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Management of Ship-Generated Pollution in Nigerian Seaports

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Abstract

The impact of ship-borne pollution in Nigeria's seaport is alarming. Following the guidelines of the International Convention for the Prevention of Pollution from Ships (MARPOL). This study identifies the types of ship-generated waste; evaluates the availability of waste reception facilities in Nigerian seaports, examining the costs of operation waste reception facilities in the Nigerian Seaports; examines the management of ship waste collection processes in the Nigerian Seaports; investigates the implementation of seaport waste management policies in Nigeria; and determines the challenges of ship waste management in the Nigerian seaports. Six research questions were used to appraise the management of waste reception facilities in the Nigerian seaports; corresponding hypotheses were analyzed; the study was based on the command-and-control theory of pollution. To achieve the study goals, copies of the questionnaire were used as a data collection tool. The data collected were analyzed using Statistical Packages for the Social Sciences (SPSS) software version 23, while the grand mean method and Analysis of Variance (ANOVA) were used to test the hypotheses. Findings show that: only 51.7% of ports have waste receiving facilities that are operational; the process of collecting and evacuating the ship's waste is poor; implementation of seaport waste management plan in Nigerian ports differs from all seaports ($p<0.05$); weak implementation of waste management plans; and lack of capacity and cost of using waste reception (83.3%) were major challenges in ship generation pollution management. Based on these findings, the study concludes that waste reception facilities were available and operational in Nigerian ports before the Zero Liquid Discharge (ZLD) criteria were introduced.

Keywords: Pollution, management, ship-generated, Nigerian seaports, zero liquid discharge

INTRODUCTION

Background of the Study

Delivering by sea has been a central action that works with the transportation of individuals (travelers) or merchandise (freight) through the seas and could cover different nations at a generally larger quantity than other media and methods of transportation. More than 90% of world trade is purportedly conveyed across the world's seas by nearly 90,000 marine vessels [1]. This industry, which works under the oceanic business, possesses an extremely unmistakable situation in the economy of countries all around the world and provides the least expensive and most effective method for moving enormous volumes of imports and products all over the planet, subsequently creating jobs and enhancing the economy. The business, in its broad sense, embraces all the ocean-related business activities that happen within the country's sea area. These incorporate seaward financial activities like fishing, rescue, and fee, submerged assets, and coastal monetary exercises like port activities, oceanic vehicle (delivering), transport development, repairs, and support exercises. Of this large number of exercises, delivery stands apart as the best lift to a country's financial development and improvement [2]. This is because any remaining oceanic exercises spin around delivery. Because of the close linkage

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between delivery exercises and monetary turn of events, most countries cannot afford to treat it with levity, thus a cognizant intercession is expected to guarantee that the public interest is safeguarded [3].

Transport-created contamination is an extreme issue militating against sea tasks, as recognized by different scientists like Ghosh and Rubly (2015) and Ng, Saurí, and Turró (2013). This contamination will, in general, show up as oil spillage, unloading of perilous materials, trash, fluid waste/sewage, and air contamination by ships [4]. This frequency of boat-created marine contamination has progressively connected with the consideration of the worldwide marine area in their work to advance safe delivery and the security of the marine environment. Ships and the transportation business are seen to be liable for 18–30% of all the world's nitrogen oxide (NOx) contamination and 9% of the worldwide sulfur oxide (SOx) contamination, and 70% of all boat outflows are within 400 km of land [5].

The developing worry about contamination focuses on the potential for the transportation business to adversely affect the marine environment and the connected biodiversity within the sea field. Ship-source marine poisons exude from freight conveyed or squander produced locally available, which normally contain oil or slick combinations and poisonous substances [6]. They gather from apparatus activity or the homegrown of the team residing locally available. Furthermore, a boat-borne poison incorporates trash, strong waste, and antifouling paints on the boat's hull. Surviving investigations have reported the impacts of boat put together contamination with respect to the marine climate [7]. These incorporate the introduction of non-native species with the oceanic climate, which undermines the oceanic creature population and the adverse consequences on the economies of nations that rely upon business fishing [8]. Against the backdrop of public concern and the requirement for relief strategies, the transportation business has effectively tried to mitigate the negative environmental impacts emerging from the delivery area. At a global level, different legal instruments and controls have been given to empower guidelines and requirements by banner states, beachfront states, and port state control [9]. Our overview will add to and fill in the information hole in this field. In this way, a survey of the difficulties related to the administration of boat-produced contamination considering the MARPOL rule is basic [10].

STATEMENT OF THE PROBLEM

The actions taken so far by the International Maritime Organization (IMO), along with the implementation of its conventions by flag state, seaside state, and port state control, have yielded productive outcomes, particularly in reducing contamination from unintentional spills emerging from collisions [11]. Be that as it may, contamination from non-coincidental sources continues unabated, and a few port authorities have been found lacking in the provision of essential port waste collection facilities [12]. The implications are that increasing levels of marine contamination from transport-based releases are normal in these ports over the long haul. For instance, between the years 2008 and 2011, there were around 32 and 18% expansions in the amounts of trash and sleek waste dealt with separately in Nigeria's Tin Can Island port gathering offices alone [13].

