Assessment of port reception facilities and waste management control in Nigeria: case study : (Tin Can Island Port)

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ASSESSMENT OF PORT RECEPTION FACILITIES
AND WASTE MANAGEMENT CONTROL IN NIGERIA.
Case Study: (Tin can Island Port).

By
Kayode Peters JOHN
NIGERIA
AND
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A dissertation submitted to the World Maritime University in partial
Fulfilment of the requirements for the award of the degree of

MASTER OF SCIENCE
In
MARITIME AFFAIRS
(MARITIME SAFETY AND ENVIRONMENTAL ADMINISTRATION)
2019

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DECLARATION

We certify that all the material in this dissertation that is not my own work has been identified and that no material is included for which a degree has previously been conferred on me.

The contents of this dissertation reflect my own personal views and are not necessarily endorsed by the University.

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ABSTRACT

Title of Dissertation: Assessment of Port Reception Facilities and Waste Management Control in Nigeria. Case Study: (Tin Can Island Port).

Degree: Master of Science

The dissertation is assessing and analyzing the processes involved in controlling ship-generated waste in Nigeria and the capacity of Port Reception Facilities to accommodate waste from ships. This is important in ensuring good environmental practices and adhering to strict safety practices during the discharge and handling of such waste between the port, its facilities and the surrounding communities.

The United Nations Conventions on the Law of the Sea 1982 (UNCLOS) and the International Convention for the Prevention of Pollution from ships 1973 (MARPOL); amended by the 1978 protocol (73/78) are the main international instruments used as standards for the regulation of marine pollution from ship generated waste. This study seeks to explore Nigeria’s compliance with these conventions, with a particular focus on the requirement for contracting governments to these conventions, provide adequate and efficient Port reception facilities that are capable of receiving all types of ship waste including oil, garbage, sewage, noxious liquids and other ship onboard residues without causing undue delay.

Furthermore, this paper will review and investigate the practices of Africa Circle Pollution Management Limited (ACPML) company which the Nigerian government through the Federal Ministry of Transportation (FMOT) and the Nigerian Port Authority (NPA), have conceded the provision, management and operation of all PRF in the ports of Nigeria. We aim to assess and analyze the effectiveness of the ACPML in the discharge of its responsibilities.

The concluding chapters reviewed Tin Can Island PRF efficiency in service delivery and waste management control based on available data and information’s. However, to this end a number of recommendations are made based on our findings.

KEYWORDS: Assessment, MARPOL, UNCLOS, Ship-generated waste, Port Reception facilities, Efficiency, Domestic waste, Nigeria.
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List of Abbreviations

ACPML: African Circle Pollution Management Ltd
BAT: Best Available Techniques
BEP: Best Environmental Practice
CDU: Comminuted and Disinfectant Unit
DPR: Department Of Petroleum Resources
FMOT: Federal Ministry of Transportation
FEPA: Federal Environmental Protection Agency
GISIS: Global Integrated Shipping Information
IMO: International Maritime Organization
LAWMA: Lagos State Waste Management Authority
MARPOL: International Convention for the Prevention of Pollution from Ships
MEPC: Marine Environment Protection Committee
NIMASA: Nigerian Maritime and Safety Agency
NEP: Nigeria Environmental Protection
NOSDRA: National Oil Spill Detection & Response Agency
NPA: Nigerian Ports Authority
OILPOL: International Convention for the Prevention of Pollution of the Sea by Oil
PRF: Port Reception Facility
PRFD: Port Reception Facility Database
PTC: Port Of Tin Can
RRFP: Regional Reception Offices Plan
UNEP: United Nations Environment Program me
CHAPTER 1: Introduction

1.1 Background study.

One of the most significant environmental problems in the world today is pollution generated from and on board ships. The use of oceans as a medium for transportation, trading routes, military activities and tourism is known to be increasing each year and most waste products generated by ships cannot be discharged directly to the ocean. Shipping fleets are being developed all over the world and the waste generated from these ships generated has serious impacts on the marine environment. According to the IMO manual on port reception facilities (1999), a port reception facility is any arrangement made at port to receive shipboard remains and mixtures, which contain oil, noxious liquids, sewage, garbage or as listed in MARPOL. Furthermore, PRF is a provision for the collection of ship residues, garbage’s and oily mixtures from sea going vessels by international ports as contaminant generated onboard vessels on international voyages cannot be discharged into the sea directly to avoid marine pollution. The type and sizes of the facility is determined by the needs and numbers of ships calling at a port. These needs could be barrels for sludge’s, bins for garbage’s, storage tanks for oil mixtures and residues containing noxious liquids (MEPC, 2014).

These reception facilities can also be referred to as any floating or fixed facility that has the capacity to receive ship waste and MARPOL residue and it should be fit for that purpose (MEPC, 2018).

For effective implementation of MARPOL, IMO recognized that the provision of reception facilities is crucial, and the Marine Environment Protection Committee has strongly encouraged Member States, particularly those that are Parties to the Convention as port States, to fulfill their treaty obligations on providing adequate reception facilities within their ports.

In accordance with MARPOL, the Government of each party to the Convention should ensure that port reception facilities are adequate to meet the needs of ships using them without causing undue delay and should be concerned when there are cases where facilities are alleged to be inadequate. The Federal Government of Nigeria, through the Federal Ministry of Transportation contracted the operation and management of Nigeria’s Port Reception Facilities to the African Circle Pollution Management Limited (ACPML). African Circle Pollution Management Ltd is a private Nigerian
company licensed to operate port reception facilities for the collection, processing, storage and disposal of ship generated waste on behalf of the Nigerian Ports Authority (NPA applying the Best Available Techniques (BAT) and Best Environmental Practice (BEP) to safely collect all vessel related waste (in line with MARPOL 73/78 Annexes). To comply with MARPOL regulations, the government emphasized the need for routine inspections of these Port Reception Facilities by appropriate government authorities such as the Federal Ministry of Transportation and the Nigeria Port Authority.

The objective of PRF is to improve the interface between land and sea by making sure that ship generated waste and residue within the scope of MARPOL is properly collected, treated and disposed of. Collection and treatment of the different types of waste is a challenge in Nigerian ports due to the volume of waste received in ports and the lack of appropriate reception facilities in the country, meanwhile port reception facilities should be able to receive all types of ship generated and provide quick and efficient services to the port users while doing so.

![PRF concept](image)

**Figure 1: PRF concept**

Pollution from ships have received global attention and has resulted to developing measures for protecting the marine environment and human health. Over the last decade there have been studies and reports of severe accidents which has resulted in catastrophic level of oil spill into the ocean and this has led to increase global awareness for the protection of the marine environment and the oceans. Plastic waste can present a major form of hazard to fishes, seabirds and other sea animals.
For instance, fishing lines which are made of plastic when lost into the sea and other types of debris can choke or strangle a fish this is often referred to as “ghost fishing”. Half of the world seabird’s species have been recorded to have eaten residues made of plastic, one of such report was a study carried out in the north pacific where over 85% of the birds examined had residues of plastic in their stomach (T.G Benton et al, 1995). Marine scientist Tim Benton in the early 1990’s carried out a research on marine pollution by collecting debris from about 1.5 mile (2km) beach length in a remote Island (Pitcairn) in South Pacific. The study revealed an estimated record of over one thousand various types of waste on the island between the distance this waste includes 75plastin cans and bottles, 287 pieces of other plastic food waste and three doll head(T.G Benton et al,1995).

