energy consumption are optimized and effluents from one process constitute raw materials for another process. The aim of industrial ecology is to reduce the environmental impact of energy and materials flow by increasing resource efficiency at all levels of the system (Korhonen, 2005). Industrial ecology theory tends to inform decision makers about the environmental impacts of their industrial production processes by tracking and analyzing resources use and flows of industrial products, consumer products and wastes (Duchine & Levine, 2014).

The industrial ecology theory is very relevant in explaining the need for green shipping practices in the maritime sector. The theory argues that sustainability performance of manufacturing organizations can be improved through the practice of green shipping practices. Waste reduction, pollution prevention and control are the guiding principles of industrial ecology theory. The theory emphasizes the need for the reduction of wastes, carbon emission and other pollutants which can be achieved the implementation of green shipping practices. It explains that maritime companies need to balance their green shipping operations with environmental preservation. The industrial ecology theory argues that green shipping operations can be carried out in any industrial setting without doing much damage to the environment. All maritime companies need to do is to adopt a new shipping method that takes environmental protection into account and ensure that all forms of pollution and degradation are drastically minimized.

## Empirical Review

A number of studies have been conducted on green shipping practices and environmental performance of firms. For instance, Lun et al (2014) explored the relationship between green shipping practices and firm performance. Their study focused on the six dimensions of green shipping practices namely company policy and procedure, shipping documentation, shipping equipment, shipper cooperation, shipping materials, and shipping design and compliance. The researcher used the input/output approach to examine the greening capability of shipping firms and the results revealed that shipping firms practice a weak shipper cooperation and shipping equipment while the activities of shipping materials, corporate policy and procedures, shipping documentation and ship design and compliance recorded a strong practice among shipping firms.

Poi and Moko (2023) examined sustainable shipping practices and supply chain performance of shipping firms in South-South Nigeria. The researchers adopted the descriptive survey research design and used a structured questionnaire to collect data from 23 supply chain managers from shipping firms in South-South Nigeria. The data were collected were analyzed statistically while their hypotheses were tested using multiple linear regression analysis which was computed with the aid of the IBM (SPSS) version 25. The findings showed that for every 1% increase in the sustainable shipping practices of firm, there is 0.523% increase in the supply chain performance of the firm. The study concluded that sustainable shipping practices have a positive impact on supply chain performance of firms.

Felico et al (2021) carried out a study to determine the effect of green shipping effect on sustainable economy and environmental performance. Their study adopted the survey research design where data were collected from 193 Spanish and Portuguese executive managers using a structured questionnaire. The data collected were analyzed using Exploratory Factor Analysis (EFA) and Structural Equation Modeling (SEM). The findings showed that green shipping has a sizeable influence on sustainable economy and environmental performance. The study also revealed that green management and green efficiency help in controlling the impact of pollution and also promote economic sustainability.

Chang and Danao (2017) explored the green shipping practices of shipping firms. The aim of their study was to identify the factors that motivate shipping firms to adopt green shipping practices. The researchers adopted the survey research design and used a structured questionnaire to collect data from managers of three large shipping companies, 40 professors and graduate students in logistics departments in Korea University. The data collected were analyzed statistically using Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM). The findings revealed that shipping firms are motivated to adopt green shipping practices mostly by industrial norms set by institutionalized bodies or association, followed by customer's demand for environmental friendliness and . The study also revealed that price has a higher influence on purchase decision than green concerns. The study equally revealed that green issues are likely to influence purchase decision of younger consumers; and thirdly, by their own strategy to make good image. The study concluded that the adoption of green shipping practices can improve environmental and economic performance of shipping firms.

Venus Lun (2013) carried out a study to determine how the development of green shipping network enhance environmental and economic performance. The researchers adopted a

survey research design and quantitative research approach and used a structured questionnaire to gather data from 25 managers of shipping firms in China. The data collected from the respondents were analyzed statistically while the hypotheses were tested using the multiple regression analysis. The findings showed that a green shipping network is a useful tool to transship containers from feeder ports to hub ports to lower the overall $CO_2$ emissions in the region. The study therefore concluded that shipping firms should develop a green shipping networks to improve their economic and environmental performance.