From the survey, a perceptible issue is that most examinations on the boat created contamination commonly assess the issue of contamination, however, do not assess its management. Thus, not many suggestions and plans are gadgets to check the rising spate of boat-produced contaminations in the Nigerian streams. Likewise, the recurrence of this sort of examination is large amounts of industrialized economies, while those in Nigeria are simply a modest number [14]. In Nigeria, for instance, the Nigeria Ports Authority (NPA), overseer of public ports, does not possess or work with waste gathering offices; however, re-appropriates the obligation to a confidential contamination control organization [15]. As per the Nigerian Ports Authority port overseeing chief, the confidential contamination control organization is to provide port gathering offices in all four navigational locales of Lagos, Port Harcourt [16]. The venture is self-supporting, and agreement residency is 20 years starting from the year 2006. To address these ecological issues, natural and perceptual-related contents are required. Besides, it likewise gives the idea that such a critical and contemporary review has not been conducted in Nigeria, which this study expects to fill this gap [17].

OBJECTIVES OF THE STUDY

The objectives of the study are:

1. Evaluate the availability of waste reception facilities in Nigerian seaports.
2. Examine the cost of operating waste reception facilities in the Nigerian seaports.
3. Examine the management of ship waste collection and evacuation processes in the Nigerian ports.
4. Investigate the implementation of seaport waste management policies in Nigeria.
5. Appraise the management of waste reception facilities in Nigerian seaports.
6. Determine the challenges in the management of ship-generated pollution in the management of ship-generated pollutions in Nigerian seaports [18].

Research Questions

Considering the above objectives, the following research questions are formulated as follows.

1. What is the availability of waste reception facilities in Nigerian seaports by stakeholders?
2. What is the cost of usage of waste reception facilities in the Nigerian seaports?
3. What is the level of management of ship waste collection and evacuation processes in the Nigerian ports?
4. How well is the implementation of the seaport waste management plan in Nigeria perceived?
5. What is the level of management of waste reception facilities in Nigerian seaports?
6. What are the challenges in the management of ship-generated pollutions in the Nigerian seaport?

Research Hypotheses

In light of the objectives and research questions, the following testable hypotheses are stated in the null form (H_0) as follows:

H_{01}: There is no significant difference in the availability of waste reception facilities across Nigerian seaports.

H_{02}: There is no significant difference in the availability of the cost of usage of waste reception facilities across Nigerian seaports.

H_{03}: There is no significant difference in the level of management of ship waste collection and evacuation processes across Nigerian seaports.

H_{04}: There is no significant difference in the implementation of seaport waste management plan across Nigerian seaports.

H_{05}: There is no significant difference in the level of management of waste reception facilities across Nigerian seaports.

H_{06}: There is no significant differences in the challenges of the management of ship-generated pollutions across Nigerian seaports.

Significance of the Research

The discoveries of the review will be significant in two unmitigated viewpoints: To Scholars, this exploration would not only add to works that have been completed around here, yet in addition incite further research into the area of contamination management in the sea environment. Understudies, Academicians, and different researchers will be influenced as it would be helpful to the researchers who might intend to compose comparative examinations to this and add to the current information lacuna [19]. Studies of the view of nearby individuals can give significant bits of knowledge into perceptions, understandings, and translations of the social effects, and biological results of preservation; the authenticity of protection administration; and the social adequacy of natural administration [20]. Impressions of these variables add to positive or negative neighborhood assessments of preservation drives. It is positive discernments, not simply true logical proof of adequacy, that eventually guarantee the help of neighborhood constituents in this way empowering the long-term progress of preservation

[21]. Research on discernments can illuminate courses regarding activity to further develop preservation and administration at scales going from individual drives to public and worldwide strategies. Better fusion of proof from across the social and innate sciences and coordination of a majority of techniques into observing and assessment will give a more complete picture on which to base protection choices and ecological administration [22].

The exploration findings will likewise be vital to policymakers at the public level as they plan strategies aimed at upgrading sustainability in the oceanic area. State-run administrations have started different plans to reduce the spate of contamination in different movement areas like the sea area and consider it as basic to direct and manage transporting business and the oceanic area since they really do have such a necessary impact on the economy [23]. Thus, the result of this study is basic as it would help the different partners in understanding and demystifying the exercises of this area [24].

DEFINITION OF TERMS

To guarantee liquid comprehension of this proposal, a few key terms are explained as follows:

Anti-fouling paints: These are particular paints applied to the boat structure to slow the marine growth on the submerged region, which can influence the vessel's execution and stability [25].

Ballast wastewater: Ship ballast is any material used to weigh or potentially balance the boat. They will quite often cause contamination in waters additional time. These releases are accepted to be the main wellspring of invasive species in different streams, subsequently presenting general wellbeing and ecological dangers [26].

Bilge water: is the water that gathers in the bilges of a vessel, which, by and large, becomes foul and poisonous. Bilge water additionally contains liquids from hardware spaces, inward seepage frameworks, slime tanks, and different sources [27].