One of the biggest recorded oil spills happened in the US waters in Alaska in 1989 when the Exxon Valdez tanker broke up and approximately 13 million gallons of oil was discharged into the waters. This incident resulted in the death of several sea animals most significantly the sea bird with an estimated 251,000 deaths recorded (P. G. Wells et al, 1995). Nigerian ports have the responsibility of providing adequate port reception facilities, as it is essential to Ports. (Georgatello, 2007). As a measure to safeguard the environment around the ports and not to generate environmental/health issues, polices and strategies for waste management have been developed. The International standards that regulate marine pollution prevention from ships are stated in ("UNCLOS") United Nations Convention on the Law of the Sea 1982 and MARPOL 73/78 International Convention for the Prevention of Pollution from Ship “1973” amended in 1978 (Phyllis Difecto,2010).

Well-established Port reception facilities should be adequate to receive waste from all types of vessels including but not limited to coastal trading vessels, cruise ships, ferries and fishing vessels. There are international regulations that are binding on the vessels and states to safely and properly dispose of ship board generated waste, some of such conventions are MARPOL, UNCLOS and the Basel conventions. One of the primary methods for doing this is to unload their ship generated waste at port reception facilities. It is therefore necessary and important that Nigeria, as a member state of IMO should comply with international standards for port reception facilities.

There are four primary phases of handling wastes discussed distinctively in MARPOL which are waste collection, processing, storage and disposal. Ideally, waste collected in port and on board ships should be separated, well treated and recycled (Per H.Olson, 1994).
Pollution in the marine and coastal space is increasing in major seaports in Nigeria due to the establishment of large industries and other commercial activities such as tank farms, textile industries and oil refineries (Sandra Kloff & Clive Wicks, 2004). Likewise to accommodate the growth in the industry Nigeria have seen a steady upward trend in the number of ships calling at the port each and every year.

Given the extensive industry growth, PRF facilities in Nigeria must be sufficient to receive almost all kinds of wastes generated onboard different types of vessels which call at its ports. Additionally vessels should not suffer delay or inconvenience during delivery their wastes. They must also ensure a safe and environmentally friendly final disposal of wastes and cargo residues received from ships, which is the aim of this study.

The port of Tin Can forbids the dumping of waste at the port entrance or within the ports indiscriminately. The carriage of waste from ships is done with specialized equipment’s and specified transport system. Collection and carting away of garbage/waste oil generated on-board vessels in the Ports, Jetties and at Anchorages is documented and kept for record purposes. The movement of waste from port reception facility and the treatment of the waste for further management or disposal is supervised by port agents (NPA, 2017).

Figure 2 - Port reception facilities for ship-generated wastes (ACPML, 2005).
Port Reception Facilities for ship-generated waste, cargo residues and ship-repairs waste services include:

- Collection of waste from the port zone by specialized vehicles and trucks.
- Collection of waste from anchorage areas by vessels.
- Processing / recycling/ energy recovery of special waste streams.
- Sampling – Labelling – Identification.
- Hazardous Waste Management (classification, packaging, processing and final disposal).
- Waste collection, transportation and certified Final Disposal of any type of waste.

Ships are mandated by IMO to use PRF rather than discharging some certain type of ship generated waste into the ocean, ships are not authorized to discharge oily waste or plastic garbage in the ocean, however there are certain exceptions to garbage disposal into the sea, these exceptions include:

- When it is necessary to secure the safety of the ship and the people onboard.
- When the escape of the garbage will result from damage to the ship or its equipment as long as all reasonable precaution have been taken prior to the occurrence of the damage and after with the aim of minimizing or preventing the escape.
- When there is an accidental loss of a synthetic fishing net and all reasonable precaution have been taken to prevent the loss.

The goal is to increase environmental consciousness in shipping and secure a clean and a more sustainable marine environment as addressed by MARPOL 73/78 convention.
Probo Koala Inappropriate waste Disposal (Case study).

Figure 3: Picture of Probo Koala ship. (Ejolt, 2015).

The Probo Koala was charted by the oil trading company Trafigura in 2006 to carry toxic waste for the company. The waste was treated with caustic soda while in transit and later moved to the port of Abidjan (Ivory Coast) and dumped at different locations around the city which resulted in ill health and deaths of severe people. Many of the people sought for medical attention to treat severe health issues and approximately 15 people were reported dead.

Trafigura attempted to dispose the waste in Amsterdam but was unsuccessful due to the result of a sample analysis of the waste which was found to contain a high levels of toxicity and due to the toxicity levels which was discovered the initial estimate for disposal cost needed to be modified, as properly disposing of toxic waste is far more complex and costly than for standard waste. As a result of the higher cost estimate, Trafigura abandoned its attempt to dispose of the waste in Amsterdam, and directed the Probo Koala to sail to Nigeria in an attempt to offload its waste but the Nigerian port authorities had already been informed on the waste’s high toxicity level, and therefore refused the waste to be offloaded in Nigeria.
From there, the ship sailed to Abidjan, Ivory Coast were Trafigura had arranged for the waste to be treated through a local subsidiary for significantly less money than had been quoted by the port of Amsterdam.

According to the investigative report, Probo Koala had hired a company named Tommy Ltd which was incorporated to treat and dispose of the waste just few days before the ship arrived Abidjan. Meanwhile the company had rented trucks to dump the waste in eight different locations around the city without further treatment of the waste. This triggered a widespread of foul smell and panic. Most of the people living in the areas where the waste was dumped were forced to leave their homes due to the suffocating odors and toxic contamination. The Ivorian ministry of health confirmed that over 34,408 cases of severe illness were confirmed to have been directly related to toxic waste exposure.

At the request of the Ivorian government, an environmental audit was carried out in June 2012 by the United Nations Environment Program me (UNEP) on the affected waste dump sites. The main purpose of the audit was to access the environment surrounding the sites to determine if it still posed any possible risk to public health and the environment. The team analyzed samples of water, soil, vegetation and sediments from the dump site and its surroundings including locations of materials were contaminated waste were treated. The result concluded that no further clean up action was necessary or needed for the environment.

Dumping of such waste without proper or adequate treatment and not following the international standard requirements set out by the Basel Convention on Control of Transboundary movement of hazardous wastes and their Disposal (Basel 1989) violated the fundamental human rights of the people of Abidjan to good health. Amnesty International had considered that the Netherlands and Côte d’Ivoire breached their obligation to providing effective remedies to the affected victims for the violation (David et, al 2009).

According to the UNEP report, the port of Abidjan had no provision for port reception facilities as stated in the MAPROL convention and as required under the Annexes I, II, III and IV of the Convention. Also, there were speculation that corruption may have contributed to the incident as due process of toxic waste discharge in the port of Abidjan was not followed by Trafigura as Abidjan port authorities denied not knowing that the waste was toxic. Following this event the
Ivorian Prime Minister Konan Banny was forced to dissolve his cabinets (Cardesa-Salzmann, 2012).

1.2 Problem Statement

The Tin Can Island ports has experienced a significant increase in the number of ships calling at the port over the past few years. This increase has in vessel traffic led to a major rise in the volume and types of ship generated waste which needs to be processed port reception facilities. The increase in maritime traffic calling the port of Tin Can is of great significance according to the annual statistical report of the Nigerian Port Authority (NPA), there has been an approximately 16 percent increase in the number of ships which call at the port of Tin Can between 2010 and 2016. During this period, the garbage waste has increased by 32% while oily waste which includes bilge water, sludge and various oily substances has increased by 18%.

Like most seaports, one of the biggest challenges faced by the port of Tin Can is the problem of maintaining a clean marine environment; ship generated waste is expected to grow significantly in the coming decade within the port of Tin Can and therefore it is imperative to improve on the capabilities of their port reception facilities.