Abbasi (2013) carried out a study to determine sustainable logistics operations of leading multinational companies in Pakistan. The researchers employed the survey research design and used a structured questionnaire to collect data from logistics managers and ship captain in six multinational companies in Pakistan. The data collected were analyzed using percentage and frequency analysis, mean, standard deviation, bar chart, pie chart, and the SPSS version 23.0 while the hypotheses were tested using Spearman Rank Order Correlation, factor analysis and ANOVA. The findings showed that leading multinational companies in the maritime sector in Pakistan practice sustainable logistics operations to a moderate extent. The study found a significant relationship between sustainable logistics operations and environmental sustainability in Pakistan. The study equally revealed that sustainable logistics operations would help to address the problem of climate change, global warming and environmental pollution and degradation.

Zhang and Zheng (2010) examined green logistics system and the development strategy in Jilin Province. The researchers employed the descriptive survey research design where questionnaire was used to obtain data from managers in 124 manufacturing companies. The data collected were analyzed using the SPSS software program. After analyzing the data collected from the respondents, the researchers found out that green transportation significantly influence environmental performance of manufacturing firms. The study also found a positive and significant relationship between green storage and environmental performance of manufacturing firms. The study equally reported a positive and significant relationship between reverse logistics and environmental performance of manufacturing firms.

### Gap in Literature

Efforts have been made to review related literature on green shipping practices of maritime companies. From the literature reviewed, it was observed that most of the studies conducted on green shipping practices did not relate green shipping policy, green shipping design and green shipping facilities to environmental performance measures such as carbon emission reduction and waste reduction in South-South Nigeria. This has created a vacuum in literature that needs to be fill. It is in view to fill this gap in literature that prompted this study.

## METHODOLOGY

This study employed the cross-sectional survey research design. The population of this study consisted of all the registered Nigerian maritime companies in Nigeria. Presently, there are 125 Nigerian Maritime Companies registered with the Nigerian Maritime Administration and Safety Agency (NIMASA). However, out of the 125 registered maritime companies in

Nigeria, 50 of them that operating the South-South Geopolitical Zone of Nigeria were selected for the study using purposive sampling method. The 50 companies were selected based on the premise that they practice green shipping strategies. The companies were drawn from the six states that make up the south-south zone namely; Akwa Ibom, Bayelsa, Cross River, Delta, Edo and Rivers State. The unit of analysis consisted of managers of the selected maritime companies in the South-South Zone. The managers include logistics managers, operational managers, distribution managers and safety managers. A population of 200 managers of the above categories were drawn from the selected maritime companies in South-South Nigeria. The census sampling technique was used for the study where all the members of the population were used as sample for the study. A structured questionnaire was used to elicit data from the respondents. The questionnaire was structured on a four (4) point Likert-type scale which range from Strong Agree, Agree, Disagree, Strongly Disagree. The validity of the instrument was determined through face and content analysis while its reliability was determined using the Cronbach Alpha method. A total copy of 200 questionnaires was administered to the respondents (managers) of the selected maritime companies in South-South Nigeria and 146 copies were collected. The data collected were analyzed using descriptive statistics while the Spearman Rank Order Correlation Coefficient (rho) was used to test the hypotheses.

## Empirical Results and Discussion

The results of the bivariate analysis carried out were presented in this section. The data collected on green shipping practices (green shipping policy, green shipping design and green shipping facilities) were correlated with those obtained on environmental performance (carbon emission reduction and waste reduction) using the Spearman Rank Order Correlation Coefficient (rho). This was done with the aid of the SPSS software program version 23.0. The results of the bivariate analysis are presented in the tables below:

**Table 1: Relationship between green shipping policy and carbon emission reduction of maritime companies**

| | | | Green Shipping Policy | Carbon Emission Reduction |
|---|---|---|---|---|
| Spearman (rho) | Green Shipping Policy | Correlation Coefficient | 1.000 | .747** |
| | | Sig. (2 tailed) | . | .001 |
| | | N | 146 | 146 |
| | Carbon Emission Reduction | Correlation Coefficient | .747** | 1.000 |
| | | Sig. (2 tailed) | .001 | . |
| | | N | 146 | 146 |

**Correlation is significant at 0.01 levels (2 tailed)
*Correlation is significant at 0.05 levels (2 tailed)

Source: SPSS-Generated Output, 2023

Table 1 contains the result of the bivariate analysis carried out between green shipping policy and carbon emission reduction of maritime companies in South-South Nigeria. The result indicates that green shipping policy has a strong positive correlation with carbon emission reduction of maritime companies (rho = .747**) and the symbol ** signifies that this correlation is significant at 0.01 level. Based on this result, the null hypothesis ($Ho_1$) is rejected and the alternate hypothesis is accepted. This means that there is strong positive and significant relationship between green shipping policy and carbon emission reduction of maritime companies in South-South Nigeria.