Black/gray wastewater: Gray water is all of the wastewater that channels from your shower and kitchen, and washroom sinks. Dim water has a few microbes; however, it very well may be separated and reused in nurseries or yards, when done appropriately. Dark water contains human waste and is hazardous [28].

Garbage and other solid waste: Garbage produced from ships, including ordinary and unsafe waste, is a critical source of waterfront contamination because of its unlawful removal into the ocean and ill-advised taking care of on shore [29].

Hazardous waste: will be squander that has significant or likely dangers to general wellbeing or the climate. Trademark risky squanders are materials that are known or tried to display at least one of the accompanying perilous characteristics: Ignitability, Reactivity, and Corrosivity [30].

Marine machinery exhaust: The fumes framework is comprised of a few parts that cooperate to diminish fumes clamor and provide a course to deplete gases to leave the motor by advancing out underneath the vessel. This adds to the contamination of the air and saturates the water [31].

Slops: Slops and slimes are a hydrocarbon-rich modern waste, delivered in different pieces of a boat's tasks, including tank cleaning, cleansing fills, and utilization of counterweight water [32].

Sludge is a semi-strong slurry that can be created from a range of modern cycles, from water treatment, wastewater treatment, or on-location disinfection frameworks [33].

Tanker Accidents: Tanker blasts, crashes, and steering into the rocks, the most widely recognized sorts of accidents with big haulers and frequently get the most attention for the natural harm these mishaps cause [34].

LITERATURE REVIEW

Theoretical Framework/Conceptual Framework

Theoretical Framework

This research is based on Durkheim's (1951) functionalist theory and Clinch's (2001) command and control pollution theory as presented below:

Functionalist Theory

The functionalist theory or perspective initially propounded by Emile Durkheim (1951) was viewed as applicable to this review. The functionalist point of view accomplished its most noteworthy notoriety among American sociologists during the 1940s and 1950s; among these American functionalist sociologists is Robert K. Merton (1973). The functionalists see the public as a framework made out of various parts and partners, which communicate, concentrate, and trade materials to keep up with the framework. Individuals are kept up with the capabilities performed by the different parts, and when the parts quit working, development is impeded. Furthermore, there are useful prerequisites that should be met in a public for its endurance. A peculiarity is believed to exist, as it serves a specific function [35].

The Resilience hypothesis has likewise been professed to be founded on fortitude, incorporation, and balance. There should be an obligation to these standards and some kind of agreement on cultural qualities to which all capability keeps up with and advance social fortitude. Functionalism is the mixture of social things in a society for society's support at harmony. Portions of the public are utilitarian up to this point; they keep up with the framework and add to its endurance [36].

Conditions are kept up with the different capabilities completed by different parts or parts in a framework. Ecological issues, exhaustion, and tainting of water emerge as individuals connect with themselves in numerous exercises to meet their everyday necessities [37]. These exercises occasionally disagreeable with our water quality and accessibility, but since individuals have needs and requests that should be met, the outcomes of certain activities are not considered. What is more, individuals are often uninformed about their activities since they are battling for endurance in this way, causing water to influence them in the future and furthermore upset the advancement of their undertakings [38]. Since issues in a single piece of the framework influence different parts, answers for such water issues should be done overall by everyone in the public. Everyone from the public plays a part by co-working and teaming up to guarantee ecological security in the public [39].

To adjust this hypothesis, it requires a huge contribution from all the sub-parts to achieve a change in our business with water. This suggests that different parts, for example, optional school understudies, sub-frameworks or parts ought to work in cooperation in keeping up with intricacy and variety, lessen enduring and contamination decrease along these lines, we can likewise somewhat conquer the issues facing water issues (for example contamination, pollution, sickness and consumption among others) which we experience on the planet [40].

Command-and-Control Theory of Pollution

The defender of this hypothesis is Clinch (2001). That is what this hypothesis communicates, the customary way to deal with managing the climate is habitually described as Command-and-Control strategy and is for the most part seen as a lawful way to deal with safeguarding the climate [41]. As indicated by Clinch (2001), order and control arrangements are basically mandates to individual chefs, expecting them to set at least one result or contributions at a few foreordained guidelines (specified levels) or denying them from surpassing (or missing the mark concerning) such principles (levels). The most predominant type of uniform order and control guidelines is innovative principles and execution norms that determine uniform cutoff points on how much contamination a firm can deliver [42]. The firm then, at that point, changes its result or decreases so that the standard is accomplished. In case of firms not agreeing with these guidelines, then such firms are viewed as culprits and monetary punishments, or different approvals are imposed to bring non-consenting sources into consistency [43]. They contend that order and control guideline permits generally little adaptability in compliance efforts

since such guidelines will in general, power all organizations to take on equivalent portions of the contamination control trouble, no matter what the cost. Where there is a critical heterogeneity of decreased expenses, order and control techniques will not be practical. Except if all polluters face a similar contamination reduction cost, uniform emission norms will not limit the expenses of diminishing outflows [44].