1.3 AIM AND OBJECTIVES

The specific objectives are:

i. To assess the current situation of Port Reception Facilities in the port of Tin Can.

ii. To identify the difficulties faced by the ports in Nigeria in the management of ship generated waste and cargo residues.

iii. To evaluate and investigate existing potentials of the port of Tin Can in the collection, processing, storage and disposal of waste generated from the ships.

iv. To identify potential areas of weakness in the management and processing of ship generated waste within the port of Tin Can and make recommendations for improvement.
1.4 RESEARCH QUESTIONS

The research study will set out to answer the following questions:

i. What is the capacity of the Port for collection and treatment of waste from ships?

ii. What are the major challenges experienced by port reception facility managers in the port of Tin Can?

iii. What are the procedures related to the collection, processing, storage and disposal of ship generated waste currently being applied in the port of Tin Can?

iv. Can we say the port reception facilities in the port of Tin Can has improved and fully complies with the prescribed standards and requirements of the MARPOL Convention?

v. What training programmes/facilities does ACPML have in place to expose their staff to international best practices on PRF annually to enable them fully understand the principles and demands of the MARPOL Convention for smooth implementation?

vi. How much ship-generated waste is discharged annually in the port of Tin Can?

1.5 Methodology

For the purpose of this research, we will employ both qualitative and quantitative methods for data collection analysis. The quantitative technique will be used to evaluate existing Port Reception Facilities and waste management control in Nigerian Ports. Using the method contained within the IMO manual report (PRF, 2016). To determine this amount we will calculate the numbers of ships and the cargoes that goes through the ports. The qualitative data will be composed of the various procedures related to the collection and the treatment of ship-generated waste applied in the ports and relevant international standards of PRF.

There will be a questionnaire template prepared to ascertain the level of improvement on gaps observed and compliance with best practice on ships’ waste management.
1.6 **Significance of the Research**

This research is expected to make practical and theoretical contributions to the existing framework of the port of Tin Can port reception facility and help provide the basis for further understanding of the port of Tin Can’s ability, both now and in the future. More so, to collect, process, store and dispose of ship generated waste in adherence to the standards of the International Maritime Organization (IMO).

Recommendations for improvement will be made regarding the collection, processing, storage and disposal processes of waste management to ensure the port of Tin Can remain in line with international best practices. The research will critically examine the operational and technical process of waste disposal with particular regard to the health and safety of the people and the environment.

Furthermore, the research aim is to anticipate the amount of ship generated waste in the port due to the anticipated increase of vessels calling the port of Tin Can.
Chapter 2: Regulatory Framework for Nigerian Port Reception Facilities

2.1 Regulatory Framework.

This chapter will look into the regulatory framework of Port Reception Facilities (PRF) at various levels (International, National and State). It will also discuss the international conventions for which Nigeria is a party to as well as the application of domestic legislation with regard to the adequacy of PRF in the Port of Tin Can Island and overall waste management control in Nigeria.

Member States that are parties to international conventions have legal obligations to domesticate these international regulations into their national laws to ensure mandatory application of the conventions. Member state must also address any issues related to non-compliance with the applicable convention including MARPOL which covers the unlawful discharge of waste. (Kraska, 1999).


The United Nations Convention on the Law of the Sea, 1982 (UNCLOS), mandates a special commitment for member states to preserve and protect its marine environment (Article 192). The convention defines the responsibilities and rights of entities and states to fulfil these obligations. It is also referred to as the most significant agreement within the international maritime regulatory framework in terms of protecting the marine environment (Fredrik, 2014).

UNCLOS was signed in 1982 and drafted at the 3rd UN law conference; it came into force in 1994. The convention addresses various issues in the marine industry, such as the consequences of all types of pollution and most maritime activities (IUCN, 2017). There are specific articles in UNCLOS which have placed obligations on states mandating they provide adequate PRF as outlined by MARPOL (IMO, 2000).

UNCLOS has been ratified in Nigeria. It was signed on October 26th 1994 and was ratified on 28th of July 1995, therefore, the state has an obligation to adhere to the provisions of the convention. With regards to protecting the marine environment, the articles in UNCLOS III, which are essential to laying the foundation for a mandate of providing adequate PRF are:

a. Article 192: States have a general obligation to protect and preserve the marine environment (IMO, 2000).
b. Article 194: States must take necessary measures by using the best practicable and acceptable means at their disposal and by their capabilities, in minimising it to the point where waste pollution from ships will be reduced drastically, in particular, measures for preventing international and unintentional discharges

c. Article 211.2: flag States have to adopt regulations and laws which have at least the same effect as that of generally accepted international rules and standards established through the IMO (IMO, 2000).

There are shared similarities between UNCLOS III and MARPOL as they both are establishing the duties and the rights of coastal states to protect their coastal zones from pollution by local and foreign vessels. UNCLOS explicitly requires that measures are taken to control and prevent the transfer of pollution from sea to land.

2.1.2 The International Convention for the Prevention of Pollution from Ships, 1973, as amended by the Protocol of 1978 relating to it (MARPOL 73/78).

The MARPOL convention was adopted at the IMO in 1973 and in 1978 it was modified by a protocol in reaction to a rise of accidents involving tanker vessels in 1976-1977. By then the 1973 convention had not yet entered into force, the 1978 MARPOL Protocol absorbed the parent convention of MARPOL while the combined convention instrument came into force on October 2, 1983 (IMO, 2019). This convention deals with preventing pollution from ships and protecting the marine environment from harmful substances discharged at sea. Specifically, the convention is to support and adopt the best functional standards to deal with issues of navigation in terms of maritime safety, the prevention and control of ship pollution in the marine environment and to provide an avenue for regulating international trade in shipping and other legal matters (IMO, 2011). The convention has established a system of safety considerations, inspections, certifications and requires member states to provide PRF for disposing of all kinds of waste.

The criteria for any form of pollution or discharge at sea requires the shipmaster to report the pollution incident, which is often referred to as a discharge above the permitted level. The platform for cooperation between member states that have ratified the convention is created to sanction violators of the convention irrespective of where the violation occurs. This is stated in article 4 of the convention “the penalties mentioned in line with the law of a Party, according to the present
article shall be adequate in severity to discourage violations of the present Convention and shall be equally severe irrespective of where the violations occur”(EMSA, 2012).

Cargo residues and ship-generated waste of various kinds are regulated by MARPOL through six annexes (Basel convention & UNEP, 2016). These annexes contain regulations which cover diverse sources of pollution from ships including oil and chemical pollutions which are addressed in annex I and II respectively, while sewage, garbage and air pollution are covered by annexes IV, V, VI, annex III cover harmful substances carried in packaged form by ships (MEPC, 2014).

<table>
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Table 1: MARPOL ANNEXES (EMSA, 2012).

The commitment to provide adequate PRF is a foundation of the Convention. The accessibility and ease of using such facilities motivates ships to adhere with MARPOL and its provisions for proper disposal of ship generated waste (IMO, 2011). MARPOL additionally indicates the classes of ports and terminals which require PRF together with their required capabilities. Furthermore, IMO created rules and guidelines to help in the facilitation of MARPOL’s requirements for the implementation and operation of port reception facilities.
Functions and structure of MARPOL as it relates to PRF.

Annex 1: Regulations for the prevention of Pollution by Oil. The annex entered into force on 2nd October 1983 and the revised annex entered into force on 1st January 2007. It covers the prevention of pollution by oil from accidental discharges as well as operational measures. An amendment to annex 1 in 1992 made it mandatory for all new oil tankers to have double hulls and for existing existing tankers to fit in double hulls within a phase out schedule. It applies to all oil tankers of 150 GT or more and each other ship of 400 GT or more. The government of each member state that is a party to the convention should guarantee the arrangements of PRF at oil stacking terminals, fix ports, and also at different points in which ships having oil residue buildups have to release it to the PRF (TOCPRO, 2015).

Annex 2: Regulations for the control of pollution by noxious liquid substances in Bulk.

