EFFECTS OF GREEN LOGISTICS ON SHIPPING OPERATIONS IN THE NIGERIAN MARITIME INDUSTRY

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ABSTRACT

Global warming and maritime environmental issues are addressed in a significant way through green logistics. Sustainable social, economic, and environmental practices demand the use of green logistics. The release of solid waste and the emission of gases and chemicals have great adverse effects on the marine environment. Hence, the need for this study to evaluate the effects of green logistics on waste management in the Nigerian maritime industry. The study adopts a survey research design in which 150 respondents were randomly selected from shipping companies. Both descriptive and inferential statistics were adopted for the purpose of this study. Questionnaires were distributed to the respondents. Findings show that the release of ballast water discharge from the vessel has the highest means. The result also showed that 50.7% strongly agreed that green logistics has an effect on service quality rendered by the shipping companies and that there is a positive relationship among green logistics, service quality, and environmental sustainability, with r equal to 0.725, 0.793, and 0.893. It was concluded that green logistics plays a significant role in ensuring environmental sustainability and improving the service quality of shipping companies. Also, customers benefit immensely from it. It was recommended that shipping companies adopt Industry 4.0 in their operations. Reforms should be reviewed in order to reduce oil spills, the emission of gases, and the release of solid waste into the marine environment, and environmental risk management should be given priority as it relates to environmental, safety, and health.

Keywords: green logistics, solid waste, shipping companies, maritime industry, environmental sustainability, service quality.

1.0 INTRODUCTION

Green logistics plays a crucial role in addressing marine environmental problems and global warming. Green logistics is inevitable in order to ensure social, economic and environmental sustainability. Green logistics is the approach that lessens the negative effects of the logistics network and delivery on the environment while promoting climate change. Therefore, logistics firms must make significant efforts to ensure environmental sustainability in response to rising carbon emissions and global warming. A large number of businesses and establishments are currently being forced to cut their carbon emission values due to worldwide competitiveness. The logistics industry is one of the major contributors to carbon emissions, which are one of the factors in climate change. The idea of "green logistics" is gaining popularity as a means of lowering carbon emissions and moving toward sustainability. A physical network known as logistics links the market and consumers. There are five main categories that make up the basic logistical functions (Tüzün and Yavus, 2017):

1. Logistics network
2. Sourcing and procurement
3. Planning and forecasting
4. Transportation
5. Distribution

The term "green logistics" refers to a strategy that integrates product development strategies with environmentally sensitive production and service practices. The goal of green logistics is

to reduce the negative environmental effects of energy use, chemical use, and emissions in the logistics processes (Tüzün and Yavus, 2017). Additionally, the discharge of solid waste into the marine environment contributes to pollution and ocean acidification. Protecting the maritime ecology becomes necessary. The United Nations established Sustainable Development Goal 14 (Goal 14 or SDG 14), which is about "Life below water" and focuses on a number of issues, including reducing ocean acidification (14.3), protecting and restoring ecosystems (14.2), promoting sustainable fishing (14.4), preserving coastal and marine areas (14.5), eliminating subsidies that encourage overfishing (14.6), and increasing the economic benefits from the sustainable use of marine resources (14.7).

Logistics companies worldwide are under intense pressure from various stakeholders, including the government and customers, to reduce their adverse environmental impacts.

Furthermore, waste minimization is one of the crucial strategy in order to achieve a green logistics. Solid waste delivery services in developing nations continue to encounter difficulties despite decades of active participation by the private sector and other actors in solid waste management (Oduro-Kwarteng, 2011). The solid waste problems in many large cities in various nations have gotten worse despite efforts by local authority and government agencies. Lack of service coverage, inconsistent garbage collection, waste leaking from bins and storage containers, and people's casual attitudes toward indiscriminate disposal at prohibited areas are the main problems with solid waste in developing countries like Nigeria. This study is therefore set to analyse the impact of green logistics on marine environment.