In actuality decrease costs fluctuate fundamentally between firms because of production plan, actual setup, period of resources, and different variables. A typical analysis of the order and control way to deal with ecological strategy making is that costs of consistency might be significantly higher than under adaptable instruments, for example, discharges trading or charges on emissions. This issue is exacerbated when guidelines appear as a mechanical remedy, obligatory utilization of a specific type of hardware [45].

In principle, the order and control approach could accomplish a natural objective in a similar most minimal expense design as a market-based instrument. In any case, features that accomplish this natural controller would have to characterize various guidelines for every contamination source, considering the reduction costs that each firm faces [46]. Since such data is not promptly accessible and probably not going to be uncovered by firms, order and control will for the most part end up being more expensive than the market-based approach [47].

The Contextual Interaction Theory

The advocate of this hypothesis is Lafferty (2012), who centers on strategy execution and sees strategy processes (including strategy execution) as entertainer cooperation processes, important processes that are affected by exercises and connections of the pertinent entertainers [48]. Entertainers are people, for example, oceanic or delivery teams or individuals, addressing themselves or their associations, and within the setting of the execution interaction, they incorporate the dependable government authorities (implementers) and the objective gathering of the strategy [49]. The Theory's essential supposition that will be that the attributes of the entertainers in question, especially their inspiration, data, and power, are vital in understanding courses and results of strategy processes [50]. This depends on the affirmation that for the achievement of some random errand one necessities a rousing goal, skill, and limit/assets. Inspiration can consolidate both inner/own objectives (values, personal matters) as well as outside factors (like those from higher specialists). It can likewise be affected by self-efficacy appraisal, by which an entertainer can become de-spurred assuming he sees his favored game plan to be impossible for him. Data incorporates translation, citations of reference, as well as information and availability to data expected for execution of the undertaking. Power consolidates accessible assets and control/authority [51]. As per the Contextual Interaction Theory, these qualities impact the stance of a given entertainer in regard to the strategy being referred to and thus his situation and exercises within the collaboration cycle with different entertainers in the approach organization [52]. The attributes of the entertainers are additionally affected by external settings like the underlying setting of the administration system, the particular setting of the strategy (previous choices, explicit conditions), and the more extensive setting (for example, political, financial, social, and others). The connection between the vital qualities as well as between the entertainers in the arrangement cycle can likewise change over the long haul [53].

The hypothesis further accepts that arrangement execution incorporates accomplishing execution as well as staying away from execution. Collaboration types might include participation, either dynamic (when entertainers have a joint desire), inactive (e.g., when one entertainer is unbiased about the execution) or constrained (when latent participation is forced by a prevailing entertainer); resistance, when one entertainer endeavors to forestall execution by different entertainers; and joint realizing when just lacking data forestalls execution [54]. The hypothesis additionally recognizes two circumstances: absence of (or deficient) execution and failed/insufficient execution [55]. In that capacity, the hypothesis is appropriate for entertainer-focused examination like the one conducted in this review. To sum up, the attributes of inspiration, data, and force of every entertainer and the elements between them

impact the cooperation cycle between the pertinent entertainers (implementers and target group), which thus impact the result and outcome of the strategy interaction [56]. Considering this, the Israeli case is dissected. For this situation, the Theory is additionally used to dissect the elements between the vital qualities and entertainers as making sense of changes in the process over the long haul (e.g., the shift from absence of authorization and persistent contamination to strong requirement and contamination control). The investigation incorporates the entertainers, the connections among them, and the result thus [57].

Marine contamination is a critically important environmental issue affecting regions worldwide, particularly concerning the preservation of inland seas. It will take facilitated tries solid areas for and of the public power of the to ensure that it is out appropriately checked by ensuring that all instruments blocking marine tainting are truly and beneficially completed and carried out. Even more altogether, care and tutoring are also indispensable to bring down contamination [58].

This is because numerous people grimy the oceans and seas without data on the adverse and risky effects of their activities. In view of the rising speed of marine tainting. Marine defilement is portrayed as "a prompt or indirect show by individuals of substances or energy into the marine environment causing damage to living resources, hazards to human prosperity, deterrents to marine activities including fishing, impairment of the quality of sea water and abatement of accommodation".

This definition decides different pathways such as streams, estuaries, waterfront establishments, and outfall structures from which spouting and of garbage can be up at the coastline and marine environment. The essential impacts related to marine pollution are the following.

Social impact: The water and its flow situation becomes foul due to marine tainting, introducing voyagers to infections and genuinely risking their lives.

Monetary impact: A model may be drawn from the impact on production of sea profundities, which contributes a particular part of the improvement of the economy [59].

Marine defilement negatively impacts marine life, the improvement of sea depth will be low, and the economy will take a blow.