It entered into force on 6th April 1987 and the revised annex entered into force 1st January 2007. It details the measures and criteria of discharges and control of pollution by noxious liquid substances carried in bulk. A list of about 250 substances was included and evaluated and appended to the convention. Discharging these residues to PRF is only allowed when certain conditions and concentrations (this varies with the different categories of substances) are met. Residues that contains noxious substances are not permitted to be discharged within 12 miles to the closest land in any situation (TOCPRO, 2015).

Annex 4: Regulations for the prevention of pollution by sewage from ships.

It entered into force on 27th September 2003 with 134 contracting parties. It contains the requirement to controlling pollution of the sea by sewage and it prohibits discharging sewage into the sea except its discharging disinfected and comminuted sewage into the sea using a system that is approved or discharging at a distance of 12 nautical miles from the closest land.

Annex 5: Regulations for the prevention of pollution by garbage from ships.

It entered into force on 31st December 1988 with 147 contracting parties. It prohibits the discharge of all types of plastic materials into the sea and sets rules for the release of distinctive types of waste within special areas (Djadjev, 2015). In January 2013, IMO adopted an amendment which prohibits discharging any type of garbage into the sea with exceptions under specific circumstances.
Regulation 7 of the Annex expresses that "the Government of each party to the convention should guarantee the arrangement of PRF at terminal and port for receiving of garbage, without resulting to unreasonable delay for the ships using the facility.

Annex 6: Regulations for the prevention of air pollution from ships.

It entered into force on 19th May 2005 with 80 contracting parties. It sets the limit on sulphur and nitrogen oxide emitted from ships and prohibits the deliberate emission of ozone depleting substances in designated emission control areas that sets more stringent standards for Nox, Sox and other particulate matters.

2.1.3 The Basel Convention

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal was received on 22 March 1989 by the Conference of Plenipotentiaries in Basel, Switzerland. The convention was brought forward primarily in response to revelations that during the 1980s, large quantities of harmful substances and toxic waste were being imported from abroad into Africa due to stricter regulations and higher disposal cost encountered in Western Europe and North America. Operating companies were essentially shopping for countries who would improperly dispose these harmful substances at a fraction of the supposed cost of disposing properly. This practice resulted in widespread illness and death in the civilian population of receiving countries.

Rising mindfulness and relating environmental guidelines in the industrialised world during the 1980s prompted the expansion of protections against the transfer of unsafe or hazardous materials/waste (this phenomenon was then known as NIMBY (Not In My Back Yard)) disorders led to a huge spike in cost for the disposal of hazardous waste. This drove operators to look for cheap alternatives for hazardous waste disposal in Eastern Europe and Africa where environmental continuousness was considerably less, and guidelines and legal components were inadequate to prevent its occurrences. It was against this backdrop that the Basel Convention was created in the late 1980s, to battle the "harmful exchange of hazardous waste". The Convention went into force in 1992 (Basel convention, UNEP, 2011).
The overall goal of the Basel Convention is to secure human wellbeing and the environment against the unfavourable impacts of hazardous waste. Its extent of use covers a wide scope of waste products designated as "hazardous waste" in view of their base, compositions and characteristics.

The arrangements of the Convention are based on the accompanying major points:

i. The advancement of safe and environmentally continuous management of hazardous waste, anywhere waste is to be disposed of.

ii. The confinement of transboundary movements of hazardous waste aside from circumstances where it is seen to conform with the standards of sound environmental management; and

iii. An administrative framework applies to situations where transboundary movements of hazardous waste are deemed acceptable.

The primary objective is tended to through various general arrangements expect member states to monitor and oversee the central standards of sound environmental waste management (Basel article 4). Various disallowances are intended to achieve the following point: hazardous waste may not be traded to Antarctica and a party not involved with the Basel Convention, or to a state that has prohibited the import of unsafe waste (Basel article 4).

States may, in any case, go into reciprocal or multilateral agreements on dangerous waste management with different states that are parties to the convention or with non-parties, given that such understandings are "solutions to sound environmental policies" other than the Basel Convention (Basel article 11). The Convention provides the foundation of provincial or sub-territorial places for preparing and executing transboundary moves concerning the administration and management of hazardous waste and the minimization of other specified waste to other regions or sub-regions. It is therefore necessary and important for Nigeria as a developing state to be awake to the corresponding environmental awareness of strengthening environmental regulations in the wake of industrialization and to prevent the importation of toxic waste from abroad as in the case of Probo Koala in Ivory Coast. Against this backdrop, the provision of PRF that can receive hazardous waste to prevent toxic trade where ship operators will seek other means of disposing their hazardous waste is essential to Nigeria and the port of Tin Can is strategically located in the business hub of Africa largest seattle route should have the facility to receive hazardous waste.
2.1.4 Various IMO guidelines for best practices of Port Reception Facilities and vessel operators.

The utilisation and arrangement of PRF for safe disposal of residues and ship-produced waste is principal to the general goal and objectives of the MARPOL Convention. To this end, IMO has created supporting instruments to encourage port/dispatch interface.

- **IMO’s Global Integrated Shipping Information System (GISIS):** This is to encourage the dispersal of data and promote free access to related informations on various aspect of shipping, the IMO built centralised online information accumulation framework known as the Global Integrated Shipping Information System (GISIS).

  Informations related to PRF is found in the Port Reception Facility Database (PRFD) module that is connected to GISIS which gives data on existing PRF (limits and constraints of each PRF), the PRF data is compiled by each member States. GISIS provides a platform for ships operators to access the inadequacy of a particular PRF, its capabilities and deficiencies.

- **The IMO manual - Port Reception Facility – How to Do It:** This manual consists of useful data for governments and port authorities specifically those in developing nations, who are looking for direction as to how to implement adequate port reception facilities. It likewise offers guidelines on the most effective methods to manage potential insufficiency and to better comply with MARPOL requirement for adequate port reception facilities. States that are parties to the convention need to guarantee arrangements for adequate PRF that can address the waste disposal needs of ships ordinarily utilising their ports without unnecessary delay.

  However, MARPOL does not contain any specific requirements regarding to the downstream preparing and treatment of residues or ship-generated waste deposited in the port. The manual elaborates on the best practices for the processing of the ship-waste and residues when received ashore.

- **Guidelines for reception facilities under MARPOL Annex VI 2011:** Resolution MEPC.199 (62): The fundamental aim of these guidelines is to help administrations when
creating facilities to accept Ozone Depletion Substances (ODS) in the port as well as of the exhaust cleaning residue.

Furthermore, in 2012, IMO adopted resolutions as an amendment to MARPOL to incorporate regional/territorial arrangements for PRF under the various Annexes to MARPOL. The resolution MEPC.216 (63) covers courses of action for PRF under specified annexes of MARPOL I, II, IV and V, while resolution MEPC.217(63) deals with PRF regional arrangement under annex VI.

- **Guidelines for the implementation of MARPOL Annex V 2012:** Resolution MEPC.219 (63): These guidelines are meant to help governments in creating and implementing domestic laws identified within Annex V. Moreover, It also gives directions to shipping operators, ship owner’s, crew, ship equipment manufacturers and cargo owners on how to comply with the requirements put forward in MARPOL Annex V. In addition it helps terminal operators and port management in surveying the requirements for providing sufficient PRF for waste (garbage) produced by different types of ships.

- **Guidelines for the development of garbage management plans 2012:** Resolution MEPC.220 (63): The Guidelines gives guidance to ships and organizations to follow the necessities for a ship's garbage management plan according to the revised annex v of MARPOL. Key regions, for example, a decrease of waste, garbage record book, segregation and discharging at the port are featured in the guidelines.