**Table 2: Relationship between green shipping policy and waste reduction of maritime companies**

| | | | Green Shipping Policy | Waste Reduction |
|---|---|---|---|---|
| Spearman (rho) | Green Shipping Policy | Correlation Coefficient | 1.000 | .662** |
| | | Sig. (2 tailed) | . | .001 |
| | | N | 146 | 146 |
| | Waste Reduction | Correlation Coefficient | .662** | 1.000 |
| | | Sig. (2 tailed) | .001 | . |
| | | N | 146 | 146 |

**Correlation is significant at 0.01 levels (2 tailed)
*Correlation is significant at 0.05 levels (2 tailed)

Source: SPSS-Generated Output, 2023

Table 2 presents the result of the bivariate analysis carried out between green shipping policy and waste reduction of maritime companies in South-South Nigeria. The result indicates that green shipping policy is strongly and positively correlated to waste reduction of maritime companies (rho = .662**) and this correlation is significant at 0.01 level as indicated by the symbol **. Consequently, the null hypothesis ($Ho_2$) is rejected and the alternate hypothesis is accepted. This means that we then accept that there is strong positive and significant relationship between green shipping policy and waste reduction of maritime companies in South-South Nigeria.

**Table 3: Relationship between green shipping design and carbon emission reduction of maritime companies**

| | | | Green Shipping Design | Carbon Emission Reduction |
|---|---|---|---|---|
| Spearman (rho) | Green Shipping Design | Correlation Coefficient | 1.000 | .688** |
| | | Sig. (2 tailed) | . | .001 |
| | | N | 146 | 146 |
| | Carbon Emission Reduction | Correlation Coefficient | .688** | 1.000 |
| | | Sig. (2 tailed) | .001 | . |
| | | N | 146 | 146 |

**Correlation is significant at 0.01 levels (2 tailed)
*Correlation is significant at 0.05 levels (2 tailed)

Source: SPSS-Generated Output, 2023

Table 3 shows the result of the bivariate analysis carried out between green shipping design and carbon emission reduction of maritime companies in South-South Nigeria. The result indicates that green shipping design has a strong positive correlation with carbon emission reduction of maritime companies (rho = .688**) and this correlation is significant at 0.01 level as signified by the symbol **. As a result of this, the null hypothesis ($Ho_3$) is rejected and the alternate hypothesis is accepted. This implies that we then accept that there is strong positive and significant relationship between green shipping design and carbon emission reduction of maritime companies in South-South Nigeria.

**Table 4: Relationship between green shipping design and waste reduction of maritime companies**

| | | | Green Shipping Design | Waste Reduction |
|---|---|---|---|---|
| Spearman (rho) | Green Shipping Design | Correlation Coefficient | 1.000 | .724** |
| | | Sig. (2 tailed) | . | .001 |
| | | N | 146 | 146 |
| | Waste Reduction | Correlation Coefficient | .724** | 1.000 |
| | | Sig. (2 tailed) | .001 | . |
| | | N | 146 | 146 |

**Correlation is significant at 0.01 levels (2 tailed)
*Correlation is significant at 0.05 levels (2 tailed)

Source: SPSS-Generated Output, 2023

Table 4 contains the result of the bivariate analysis carried out between green shipping design and waste reduction of maritime companies in South-South Nigeria. The result shows that green shipping design is strongly and positively correlated to waste reduction of maritime companies (rho = .724**) and this correlation is significant at 0.01 level as indicated by the symbol **. Based on this result, the null hypothesis ($Ho_4$) is rejected and the alternate hypothesis is accepted. This implies that we then accept that there is strong positive and significant relationship between green shipping design and waste reduction of maritime companies in South-South Nigeria.