2.0 LITERATURE REVIEW

2.1 Concept of green Logistics

The term "logistics" is frequently used to refer to the movement of products from the source of the raw materials through the production system to their final point of sale or consumption. However, a type of logistics known as "green logistics" is designed to be economically viable as well as environmentally and socially acceptable. It describes all initiatives to gauge and lessen the environmental impact of logistical operations. The role of logistics in contemporary transportation systems is crucial (Urbina, 2019). Green logistics is a brand-new sub-segment that emerged as a result of environmental concerns, while traditional logistics aims to organize forward distribution—that is, transport, warehousing, packaging, and inventory management—from the producer to the consumer (Philhipp, 2021).

A significant new market has emerged around the integration of logistics into waste management and recycling, including the disposal of poisonous and hazardous products. Reverse distribution is a continuous, embedded process in which the company (maker or distributor) is in charge of both the take-back and delivery of new products(Simpson, et al, 2010). This would entail taking environmental factors into account across a product's whole life cycle (manufacturing, distribution, use, and disposal).

2.1.1 Concept of green operations

Green operations include all aspects of product use, handling, manufacture, remanufacture, logistics, and waste disposal once the design is complete. Green manufacturing aims to reduce its environmental impact by using the appropriate materials and techniques, whereas remanufacturing is an industrial process used to restore worn-out products to a like-new state (Lund 1984). Reverse logistics and network design both include operational elements for green manufacturing and remanufacturing (reduce; recycle; production planning and scheduling; inventory management; remanufacturing: re-use, product, and material recovery); and waste management (source reduction; pollution prevention; disposal). Green operations

are also possible in the maritime industry. Digitalization is a significant force behind greener maritime operations (Philipp, 2021). The use of innovative technologies appears to be a critical conduit in achieving a transition from a carbon-intensive port industry to a low-carbon port model by utilizing renewable energy, alternative fuels, smarter power distribution systems, and energy consumption measurement systems, as noted by Iris and Lam (Iris and Lam, 2019), who also emphasize that climate change mitigation is a key target for the port industry.

2.1.2 The convention for the prevention of pollution from ships

The convention for the prevention of pollution from ships is enshrined in the International Convention for the Prevention of Pollution from Ships (MARPOL). The principal international convention for preventing pollution from ships due to operational or unintentional causes is called the International Convention for the Prevention of Pollution from Ships (MARPOL). The IMO adopted the MARPOL Convention on November 2, 1973. In response to a string of tanker incidents in 1976–1977, the Protocol of 1978 was adopted. The 1978 MARPOL Protocol incorporated the parent convention because the 1973 MARPOL Convention had not yet been effective. On October 2, 1983, the merged instrument went into effect. A new Annex VI was added to the Convention in 1997 and went into effect on May 19, 2005. This protocol was approved to update the Convention. Through the years, MARPOL has undergone updates. The Convention, which now has six technical annexes, contains rules intended to prevent and minimize pollution by ships—both unintentional contamination and that from ordinary operations. Most annexations have special areas with severe restrictions on operating discharges. The six technical annexes are as follows:

Regulations in Annex I for Preventing Oil Pollution (came into effect on October 2, 1983) Regulations in Annex II for the Prevention of Pollution by Noxious Liquids in Bulk (effective as of October 2, 1983)

Annex III, which went into effect on July 1, 1992, prevents pollution by harmful substances transported by sea in packaged form.

Annex IV, Prevention of Pollution by Sewage from Ships (effective as of September 27, 2003)

Annex V: Prevention of Pollution by Ships' Garbage (effective as of December 31, 1988)

Annex VI, Prevention of Air Pollution from Ships, which became effective on May 19, 2005

The essence of this convention is to prevent pollution from ships, which is dangerous to marine habitat. It becomes expedient for the Nigerian maritime industry to engage in green operations in order to ensure social, economic, and environmental sustainability across all its operations in the ports and their environs.