- **Guidelines for the development of a regional PRF plan 2012:** Resolution MEPC.221(63): This guidance provides information on the development of a Regional Reception Offices Plan (RRFP), which can assist Member States in certain geographic areas of the world to unite and work together to meet MARPOL requirement for adequate port reception facilities due to the fragmented geography PRFs in Small Island Developing States (SIDS) have genuine difficulties in meetings universal waste delivery needs; the rules provide mechanisms to encourage the advancement of a regional PRF plan, including the arrangement of sufficient PRF offices. Such rules might be helpful notwithstanding for non-SIDS that lack national abilities to build up regional reception centers for waste.
Consolidated guidance for port reception facility providers and users 2014: Circular MEPC.1/Circ.834: The Consolidated Guidelines is planned to be a useful guide for:

- Crew conveying MARPOL residues and waste ashore, and
- PRF managers who seek to provide auspicious, productive and efficient PRF administration to ships.

It provides best practices and strategies for port reception facility operations, with the intention of improving and allowing them to increase waste intake and dispose of these waste in a more environmentally sound manner. These guidelines summarize and consolidate the core principles and best practices for reception facilities as describe MARPOL Convention, in the IMO "Complete Manual on Port Reception Facilities" and the Guidelines help guarantee the adequacy of PRF (MEPC.83 (44)).

Building further upon the Manual and the Guidelines, the consolidated guidelines propose how environmental administrative framework and strategies can help in improving the conveyance of MARPOL residues and waste ashore. Methods prescribed by the IMO incorporate correspondence and detail techniques and the utilization of institutionalized structures, the example includes:

(I) Groups for addressing claimed deficiencies of PRF

(ii) Standard organization of the development and structure for waste conveyance to PRF.

(iii) Standardized mechanisms for providing waste delivery organization for the waste conveyance receipt.

2.1.5 Applicable Nigerian Laws and Government Agencies.

In complying with MARPOL, the Government of each Member State to the Convention guarantees that PRF is sufficient to the waste disposal needs of ships utilizing them without undue delay or burden. Therefore, it is vital for the Government of each member state to audit and ensure the adequacy of Port Reception Facilities in their States.
The Federal Ministry of Transportation is responsible for formulating policies and the plans at national level in ensuring basic marine infrastructure, legislation and international relations in shipping. Additionally, as part of its requirement as a member state to MARPOL, the administration implemented a requirement for regular assessments of these Port Reception Facilities by trained and specialized staff.

Consequently, the Permanent Secretary of the Nigerian Federal Ministry of Transportation mandates a five-man specialized team to visit and audit all PRF in the four Navigational District Ports in Nigeria quarterly (this includes the port of Tin Can) and ensure the following:

i. African Circle Pollution Management Limited (ACPML) must sustain the highest levels of safety and hygiene culture at Port Reception Facilities.

ii. ACPML shall continue to update the Port Reception Facilities Management Data Book, whenever changes are made to PRF procedure.

iii. The Federal Ministry of Transport through the NPA request all ports users make use of the services provided by ACPML as their waste management service provider.

iv. ACPML should be encouraged to sustain the existing harmonious relationship with the hosting communities and intensify a workable corporate social responsibility to cooperation amongst all involved parties.

v. Nigerian Maritime Administrations and Safety Agency (NIMASA) as the focal Agency for IMO Matters is directed to develop Guidelines for the implementation of MARPOL and make it easy for NIMASA to enforce and oversee the actions of ACPML.

vi. ACPML should be encouraged to keep up training activities and capacity building exercises to enhance the skills of their workforce. (ACPML, 2006)

**Environmental Legislations**

The legislation's on environments are laws and guidelines covering a variety of environmental matters influencing issues such as land, water and air management in Nigeria. These laws are backed by enforcement action in the form of fines or imprisonment, which can be brought forth against those who violate these law. In Nigeria the environmental issues we are most often faced
with are those emerging from the exploitation of mines and mineral, oil reserves, deforestation and pollution resulting from industrialization.

**Federal Environmental Protection Agency (FEPA)**

The Government of Nigeria enacted the Federal Environmental Protection Agency (FEPA) Act in 1988. FEPA was set up by Decree 55 on December 30 1988. FEPA was entrusted with the statutory responsibilities to oversee and ensure protection of Nigerian natural resources and the environment. The creation and implementation of FEPA is arguably the most important and expansive environmental development ever to be created in Nigeria. The Decree established punitive measures for guilty parties found to have released harmful substances in destructive amounts into the air, water and land. The legislation requires FEPA to create environmental laws and regulations aimed at decreasing and controlling of all forms of contamination and pollution. (Nwufo, Cecilia, 2010).

**The Environmental Impact Assessment Act**

This environmental evaluation Decree No 86 of 1992 was additional environmental legislation aimed at supplementing the FEPA Decree but having a particular focus on land use, industrial siting and waste dumpsites. The foremost objective of this order was expressed under area 1, which was to guarantee that any conceivable negative effects from development undertaking were to be anticipated and mitigated as much as feasibly possible before any venture take-off. The objective of this decree was to advance manageable improvement and sustainable development (Nwufo, Cecilia, 2010).

**The Harmful Waste Act (Special Criminal Provision Etc) 1988**

The Act was instituted on a particular objective of disallowing the transport, dumping and storing of hazardous waste on any land, regional waters and the exclusive economic zone. This Act is a correctional enactment. The offences of involvement in these acts are expressed in section 12 of the regulation. The purview of the Act is expansive as it tried to expel any vulnerability presented by conciliatory immunities' and benefits on any individual with the end goal of the criminal indictment (Nwufo, Cecilia, 2010).
Figure 4: Systems of PRF in Nigeria.
Chapter 3: Literature Review and Analysis of Port of Tin Can’s Port Reception Facilities

3.1 Port of Tin Can Island general overview and analysis (background)

According to research carried out on “The analysis of sources of marine pollution in Nigeria seaport”, the report found that the effective control of marine pollution in developing countries such as Nigeria is affected by incompetent administrations (government & private) and most importantly inadequate provision of PRF (Onwuegbu et al 2017).

The measures of controlling and preventing marine pollution applied by IMO in the form international guidelines and conventions (i.e. MARPOL) and its associated obligations for signatory member states have yielded positive results in minimizing and ensuring proper disposal of ship generated waste (Szepes 2013). Some studies have found that the absence of adequate PRF with the capacity to receive all types of waste generated from ships in many developing nations have resulted in marine pollution, as some ships are forced to improperly dispose of their waste at sea in order to maintain a clean ship (Carpenter, A 2005). The regulations for safe disposal of waste is enshrined in MARPOL 73/78 and the merchant shipping regulations in Nigeria which require all marine terminals throughout Nigeria to have a plan that shows the details of how they provide and organize PRF for all MARPOL designated waste; this plan is referred to as the port waste management plan. The port waste management plan, includes information on the port reception facilities and details the types and quantity of waste that can be received by a particular facility. Additionally it dictates the requirements that must be met by the vessels before disposing of its wastes, the type of equipment used for recycling and the estimated cost of disposing of different types of waste. The port waste management plan is made accessible to port clients online to guarantee that the needs of vessels are met expeditiously. However, pollution from accidental discharges of waste due to marine accidents continue to occur and the Nigerian port authorities have been found in need of additional provisions of the requisite port waste management plan for responding to such events. Increased levels of marine pollution from ship-based discharges are expected in the future due to the rapid growth of vessel’s traffic within Nigerian ports, making improvement in port waste management plans all the more critical. For example, between the years 2008 and 2011, there was an approximate thirty-two percent (32%) increase in garbage and an eighteen percent (18%) increase in quantities of oily wastes handled by the port of Tin Can port reception facilities alone (NPA, 2018).
Another study, conducted by Donatus Eberechukwu found that, Nigerian ports need to do a better job adhering to international conventions and protocols that relates to the provision of effective and efficient PRF to ensure cleaner oceans and safer seas which is the aim of the IMO (Donatus Eberechukwu 2017). Furthermore they must develop more comprehensive Manuals on PRF that provides specific guidance on the requirements of Nigerian ports reception facilities for ship generated waste. The report highlighted the inability of the port of Tin Can PRF to receive large quantities of garbage and the need to bridge this gap.