Natural impacts: happen where the marine climate and domain become adulterated, marine animals and plants are affected, engendering a pattern of marine animals resentful, and marine animals and plants could become cleared out. In 1950, unquestionably the most over-the-top, horrible mercury poisoning catastrophe the world had ever seen happened in Minamata, Japan. A major hauler, which is perhaps the best huge hauler on earth, guided into the stones between Land's End and the Isles of Scilly, delivering more than 100,000 t of crude oil into the sea and inflicting damage and spoiling of more than 20,000 sea birds. The event sparked interest in the overall neighborhood, the danger of marine pollution, and starting there made overwhelming care on the stunning impacts and effects of marine pollution [60]. It is, in any case, particularly focusing on that after this episode and despite the grave models the defilement gave, Japanese society continued to experience a second occurrence of Minamata disease during the 1960s. The authentic scenery of the two rates shows a shortfall of natural organization in Japanese society. In any case, care got a move on from one side of the planet to the other, and rational countries started to learn models and took a particularly firm stand against marine pollution by familiarizing strong guidelines with direct control of marine pollution [61]. Moreover, during the 1967s, a vessel from Liberia caused marine pollution conspicuously known as the Torrey Gulch by delivering 120,000 t of oil spills into the sea. This occasion developed and prompted the whole world to make an incredibly noteworthy drive against marine pollution. To this end, different regulatory frameworks were declared extensively and all around to block, stop, or ease marine tainting; regardless of this, marine pollution continues to be an issue of phenomenal concern in the world, and it continues to happen reliably [62]. The Torrey Ravine made biological assurance end up being more objective. During the

1970s, there was a general perception concerning the overall neighborhood control of marine defilement and supervising ocean resources. This incited the statement of the Show for the Counteraction of Marine Contamination by Unloading from Boats and Airplanes (Airplane 1972). "For the control of dumping hazardous substances from boats and planes into the ocean and further made an impediment by requiring an award to dump specific substances like arsenic, lead, copper, zinc, and their combinations". In 1973, the Show for the Counteraction of Contamination from Boats (MARPOL) was introduced [63]. It is fitting to note that both the OSLO and MARPOL Shows are modified as new fines not outperforming R20,000. 00 or confinement for a period not exceeding two years, or with both fine and confinement. Both overall and metropolitan guidelines have been familiar expressly for overseeing and limiting marine pollution of different sorts [64]. The justification for this is to ensure that marine life and the real water are protected by preventing the dumping of pernicious and unsafe substances either deliberately or suddenly into the seas or oceans through human activities [65]. It can indicate that marine pollution affects the ocean economy and could make monetary impacts and hardships on the marine environment and resources. Against the foundation of the need to protect and shield the oceans and seas from the crushing impacts of marine pollution, there is a need to uplift and strengthen the execution and necessity of guidelines and procedures overseeing marine pollution. In Nigeria, the earliest reference to marine tainting was recorded, confirming that some place in the scope of 1976 and 1980, a total of 784 cases were reported. These oil spill episodes delivered 1,337000 barrels of oil into the environment. This exhibit of marine pollution continued unabated with no possible repercussions until the public power and the authoritative experts confronted it by broadcasting guidelines forbidding marine defilement [66]. It is suitable to determine that marine tainting is one of the focal issues of the overall neighborhood, it has continued to intervene in such a way. Providing details regarding the disavowal of marine defilement, Boyle pronounces that the "end of the Worldwide Show for the Anticipation of Contamination of the Ocean by Oil signified the worldwide neighborhood's important, serious undertaking to adjust to the rising size of marine pollution". Regardless, it was astonishing that regardless, when worldwide neighborhood the Show for the Counteraction of Contamination of the Ocean by Oil, despite opposition to the marine pollution being contained and lessened, unbelievably, marine pollution from oil spillages extended at a faster rate [67].

Marine contamination is a pressing issue around the world. It will take purposeful endeavors, serious areas of strength for and of the public authority of the overall to guarantee that it is out appropriately checked by ensuring that all instruments denying marine contamination are successfully and proficiently carried out and upheld [68].

Conceptual Framework

Ship-Generated Pollution

Considering pollution generated by ships, the resource most heavily affected is the water itself. Following centuries of human improvement in which water has been a plentiful resource in numerous districts, delivering basically to a free fair, the situation is now unexpectedly developing. Particularly in the drier regions of the world, water deficiency has transformed into the most imperative risk to food security, human prosperity, and typical organic framework. Considering another Global Water The executives Establishment (IWM1) projection of water market revenue for 118 countries for the period 1990 to 2025, it is evaluated that practically 1.4 billion people, amounting to a fourth of the total people, or 33% of the general population in developing countries, live in locale that will experience serious water scarcity in the fundamental quarter of this lengthy timespan. Water is an essential resource [69]. It maintains human life and culture, organic capacities, and financial activities. As interest in new water increases, demand for the board systems ends up being logically huge. The benefits of water demand that the leaders consolidate cost-holding subsidies through surrendering the prerequisite for premium in new establishments, save finances in the treatment and supply of water to schools and families, and venture supports in wastewater management through diminished streams. There are many possible ways of managing water demand the leaders, including anyway not confined to water setback control and asset support, water-capable developments, rules, non-regulatory procedures (e.g., tutoring and exertion), and monetary instruments [70]. Starting from the introduction of interest, the board

mediations are most likely going to impact on open, an understanding of students' points of view, approaches to acting, and perspective on water use, is critical for convincing usage, really talking with individuals overall.