2.1.3 Solid waste

Glass, paper, cardboard, aluminum and steel cans, plastics, and other solid waste materials are produced on ships (Walker, 2019). It may be dangerous or non-hazardous in nature. A threat to marine life, people, coastal towns, and businesses that use marine waters can result from solid waste entering the ocean and turning into marine debris. Source reduction, waste minimization, and recycling are often used in tandem to control solid waste on cruise liners. However, up to 75% of solid garbage is burned on board, and most of the ash is sent into the ocean, but some is dumped on land for recycling or disposal. Entanglement with plastics and

other solid trash that may be released or disposed of off cruise ships can cause marine mammals, fish, sea turtles, and birds to become damaged or even die. Each cruise ship passenger produces two pounds or more of non-hazardous solid waste every day on average (Simpson, 2010). Large cruise ships with thousands of passengers can produce a significant quantity of trash each day. For a large cruise ship, a one-week voyage results in the production of around 8 tons of solid garbage. According to estimates, cruise ships account for 24% of the solid garbage that ships produce worldwide (measured by weight). The majority of waste from cruise ships is processed on board (incinerated, pulped, or crushed) before being dumped overboard. Cruise ships can impose a burden on port welcome facilities when trash needs to be offloaded (for instance, because glass and aluminium cannot be burned). These facilities are rarely up to the task of feeding a large passenger vessel.

3.0 METHODOLOGY

This study concentrated on the Nigerian maritime industry, particularly the shipping sector in Lagos State. The largest and busiest port on the continent is located in Lagos, a major financial hub in Africa with the highest GDP. The islands, which are located in the modern Local Government Areas (LGAs) of Lagos Island, Eti-Osa, Amuwo-Odofin, and Apapa, are separated by creeks and border the southwest mouth of the Lagos Lagoon. The islands are shielded from the Atlantic Ocean by barrier islands and long sand spits like Bar Beach, which extend up to 100 kilometers (60 miles) east and west of the mouth. This study adopts a survey research design in which 150 respondents were randomly selected from shipping companies. Both descriptive and inferential statistics were adopted for the purpose of this study. Questionnaires were distributed to the respondents.

4.0 RESULTS

Table 1 shows the various means through which waste are release into the marine environment. The result futher showed the mean and standard deviation of various waste released into the marine environment It was shown that release of ballast water discharge from the vessel has a mean ($\bar{x} = 3.2733$) and the standard deviation ($\sigma = 0.99594$), the release of solid waste from the ship with the mean ($\bar{x} = 3.1533$) and the standard deviation ($\sigma = 1.06649$), emission of gases with the mean ($\bar{x} = 2.7800$) and the standard deviation ($\sigma = 1.120886$), Release of bilge water with the mean ($\bar{x} = 2.5400$) and the standard deviation ($\sigma = 1.15642$), oil spill with the mean ($\bar{x} = 2.4933$) and the standard deviation ($\sigma = 1.28881$), defecating on the seashore with the mean ($\bar{x}$ =2.3523) and the standard deviation ($\sigma = 1.16312$) the dumping site close to the sea with the mean ($\bar{x} = 2.2533$) and the standard deviation ($\sigma = 1.120886$). It can be deduced that Release of ballast water discharge from the vessel has the highest means. Table 2 shows the result of service quality. 10% strongly disagreed that green logistics has an effect on service quality rendered by the shipping companies, 16.0% disagreed, 23.3% agreed and 50.7% strongly agreed that green logistics has an effect on service quality rendered by the shipping companies. It was generalised that green logistics has an effect on service quality rendered by the shipping companies. Table 3 shows the positive relationship among green logistics service, service quality and environmental sustainability with r = 0.725, 0.793 and 0.893.

This result agreed with Philipp, Prause, Olaniyi, and Lemke (2021) assertion that full automation of the loading process has advantageous benefits on a number of levels. Operational performance, including reduced loading times, an optimal occupancy rate of 100% for the bulk loading plant, and lower loading costs for customers, are among the significant improvements in service quality and environmental performance. Ship owners are also using less ballast water, which results in less fuel waste and a 45% reduction in CO2 emissions for the entire port. All these are the result of green logistics.