**Table 5: Relationship between green shipping facilities and carbon emission reduction of maritime companies**

| | | | Green Shipping Facilities | Carbon Emission Reduction |
|---|---|---|---|---|
| Spearman (rho) | Green Shipping Facilities | Correlation Coefficient | 1.000 | .791** |
| | | Sig. (2 tailed) | . | .001 |
| | | N | 146 | 146 |
| | Carbon Emission Reduction | Correlation Coefficient | .791** | 1.000 |
| | | Sig. (2 tailed) | .001 | . |
| | | N | 146 | 146 |

**Correlation is significant at 0.01 levels (2 tailed)
*Correlation is significant at 0.05 levels (2 tailed)

Source: SPSS-Generated Output, 2023

Table 5 presents the result of the bivariate analysis carried out between green shipping facilities and carbon emission reduction of maritime companies in South-South Nigeria. The result shows a strong and positive correlation between green shipping facilities and carbon emission reduction of maritime companies (rho = .791**) and this correlation is significant at 0.01 level as indicated by the symbol **. Consequently, the null hypothesis ($Ho_5$) is rejected and the alternate hypothesis is accepted. This implies that there is strong positive and significant relationship between green shipping facilities and carbon emission reduction of maritime companies in South-South Nigeria.

**Table 6: Relationship between green shipping facilities and waste reduction of maritime companies**

| | | | Green Shipping Facilities | Waste Reduction |
|---|---|---|---|---|
| Spearman (rho) | Green Shipping Facilities | Correlation Coefficient | 1.000 | .627** |
| | | Sig. (2 tailed) | . | .001 |
| | | N | 146 | 146 |
| | Waste Reduction | Correlation Coefficient | .627** | 1.000 |

| | | | |
|---|---|---|---|
| | Sig. (2 tailed) | .001 | . |
| | N | 146 | 146 |

**Correlation is significant at 0.01 levels (2 tailed)
*Correlation is significant at 0.05 levels (2 tailed)

Source: SPSS-Generated Output, 2023

Table 6 depicts the result of the bivariate analysis carried out between green shipping facilities and waste reduction of maritime companies in South-South Nigeria. The result shows that green shipping facilities is strongly and positively correlated to waste reduction of maritime companies (rho = .627**) and this correlation is significant at 0.01 level as indicated by the symbol **. Based on this result, the null hypothesis ($Ho_6$) is rejected and the alternate hypothesis is accepted. This implies that we then accept that there is strong positive and significant relationship between green shipping facilities and waste reduction of maritime companies in South-South Nigeria.

**Discussion of Findings**

This study discovered a strong positive and significant relationship between green shipping policy and carbon emission reduction of maritime companies in South-South Nigeria. This finding was derived from the result of the bivariate analysis carried out on the two variables in the first hypothesis. The result revealed that green shipping policy has a strong positive correlation with carbon emission reduction of maritime companies (rho = .747**) and this correlation is significant at 0.01 level. Based on this result, the null hypothesis ($Ho_1$) was rejected and the alternate hypothesis was accepted. This means that there is strong positive and significant relationship between green shipping policy and carbon emission reduction of maritime companies in South-South Nigeria. This finding is supported by Chang & Dunao (2017) and Lam & Lai (2015) as both studies reported that companies with green shipping policy is likely to reduce the level of carbon emission released into the environment.

This study also found a strong positive and significant relationship between green shipping policy and waste reduction of maritime companies in South-South Nigeria. This finding was deduced from the result of the bivariate analysis carried out on the two variables in the second hypothesis. The result revealed that green shipping policy is strongly and positively correlated to waste reduction of maritime companies (rho = .662**) and this correlation is significant at 0.01 level. Consequently, the null hypothesis ($Ho_2$) was rejected and the alternate hypothesis was accepted. This means that there is strong positive and significant relationship between green shipping policy and waste reduction of maritime companies in South-South Nigeria. This finding is in line with the research conducted by Felico et al (2021) and Poi and Moko (2023) which revealed that waste generation will reduced drastically if companies develop a green policy that will affect all their operations.

This study discovered a strong positive and significant relationship between green shipping design and carbon emission reduction of maritime companies in South-South Nigeria. This finding was obtained from the result of the bivariate analysis carried out on the two variables in the third hypothesis. The result revealed that green shipping design has a strong positive correlation with carbon emission reduction of maritime companies (rho = .688**) and this correlation is significant at 0.01 level. As a result of this, the null hypothesis ($Ho_3$) was rejected and the alternate hypothesis was accepted. This implies that there is strong positive and significant relationship between green shipping design and carbon emission reduction of maritime companies in South-South Nigeria. This finding is consistent with the research conducted by Van Leeuwen (2015) and Cheng et al (2013) which revealed that green shipping design has the capability of reducing carbon emission in the atmosphere.