Despite the reduction of how much water per capita, water is getting more degraded at a rapid rate, and the course of water across the world is developing [71]. Thus, people truly should realize the circumstances affecting close by water resources. Water in sufficient quantities and of expected quality is the head fundamental necessity for sound individuals and quality creation. In this manner, it is a responsibility of the large populace not to bring any difficulty as to water utilization for individuals later and to find ways to increase how much of usable water today and to use water sparingly [72].

Types of Ship-Generated Marine Pollution

Article 1(4) of the 1982 United Nations Convention on the Law of the Seas (UNCLOS) characterizes contamination of the marine climate to mean the presentation by man, straightforwardly or in a roundabout way, of substances or energy into the marine climate which are probably going to bring about adverse consequences on living assets, are dangerous to human wellbeing, an obstruction to marine exercises including fishing and other genuine purposes of the ocean, cause a hindrance in quality of seawater uses and diminishing amenities [73]. On a worldwide scale, it is by and large perceived that marine contamination is principally brought about by human exercises in view of land and substantially less by human activity occurring drift:

- Contamination by oil and unsafe or harmful substances from coincidental, functional, and unlawful releases;
- Release of functional waste from ships, including release of crude sewage and trash (litter);
- Arrival of poisonous synthetic compounds utilized in enemy of fouling paints and filtering of heavy metals from anodes;
- The presentation of non-native organic entities through boats' stabilizer water and related silt, and fouling on boats' bodies;
- Physical and different effects incorporating commotion and impact with marine warm-blooded animals; and
- The impacts of these are fundamentally observable in the middle of transportation paths and harbors; influence in or near environmentally sensitive regions might be more critical in waterfront regions [74].

METHODOLOGY

Research Design

A research design can be characterized as a layout that capability as an aide in gathering and breaking down the information for a review. It serves as a model of confirmation that permits the scientists to reach determinations concerning the principal connection among the factors. This study will utilize the cross-sectional overview research plan, which is a sort of semi-trial plan. The semi-exploratory plan was utilized on the grounds that the factors under study are not heavily influenced by the specialist, and the examination aims to create new truth without deliberate control of the factors [75]. The cross-sectional overview should be visible as a preview of a population in a given timeframe. The cross-sectional overview is fundamental since it is moderately cheap and requires little investment to lead. It can likewise gauge the predominance of the result of interest owing that examples are frequently taken from a given population.

Study Area

The study area is the Nigerian ports. As per the Nigerian Ports Authority (NPA), the nation has six seaports: Apapa and Tin Can in Lagos, the Onne and Port-Harcourt ports in Rivers State, the Warri Port, and the Calabar Port (Nigerian Port Authority, 2021) [76].

Lagos Port Complex: This is the Apapa port in Lagos. Along with the Tin Can Island Port, it serves principally Lagos and western Nigeria. The Lagos Port Complex serves as the major financial way to the country [77].

Tin Can Island Port: Tin Can Island Port at Lagos was hurriedly developed in 1976 to address the issues of the 1975 'concrete naval force' emergency. It was charged on 14 October 1977 at a complete expense of N200 million and included 10 compartments and 2.5 km of hard quay (Nigerian Port Authority, 2021) [78].

Calabar Port: Located in the southeast corner of the nation in Cross River State, Calabar is the home of the Eastern Naval Command of the Nigerian Navy [79]. This is the longest serving port and furthermore the most established seaport in Nigeria. Port offices are found 55 nautical miles up the Calabar River (Nigerian Port Authority, 2021).

Delta Port: Delta Port, Rivers Port, and Onne Port are situated in the petrol and flammable gas delivery to the Niger River Delta district of Nigeria. Delta Port in Delta State incorporates the ports of Warri, Burutu, Sapele, and petrol terminals at Escravos and Forcados (Nigerian Port Authority, 2021).

Streams Port/Port Harcourt: The Rivers Port Complex in seaside Rivers State contains Port of Port Harcourt, Okrika Refined Petroleum Oil Jetty, Haastrup/Eagle Bulk Cement Jetty, Kidney Island Jetty, Ibeto Jetty, Macobar Jetty, and Bitumen Jetty [80]. The board of port tasks at Port Harcourt itself has been authorized out to two port administrators, Ports and Terminal Operators, and BUA Ports and Terminal; it is not worked by the NPA. Like Delta State, Rivers State is a vital oil-producing district of Nigeria (Nigerian Port Authority, 2021) [81].

Onne Port: Onne is situated in Rivers State on Ogu Creek close to the Bonny River, 19 km from Port Harcourt; the port region is situated in three Local Government Areas of Rivers State, Eleme LGA, Ogu-Bolo LGA, and Bonny LGA [82]. The port comprises two significant offices, the Federal Ocean Terminal and the Federal Lighter Terminal. Onne Port has been assigned as an Oil and Gas Free Zone by the public authority of Nigeria; presently north over 100 organizations have licenses to work at Onne Port; as a monetary free zone, it fills in as a center port for oil and gas tasks all through West Africa and Central Africa (Nigerian Port Authority, 2021) [83].