Table 1: Descriptive Statistics of various means in which waste contaminate the environment

	N	Minimum	Maximum	Mean	Std. Deviation
Release of ballast water discharge from the vessel	150	1.00	4.00	3.2733	.99594
Release of solid waste from the ship into the sea	150	1.00	4.00	3.1533	1.06649
Emission of gases into the marine environment	150	1.00	4.00	2.7800	1.20886
Release of bilge water	150	1.00	4.00	2.5400	1.15642
Oil spill from marine accident	150	1.00	4.00	2.4933	1.28881
Defecating on the seashore	150	1.00	4.00	2.3523	1.16312
Dumping site close to the sea	150	1.00	4.00	2.2533	.99789
Valid N (listwise)	150				

Table 2: Service quality

		Frequency	Percent	Cumulative Percent
Valid	strongly disagreed	15	10.0	10.0
	Disagreed	24	16.0	49.3
	Agreed	35	23.3	33.3
	strongly agreed	76	50.7	100.0
	Total	150	100.0	

Table 3: Correlation

		Green logistics	Service quality	Environmental sustainability
Green Logistics	Pearson Correlation	1	.725**	.793**
	Sig. (2-tailed)		.000	.000
	N	150	150	150
Service quality	Pearson Correlation	.725**	1	.893**
	Sig. (2-tailed)	.000		.000
	N	150	150	150
Environmental sustainability	Pearson Correlation	.793**	.893**	1
	Sig. (2-tailed)	.000	.000	
	N	150	150	150

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

5.0 CONCLUSION AND RECOMMENDATION

It was concluded that green logistics plays a significant role in ensuring environmental sustainability and improving the service quality of shipping companies. Also, customers benefit immensely from it, as timely delivery is inevitable in green logistics. Green logistics ensure

digitalization and clean port operations. Based on the findings, the following recommendations were made:

1. A policy should be put in place to put an end to dumping sites close to the sea.
2. Shipping companies should adopt Industry 4.0 in their operations.
3. Reforms should be reviewed in order to reduce oil spills, the emission of gases, and the release of solid waste into the marine environment.
4. Environmental risk management should be given priority as it relates to environmental, safety, and health
5. Regulatory enforcement and compliance for the prevention of pollution from ships should be given priority so as to reduce or remove informal practices.

REFERENCES

IMO (2023). Convention for the prevention of pollution from ships https://www.imo.org/en/about/Conventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-(MARPOL).aspx

Iris Ç., Lam J. S. L.(2019). A review of energy efficiency in ports: Operational strategies, technologies and energy management systems. *Renewable and Sustainable Energy Reviews* 2019:112:170–182. https://doi.org/10.1016/j.rser.2019.04.069

Lund, R.T. (1984). Remanufacturing. *Technology Review*, **87**, 18–23. DOI: 10.1007/978-1-4020-8939-8_93

Oduro-Kwarteng S. (2011*). Private sector involvement in urban solid waste collection (Thesis*). CRC Press/Balkema: Erasmus University, Rotterdam.

Philipp R. (2021). *Smart Seaports as Innovation Drivers for Blue Growth.* PhD Thesis. Tallinn: Tallinn University of Technology, School of Business and Governance, 2021.

Simpson, Stephen D.; Meekan, Mark G.; Larsen, Nicholas J.; McCauley, Robert D.; Jeffs, Andrew (2010). "Behavioral plasticity in larval reef fish: Orientation is influenced by recent acoustic experiences". *Behavioral Ecology 21 (5)*: 1098–1105. doi:10.1093/beheco/arq117. https://dx.doi.org/10.1093%2Fbeheco%2Farq117

Tuun Rad S. and Yavuz Selim G (2017). Green logistics for sustainability. *International. Journal of Management Economics and Business, 13(3),.*

Urbina, Ian (September 25, 2019). "Dumping into the Ocean | #TheOutlawOcean.". https://www.youtube.com/watch?v=mbAC0LaIXUc&feature=emb_logo

Walker, Tony R.; Adebambo, Olubukola; Del Aguila Feijoo, Monica C.; Elhaimer, Elias; Hossain, Tahazzud; Edwards, Stuart Johnston; Morrison, Courtney E.; Romo, Jessica et al. (2019). "Environmental Effects of Marine Transportation". World Seas: An Environmental Evaluation. pp. 505–530. doi:10.1016/B978-0-12-805052-1.00030-9. ISBN 978-0-12-805052-1. https://dx.doi.org/10.1016%2FB978-0-12-805052-1.00030-9

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