Most ports in Africa especially in Nigeria are undergoing development and many have been privatized or concessioned. In Nigeria, the Africa Circle Pollution Management Limited (ACPML) is the current port reception facility service provider in the port of Tin Can. ACPML is a private company that is solely responsible for the management of port reception facilities in Nigeria: it is supervised and audited by different Nigerian ministries and agencies. This oversight is done quarterly by the Federal Ministry of Transportation and reports are produced at the end of the inspections to ensure compliance and highlights areas in need of improvement. One of such report found that the land allocated for the Port Reception Facilities in the port of Tin Can was becoming inaccessible due to the expansion of the facility and development of commercial activities in the area, thus dictating the need for changing the location of the facility. It also discovered that there were no facilities capable of receiving MARPOL Annex II wastes-Noxious Liquid Substances (NLS) in any of the Navigational District Ports in Nigeria (PRF, 2018)

3.2 Quantities and types of Waste generated from ships calling at the port of Tin Can.

The role of ports in national economic and social development is critical; ports directly support the shipping industry which is the most efficient method of transporting large quantities of cargoes from one point to another. The demand for port reception facilities services by vessels is derived through conscious and deliberate policy choices made and implemented to create an enabling environment for ship-owners to make efficient port calls due to prompt and adequate services provided (NPA, 2018). According to the United Nations Department of Economic and Social Affairs, Nigeria is rated as the most populous nation in Africa with an estimated population of about 180 million people; this also makes Nigeria the seventh-largest country in the world by population. By land mass, Nigeria is the 14th largest country in Africa with a total land area of 923,768 sq. km. Its long coastline, which lies on the Gulf of Guinea in the south, stretches over
853 km and lies between latitude 4° 10’ to 6° 20” North and latitude 2° 45’ to 8° 35’ East. It shares land borders with the Republic of Benin in the West, Chad and Cameroun in the East and Niger in the North. These are landlocked countries which offer Nigeria the opportunity for transshipment, thereby promoting its seaborne trade hub status.

The port of Tin Can (PTC) is operated by the Nigerian Port Authority and is considered a medium-sized port; it is the second-largest port in Nigeria. The port of Tin Can is situated in Lagos Port Complex (North West). It was commissioned in 1985 due to an increase in the country’s economic activities resulting from the discovery of oil and post-civil war industrial development. This brought about an increase in the volume of importation and exportation of raw materials through the port of Tin Can, drastically increasing the level of vessel traffic in the Port. This increase generated a need for the government to introduce and implement a method or system to collect waste from vessels calling at the port; this led to the construction of the PRF at the port of Tin Can in Lagos state, Nigeria (NPA, 2013).

Figure 5: An Aerial view of Tin Can Island Port Nigeria (Dock, 2019)

The Nigerian Investment and Business Guide of 2017 (Volume 1) stated that Nigeria handled approximately 68 percent of the total maritime trade in West Africa through its seaports. The port of Tin Can handle about 32 percent of the total volume of this trade and this indicates a high volume of ship generated waste. Waste generated by ships is dependent on a number of factors including the type and size of the vessel, its cargo, preventive or routine maintenance, engine room design (which determines the amounts of oily waste), the life span of components of the ship, number of persons on board their activities as well as the conditions of the ship (EPA, 2018).
Figure 6 Port of Tin Can statistics for ship traffic (NPA, 2018).

The number of ships and cargo throughput at the port of Tin Can have increased in the last ten years as seen in the figure above. In the last three years the port has received largely domestic waste totaling about 13,146.6m$^3$, Broken down as follows: food waste (70.91m$^3$), plastics (364.13m$^3$), cargo residue (57.08m$^3$), oily waste (228m$^3$) and have also generated incinerated waste of about 42.01m$^3$. The majority of waste received is discharged by bulk carriers, container vessels and RORO vessels (NPA, 2018).

Table 2: Summary of the quantities and types of waste generated from ships at the port of Tin Can from 2016 to 2018 (NPA, 2018).

<table>
<thead>
<tr>
<th>Year</th>
<th>Food waste</th>
<th>Plastics</th>
<th>Cargo residues</th>
<th>Domestic waste</th>
<th>Incinerated waste</th>
<th>Oily waste</th>
<th>Fishing gear</th>
<th>Animal carcass</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>19</td>
<td>89</td>
<td>28</td>
<td>3602</td>
<td>10</td>
<td>52</td>
<td>5.6</td>
<td>10</td>
<td>102</td>
</tr>
<tr>
<td>2017</td>
<td>22.91</td>
<td>124.02</td>
<td>12.02</td>
<td>8241</td>
<td>14.01</td>
<td>60</td>
<td>10</td>
<td>15</td>
<td>132.2</td>
</tr>
<tr>
<td>2018</td>
<td>29</td>
<td>151.11</td>
<td>17.06</td>
<td>1303.6</td>
<td>18</td>
<td>96</td>
<td>16</td>
<td>20</td>
<td>158.9</td>
</tr>
<tr>
<td>Total per type</td>
<td>70.91</td>
<td>364.13</td>
<td>57.08</td>
<td>13,146.6</td>
<td>42.01</td>
<td>228</td>
<td>31.6</td>
<td>45</td>
<td>393.1</td>
</tr>
</tbody>
</table>
Types of waste

Oily Bilge Water: This is a blend of fluids that are produced in the bilge of a ship. It is made of a blend of fresh water, oil, seawater, chemicals, synthetics and different liquids that are channeled into the Bilge. Fresh water and sea water also flow into the bilge wells due to run off from the deck, spillage in the pipelines, defective valve glands or a spill in the engine room.

Figure 7: Waste flow diagram of oily bilge water (CHEW, 2017).

Oily Residues (Sludge): Sludge is also referred to as oily residue and its generated from the cleansing of fuel or isolated waste oil from oil-water separators, oil sifting hardware or oil gathered in dribble plate and greasing oils for lubricating parts of the ship (IMO, 2008). Sludge is usually kept in a dedicated sludge tank before it is delivered to a PRF, however, in some cases oily bilge water and sludge are kept in the same tank.

Sewage: Sewage is characterized as waste products generated from any type of urinal or toilet on a vessel; it is also referred to as black water and treated separately from greywater. Greywater includes drainage from showers, dishwashers and washbasin channels (MEPC, 2012). The discharge of sewage into the ocean is prohibited under MARPOL annex IV, with certain exception’s such as having an approved sewage treatment plant, via a Comminuted and
Disinfectant Unit (CDU) at a distance of three nautical miles from the closest land or to the open sea (>12nm) while en-route at not less than 4 knots.

![Sewage waste flow Diagram](CHEW, 2017).

**Plastics Waste:** Plastics currently play a massive role in our daily lives; they are utilized in virtually all areas of manufacturing. Tons of plastic products are produced on a daily basis, even as the waste continues to build up. From water bottles, to credit cards, to the dashboard of a car, plastic is often a primary component. Due to the fact that most plastics are not biodegradable, an enormous sum of plastic waste continues to build up worldwide, with industrialized nations contributing the largest amount of plastic waste (Pinto, et al., 2008). To be specific, most plastic waste are generated from containers and packaging (e.g. beverage bottles, polythene bags, water bottles etc.). The containers of these materials aforementioned after consumption become waste. Continuous use of materials produced from plastics will further produce more waste. More so, some durable products for example furniture’s are made from plastics. The discharge of plastics into the ocean is strictly prohibited in all circumstances, under MARPOL annex V.