This study also found a strong positive and significant relationship between green shipping design and waste reduction of maritime companies in South-South Nigeria. This finding emerged the result

of the bivariate analysis carried out on the two variables in the fourth hypothesis. The result revealed that green shipping design is strongly and positively correlated to waste reduction of maritime companies (rho = .724**) and this correlation is significant at 0.01 level as indicated by the symbol **. Based on this result, the null hypothesis ($Ho_4$) was rejected and the alternate hypothesis was accepted. This implies that there is strong positive and significant relationship between green shipping design and waste reduction of maritime companies in South-South Nigeria. This finding is supported by Chang and Dunao (2017) and Lun (2013) as both studies confirmed that green shipping design has the potentials of reducing the amount of waste in the environment.

A strong positive and significant relationship was reported between green shipping facilities and carbon emission reduction of maritime companies in South-South Nigeria. This finding emanated from the result of the bivariate analysis carried out on the two variables in the fifth hypothesis. The result revealed that green shipping facilities and carbon emission reduction of maritime companies in South-South Nigeria. The result shows a strong and positive correlation between green shipping facilities and carbon emission reduction of maritime companies (rho = .791**) and this correlation is significant at 0.01 level as indicated by the symbol **. Consequently, the null hypothesis ($Ho_5$) was rejected and the alternate hypothesis was accepted. This implies that there is strong positive and significant relationship between green shipping facilities and carbon emission reduction of maritime companies in South-South Nigeria. This finding is supported by Abbasi (2013) and Lai et al (2014) as both studies confirmed that companies can reduce their carbon emission released into the environment if they employ green facilities in their shipping operations.

Finally, it was discovered that green shipping facilities has a strong positive and significant relationship with waste reduction of maritime companies in South-South Nigeria. This finding emerged the result of the bivariate analysis carried out on the two variables in the fourth hypothesis. The result revealed that green shipping facilities is strongly and positively correlated to waste reduction of maritime companies (rho = .627**) and this correlation is significant at 0.01 level as indicated by the symbol **. Based on this result, the null hypothesis ($Ho_6$) was rejected and the alternate hypothesis was accepted. This implies that there is strong positive and significant relationship between green shipping facilities and waste reduction of maritime companies in South-South Nigeria. This finding is supported by Zhang & Zheng (2010) and Chang & Dunao (2017) as both studies reported that green shipping facilities can help companies to reduce the amount of carbon emission released into the environment.

## CONCLUSION

This study explored green shipping practices and environmental performance of maritime companies in South-South Nigeria. It focused on green shipping policy, green shipping design and green shipping facilities of maritime companies and relate them to environmental performance such as carbon emission reduction and waste reduction. The result of the analysis revealed that green shipping policy has significant relationship with carbon emission reduction and waste reduction in South-South Nigeria. The study also found a significant relationship between green shipping design and environmental performance (carbon emission reduction and waste reduction) of maritime companies in South-South Nigeria. The study equally revealed that green shipping facilities have a significant relationship with carbon emission reduction and waste reduction in South-South Nigeria. Based on these findings, it is therefore concluded that green shipping practices such as green shipping policy, green shipping design and green shipping facilities are significant predictors of environmental performance of maritime companies in South-South Nigeria.

## RECOMMENDATIONS

The following recommendations are made for the study:

1. That, maritime companies in South-South Nigeria especially those that are yet to embrace sustainability practices should integrate sustainability dimensions into their shipping operations as it would improve their environmental performance.
2. That, maritime companies that want to integrate sustainability practices into their shipping operations should start by developing a green shipping policy that will align with their green shipping strategies as it would enable them practice green shipping successfully and improve their environmental performance.
3. That, maritime companies in South-South Nigeria should design their shipping operations in such a manner it takes care of environmental concerns as it would enable them successfully implement green shipping strategies and reduce the amount of carbon emission released into the atmosphere during shipping of goods.
4. That, maritime companies in South-South Nigeria should replace their shipping facilities and equipment with environmental friendly ones as it would enhance effective practice of green shipping strategies and reduce waste in the environment.
5. Finally, it is recommended that maritime companies in South-South Nigeria should ensure that green shipping practices meet the accepted standard provided by the International Maritime Organization (IMO) in April 2018 and report their environmental performance as required by the Environmental Protection Agency (EPA).

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