Population for the Study

Research population is the whole group of events, individuals, or things of interest that the researcher intends to appraise [84]. The number of inhabitants in the review is the center partners and functional staff of the different Nigerian ports and includes the encompassing networks. The objective population of 493,890 is displayed in Table 1.

Table 1. Surveyed the population of the study.

S.N.	Selected port	Type of docking ship	State	Target/accessible population
1	Apapa Port	Bulk ship, container ships	Lagos State	130,417
2	Tin Can Port	Bulk ship, container ships	Lagos State	86,944
3	Onne Port	Bulk ship, container ships	Rivers State	77,864
4	Port Harcourt Port	Bulk ship, container ships	Rivers State	115,000
5	Warri Port	Bulk ship, container ships	Delta State	63,819
6	Calabar Port	Bulk ship, container ships	Cross River State	19,846
	Total			493,890

Source: Nigerian Bureau of Statistics (2019 estimates).

Sample and Sampling Techniques

Sampling involves the random selection of a subset (sample) from the entire study population, which serves as a true representation of that group, since it is often impractical to access the whole population (Figure 1). The simple random sampling technique was adopted for the survey administration [85–87]. The sample size was determined using Taro Yamane's formula, expressed as:

$$S = \frac{N}{1 + N(e)^2}$$

Where:
S = Sample size
N = Population size
e = Margin of error (assumed to be 0.05)
1 = Theoretical constant

Given that the target population (N) is 493,890, the calculation is as follows:

$$S = \frac{493{,}890}{1 + 493{,}890(0.05)^2}$$

$$S = \frac{493{,}890}{1 + 1234.725}$$

$$S = \frac{493{,}890}{1235.725}$$

$$S \approx 400$$

Therefore, the sample size determined for this study is 400 respondents.

A stratified sampling technique was subsequently employed, dividing the total sample into different subgroups (strata) proportionally, as shown in Table 2.

Table 2. Proportional sample size distribution across various Nigerian ports.

S.N.	Selected port	State	Proportion	Target/accessible population
1	Apapa Port	Lagos State		106
2	Tin Can Port	Lagos State		70
3	Onne Port	Rivers State		63
4	Port Harcourt Port	Rivers State		93
5	Warri Port	Delta State		52
6	Calabar Port	Cross River State		16
	Total			400

Nature/Sources of Data

Primary source of information was a questionnaire administered to the group individuals that relate to this review, while secondary information was derived via magazines, papers, course books, diaries, and the web [88–90]. The sources of data collection include the following.

Primary Source of Data

The primary sources of data collection for this research were a structured questionnaire [91]. These questionnaires were carefully designed and distributed to a targeted sample of respondents in order to gather comprehensive and specific information, ensuring a more in-depth exploration of the research objectives and a more robust foundation for the subsequent data analysis and findings [92–94].

Secondary Source of Data

The sources of secondary data are the documents obtained from published sources like magazines, newspapers, textbooks, journals, and the internet [95, 96].

Method of Data Collection/Instrumentation

Data collection involves obtaining and measuring information concerning a phenomenon, this is to enable the researcher undergo intense analysis needed to answer stated objectives, test hypotheses and appraise the study outcomes [97, 98]. In achieving this, the data based on each objective was analyzed:

Figure 1. Map of Nigeria showing major seaports (study area).
Source: Modified from the administrative map of Nigeria

Objective I: To Evaluate the Availability of Waste Reception Facilities in Nigerian Seaports

- *Data:* Data for this objective is the primary data.
- *Data Collection:* Primary data sources were employed in achieving this objective using 3-point rating scale questionnaire structured in the form as: Not Available (NA) 1, Available but Non-functional (AVNF) 2, and Available and Functional (AVFA) 3, in a tabular form [99, 100].
- *Hypotheses-(H_{01}):* There is no significant difference in the availability of waste reception facilities across Nigerian seaports.
- *Data Analysis:* Descriptive statistics (tables, charts, frequencies), Inferential statistics (Mean) were used for making inferences and data presentations, while ANOVA was employed in testing this hypothesis [101, 102].

Objective II: To Examine the Cost Associated with the Utilization of Waste Reception Facilities in the Nigerian Seaports

- *Data:* Data for this objective is the primary data [103, 104].
- *Data Collection:* Primary data sources were employed in achieving this objective using a 4-point Likert scale questionnaire structured in the form as: Strongly Agreed (SA) 4, Agreed (A) 3, Disagreed (D) 2, and Strongly Disagreed (SD) 1, in a tabular form [105–107].
- *Hypotheses-(H_{02}):* There is no significant difference in the cost of usage of waste reception facilities across Nigerian seaports [108, 109].
- *Data Analysis:* Descriptive statistics (Tables, charts, frequencies), Inferential statistics (Grand Mean Method) were used for making inferences and data presentations, while ANOVA was employed in testing this hypothesis [110, 111].