**Food Wastes:** IMO characterizes food waste as any unspoiled or discarded food substances, this includes vegetables, fruits, poultry or dairy products, food scraps and meat products generated onboard vessels. On large vessels (freight and cruise ships) further separation is usually conducted
to divide organic food waste (leftovers, fruit peels etc.) and packaged food substances. Discharge of food waste into the sea is permitted under certain circumstances such as; when the food waste is capable of passing a screen having an opening of not greater than 25mm and have been comminuted but at a distance of 3nm and above from the closest land (Garry Prosser, 2016).

Domestic Wastes: Domestic waste is referred to as waste generated on-board ships that are not cooking oil, food waste or plastic. IMO refers to domestic waste as a wide range of waste that is not covered in MARPOL Annexes but is produced in the accommodation space onboard vessels. This waste includes paper, fluorescent lights, card board, foils, engineering material, metal jars, glass, covers, washroom bundling waste and so forth.

Incinerator Ashes: Vessels can be furnished with incinerators to enable the burning of domestic waste, sludge, operational waste and all other types of waste generated onboard. The ashes from the incinerator are accounted for independently in the garbage record book.

Operational Wastes: MARPOL Annex V defines operational waste as onboard vessel waste that is not otherwise classified. Solid waste can be referred to as operational waste (slurries included), not covered by different Annexes. Operational waste are produced onboard vessel during normal operations or maintenance of a ship. Operational waste includes additives like, cleaning agents, external wash water, bilge water, and other discharges relevant to the activity of a ship, considering the rules and guidelines created by the Organization (IMO, 2011).

![Operational waste chart](image)

Figure 9: Operational waste chart (CHEW, 2017).
3.3 Infrastructure and Equipment

Africa Circle Pollution Management Limited is a company licensed by the Nigerian government through NPA to ensure they operate standardized port reception facilities as prescribed by MARPOL 73/78, for the collection, storage and processing of waste generated on board ships. The operational office is situated in Tin-Can Island/Snake Island Free Zone Area, Apapa, Lagos State. Within the office premises, they have sections for different waste processing divisions such as, laboratory Unit, Solid Waste Unit, Liquid Waste Unit, Mechanical Unit, Processing Unit, etc.

To comply with the waste collection and procedural management requirements set out in MARPOL 73/78, the Federal government of Nigerian signed a contractual agreement through the Nigerian Ports Authority with ACPML for the management of adequate port reception facilities.

In response to the daunting challenges, the African Circle Pollution Management Limited procured four (4) different sized vessels to enhance its waste reception facility operations. The two small sized vessels named MAIZUBE I and MAIZUBE II, both have a capacity of 120m³ of oil waste, 12 tonnes of solid waste, supported with 1st tier oil spill response equipment (equipments that are highly portable, light and mechanically reliable and simple) and firefighting capabilities. In furtherance to its ambitions to deliver excellent services, the company acquired an additional two (2) medium-sized vessels, named BICS and ETYPOU, having a capacity to hold 240m³ of waste oil, 12 tonnes of solid waste and supports 1st tier oil spill response with firefighting capabilities. All four vessels are fully equipped with the latest navigational equipment.

Additionally, the company has acquired more garbage vans and MARPOL Annex 1 trucks to facilitate the quick collection of solid waste and oily waste from ships allowing for a faster turnaround of vessels and ensuring that there is no unnecessary delay at the port.
The company also has a processing unit which is divided into two sections at the Snake Island operational base, namely; the solid waste section and the material recovery facility section. The solid waste unit is where all domestic waste collected from ships is further segregated and processed in order to produce high-quality recyclable material. The material recovery facility section (MRF) is where all the waste goes on a conveyor belt, and this further segregates them into various categories, like, paper, cardboard, cans, plastic, glass bottle and non-recyclable contaminated waste.

Similarly, there are non-recyclable contaminated waste incinerators; these wastes are put into the Pyrotec G. incinerators, which are equipped with scrubbers to ensure it expels cleaner gases, to meet stringent national and international emission standard levels.
The use of Barges: Liquid waste will be pumped from the ship into one of the PRF barges and then transported to the Snake Island factory where it is transferred into a holding tank. Thereafter, the oily waste is processed to ensure that the oil is separated from the water; the treated water is released into the lagoon while the remaining oil is pumped into another tank used for the storage of oil waste which will be refined and recycled for resale.
ACPML has two incinerators machines used to burn waste; these machines have in-built pollution mitigation equipment like Flue Gas Cleaning Systems. Waste materials incinerated at Snake Island include plastic, paper, food waste, cardboard, clothes, oily rags etc. Under certain provincial, national or local guidelines for PRF, some types of waste are subject to the additional requirement. For instance, in Europe, the international transport of food generated waste must be incinerated (Basel Convention, & UNEP 2016). However, there are some materials they cannot incinerate like, tires, glass, alkaline batteries etc. These waste products will be reloaded into the truck and transported to the Lagos State dump sites.

Figure 13: Picture of One of the Incinerators at ACPML (Author, 2019).

The company also has a Compressing Machine, which they use in compressing materials such as papers, plastic, cardboard etc. into a reasonable size for packaging and onward movement to the company that has requested for it.

Figure 14: Staff of ACPML on duty operating the Compressing Machine.
ACPML has a sludge separating machine which is used to process, manage and dispose of sewage sludge produced during sewage treatment. A sludge separator is a machine designed to process and to separate the solid waste materials from liquid sewage. There are two essential reasons for the treatment before final disposal of the sewage sludge; first is to ensure the stability of the organic materials and secondly to reduce the cost of pumping and storage.

Figure 15: Sludge separating machine for processing sewage mixtures.

Pictures of operational activities of ACPML at the port of Tin Can (Author, 2019).

Figure 16: some equipment and machines at ACPML.
Figure 17: The Portal Cabins used as offices

Figure 18: Set of newly acquired Barges.
3.4 Waste Processes and stages

It is worth mentioning that since the commissioning of port reception facilities and privatization of Nigerian Ports in 2006, there has been a significant increase in ships that call Nigerian ports, (Okeudo, G. N. 2013). The port of Tin-Can Island, in particular, has experienced a tremendous turn around because of its multi-purpose nature, where different terminals and jetties can now handle a wide variety of vessel type. The increase in the number of ships that call at the port of Tin Can have given rise to the significant increase in the volume of waste generated which has brought about a heavy burden on the waste collection system and its management in Tin-Can Island Port.
3.4.1 Collection and Processing

Stage 1: The captain or the Agent: Either of these two parties will call the “Control Tower” (Radio Room) to inform and give details of the ship intention to berth. Such information will include the name of the ship, expected time of arrival and departure, the length and draft of the vessel, type of cargo on board, and estimated types and quantities of waste they intend to unload. This information will enable the operation unit to make adequate preparation to receive the ship.

Stage 2: Port Health: Once the control room receives information on a potential inbound vessel, the arrival and berthing time of the ship confirmed. The first government agency that will be informed of the arrival and go on board the vessel once it is moored is the Port Health Agency. The Port Health Agency is the arm of government that ensures newly arrived ships are checked and certified safe, i.e. the vessels have not come with diseases or contaminated substances that would be harmful to the people and the environment. Moreover, it is in fulfilment of the resolution reached on the adoption of the International Health Regulation (IHR) by the World Health Organisation in 2005, (WHO, 2005). All state parties agreed to develop, strengthen and to maintain public health by raising capacities, putting up adequate surveillance and prompt response at every designated Port entry point. As soon as the port health officers conduct their inspection and certify that the ship is free from any kind of diseases, the initial yellow flag hoisted to signify that the vessel is free to be boarded by additional parties who need to service or inspect it.