Objective III: To Determine the Level of Management of Ship Waste Collection and Evacuation Processes in the Nigerian Ports

- *Data:* Data for this objective is the primary data [112, 113].
- *Data Collection:* Primary data sources were employed in achieving this objective using a 4-point Likert scale questionnaire structured in the form as: Strongly Agreed (SA) 4, Agreed (A) 3, Disagreed (D) 2, and Strongly Disagreed (SD) 1, in a tabular form [114, 115].
- *Hypotheses-(H_{03}):* There is no significant difference in the perceived level of management of ship waste collection and evacuation processes across Nigerian seaports [116, 117].
- *Data Analysis:* Descriptive statistics (Tables, charts, frequencies), Inferential statistics (Grand Mean Method) were used for making inferences and data presentations, while ANOVA was employed in testing this hypothesis [118, 119].

Objective IV: To Evaluate the Implementation of Seaport Waste Management Plan in Nigeria

- *Data:* Data for this objective is the primary data.
- *Data Collection:* Primary data sources were employed in achieving this objective using a 4-point Likert scale questionnaire structured in the form as: Strongly Agreed (SA) 4, Agreed (A) 3, Disagreed (D) 2, and Strongly Disagreed (SD) 1, in a tabular form [120, 121].
- *Hypotheses-(H_{04}):* There is no significant difference in perceived implementation of seaport waste management plan across Nigerian seaports [122–124].
- *Data Analysis:* Descriptive statistics (Tables, charts, frequencies), Inferential statistics (Grand Mean Method) were used for making inferences and data presentations, while ANOVA was used in testing this hypothesis [125–127].

Objective V: To Appraise the Management of Waste Reception Facilities in Nigerian Seaports

- *Data:* Data for this objective is the primary data [128–130].
- *Data Collection:* Primary data sources were engaged in achieving this objective using a 4-point Likert scale questionnaire structured in the form as: Strongly Agreed (SA) 4, Agreed (A) 3, Disagreed (D) 2, and Strongly Disagreed (SD) 1, in a tabular form [131, 132].
- *Hypotheses-(H_{05}):* There is no significant difference in the perceived level of management of waste reception facilities across Nigerian seaports [133, 134].
- *Data Analysis:* Descriptive statistics (Tables, charts, frequencies), Inferential statistics (Grand Mean Method) were used for making inferences and data presentations, while ANOVA was employed in testing this hypothesis [135, 136].

Objective VI: To Determine the Challenges in the Management of Ship-Generated Pollutions in the Nigerian Seaports

- *Data:* Data for this objective is the primary data [137, 138].
- *Data Collection:* Primary data sources were employed in achieving this objective using a 4-point Likert scale questionnaire structured in the form as: Strongly Agreed (SA) 4, Agreed (A) 3, Disagreed (D) 2, and Strongly Disagreed (SD) 1, in a tabular form [139].

- *Hypotheses-(H_{06}):* There are no significant differences in the perceived challenges experienced in the management of ship-generated pollutions across Nigerian seaports [140].
- *Data Analysis:* Descriptive statistics (Tables, charts, frequencies), Inferential statistics (Grand Mean Method) were used for making inferences and data presentations, while ANOVA was employed in testing this hypothesis.

Validity/Reliability of Instrument

To validate the examination instrument, in a piece to guarantee that the instruments completely address the points, a draft of the survey was introduced to the task manager for evaluation and agreement, and furthermore, to seek order and direction in the viable field study. The face legitimacy of the instrument was to determine, and from that point, a duplicate was ready to be utilized for the exploration work [141].

To survey the unwavering quality of the instrument, a pilot study was conducted on a normal of 50 respondents from the two entertainers (center partners and functional staff) utilized in this review. The aftereffects of the pre-directed 50 respondents were recorded. Following a month of beginning organization, the polls were controlled again to them once more, and their scores were kept in what is known as the Retest strategy. The test-retest trustworthiness of the not entirely settled by oppressing the two scores obtained from the pilot review to a connection measurement, which gave an unwavering quality list of 0.82 utilizing Pearson Product-Moment Correlation Coefficient. The instrument is thought of as sufficient on the off chance that the coefficient obtained is more prominent than 0.70 [142].

CONCLUSION

In conclusion, the findings of this comprehensive review lead is to the presumption that, waste reception facilities are available and functional in the studied seaports, the overarching challenges in managing ship-generated pollution are indicative of deep concerns, these Challenges manifest as issues of weak implementation of existing regulations, the economically burdensome aspects of waste generation and disposal and the apparent inadequate in overall pollution management practices. It becomes evident that addressing this multifaceted issue requires a more holistic and robust approach involving coordinated efforts across various stakeholders, innovative solutions, and a renewed commitment to environmental stewardship in Nigeria's Maritime industry. The recognition of these complexities surrounding the ship-generated pollution management underscores the urgency of further research, policy development, and strategic initiatives to foster lasting improvement in this crucial domain.

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