Collection of sample of the oily waste

The officials of NPA and ACPML will collect a sample of any waste oil a vessel is looking to discharge for toxicological analysis to determine the level of toxin it carries. Depending on the outcome of result from ACPML laboratory, if it falls short of the required standard, the authorisation to discharge the oily waste will not be granted. However, if the result from the laboratory is satisfactory, then permission to discharge will be issued, and representative of both NPA and ACPML will conduct strict monitoring and supervision to ensure the operation is carried out in line with the international and national standards/regulations.
Stage 3: Port Environmental Department and Africa Circle Officers are mandated to go on board any vessel that calls at the port of Tin Can. After the clearance of the ship by Port Health Officers, the control tower will inform the Port Environmental Department; NPA and ACPML officers will then proceed to inspect the vessel. On arrival the team will request to see the "Oil Record Book" it is one of the vital document that must be on board as required by MARPOL Annex I, regulation 15 and 17. In the same vein, the officers will ask for the “Garbage Record Book” which shows every discharge of garbage made into the sea and every garbage delivered to port reception facilities, in line with rule 9 of Annex V of MARPOL. When the team has ascertained the quantities and the types of waste on board, they will then call the necessary trucks and barges that will be required to unload the vessel waste.
3.4.2 Storage

Africa Circle Operational Area. Snake Island, is the operational base of ACPML, here there are different offices and various equipment used for the management, processing and storage of waste collected from ships as listed and shown in the figures throughout this paper. The different types of waste are processed and stored in specialized equipment dictated for various waste. Thereafter, any type of waste that cannot be processed or managed will be loaded on a truck for final disposal at the ACPML dumpsite in Oshodi, Nigeria.

![Figure 23: Tank for treated and separated oily waste.](image)

3.4.3 Disposal

ACPML is managing the dumpsites, approved by Lagos State Waste Management Authority (LAWMA), an agency under the State Ministry Environment of Lagos State. There are three (3) districts of waste management within the states, the Central, Eastern and Western Districts. The waste collected from the PRF is transported to these dumpsites, and disposal facilities for proper management.
Ship intends to berth and to discharge garbage/oil waste

The ship’s Master will radio the Control Tower and ship Agent

The ship master notifies the port harbor on Estimated Time of Arrival (ETA) usually between 24 – 48 hours notices is required on the types and quantities of waste to be discharged via email.

The Control Tower (C.T) informs the Traffic Department which in turn will issue the vessel a Ship Entry Notice (SEN) a permit to proceed to berth

The ship agent and one of the vessel crew members will on ground to conduct the staffs of NPA and ACPML around the ship to inspect the types and quantities of waste to be carried

Once the permit is issued and the ship berthed, the control tower will inform the Port Health Department which will certify the ship free from diseases after inspection

After certifying the ship disease free from the Port Health, the yellow flag hoisted on arrival is then lowered signifying that the vessel is free to be boarded

The C.T will further send a signal to the environmental department of NPA & ACPML office to commence inspection on the content and quantity of waste intended for discharge at the PRF.

If the result of the Lab test falls short of the expected standard, the authorization to discharge waste will not be granted

The NPA & ACPML staff will collect a sample of the oily waste for laboratory analysis to ascertain the content and type.

If the result of the test analysis meets with the required standard, permission to discharge its waste is granted.

The discharge of waste is carried out under strict supervision by NPA & ACPML officials to ensure that the operation is conducted in line with international standards and national regulations.

Once waste discharge is completed, the port authority will issue the vessel a Certificate of Discharge duly signed by the officials of NPA, ACPML and the ship master.

The received waste will be transported to Snake Inland for processing, storage and disposal

Waste that cannot be processed or managed at ACPML operational base at Snake Island is reloaded into the truck for final disposal at the ACMPL dumpsite in Oshodi, Nigeria

Figure 24: A summary of waste discharge procedure at the Port of Tin Can.
Chapter 4: State and Municipal waste management system in Nigeria

4.1 Review of solid waste management in Nigeria (Household)

In this chapter, we examine the need to integrate ship-generated waste received in the port of Tin Can into the municipal waste management system of Lagos state where the port reception facility is located. It is important to note that these divided waste management systems, where ship-generated waste is collected, processed, and disposed separately of the high volume of household solid waste generated in Lagos state is not economically efficient. Combining these streams of waste from both sources, (ship-generated waste and municipal waste) will bring down the costs of reducing, reusing and recycling of waste. Additionally, such a meagre could provide more land allowing the port of Tin Can to expand its port reception facility and accommodate new equipment and machinery to facilitate fast and efficient service delivery to ships using the port. Therefore, to move this concept forward, an overview of the existing situation of the municipal household solid waste management system is necessary.

The management of solid waste is the most urgent environmental problem faced by rural and urban areas in Nigeria. The country has a population of over 170 million people and is likely the highest of solid waste producers in Africa. Regardless of a large number of well intention guideline designed to assist in solid waste management administration, the country is disturbed with the increase of waste as time passes on (Wale Bakare, 2019).

Nigeria generates in excess 32mt's of solid waste yearly; however, it is estimated that only 20-30% is being collected and disposed of correctly. Disposing of solid waste recklessly has led to the blockage of drainage systems, sewers, and stifling of surface water bodies. A big portion of the waste is produced at homes by people, local businesses and large factories which often pollute the environment. The collection of municipal waste and indiscriminate disposal has resulted in the accumulation of waste in undesirable locations prompting the nation to increase budgetary allocations for implementing comprehensive and sustainable programs on waste management across the states in Nigeria.

The United Nations Habitat Watch reported that African city populaces would dramatically multiply throughout the next 40 years. African urban communities are as of now inundated with slums; a situation that could significantly increase the population and the potential for improper
and unsanitary disposal of waste. Among the 36 states and the capital territory of the nation, just a few have demonstrated a significant degree of determination to make proactive strides in battling this issue, while the others have only paid lip service to issues of waste administration showing little importance to building up the waste management sector (UNHW, 2014).

**Municipal waste Management (Lagos State).**

Lagos State is referred to as the centre of commerce in Nigeria and is the second-quickest developing city in West Africa and the seventh globally (Wale Bakare, 2019). Most recent reports estimate its population to be in excess of 22 million people; this number makes it the biggest city in the whole of Africa. Recording an approximate 0.5kg waste per person waste every day, the city estimates production of waste in excess of 10,000 tons each day.

The Lagos State is known to be the model for different states in the country; however, metropolitan waste control has been a major challenge for the Lagos State Waste Management Agency (LAWMA) to manage independently. To better manage this challenge, LAWMA contracted with waste management companies to reduce the burden of collecting and disposing of waste themselves. One significant issue is the deferred accumulation of household solid waste. Sometimes this waste is not regularly collected, allowing it to accumulate for up to 14 days, thus polluting the sea community and environment as a whole.

Unlawful waste disposal in the state is often attributed to the absence of dependable means of transporting waste from homes by waste management officials, as the vans used for waste collection are often not regular. Waste is, therefore littered at different locations within the city, which leads to environmental pollution and diseases. Waste collection trucks are few in number and are often overloaded with 4-5 tons of waste to decrease the numbers of returns and trips require to collect the waste, thus avoiding the cost of refuelling the trucks. There are, however, calls from environmental activists and some concerned citizens for responsible governing bodies to implement modern waste management transport system by contracting these duties under a Public-Private Participation (PPP) arrangement.

**4.2 Strategies for waste management**

The main strategy for waste management in Lagos state is the participation of the private sector (PSP). PSP participation in the collection and transportation of waste has been in existence since
1997 at which time the Ministry of Environment implement a pilot program in two (2) Local Government controlled communities (LAWMA, 2018). The programme was further extended to other areas in 1999; however, multiple setbacks occurred in 2002 as result of poor management. A review of this program was done in 2004, and new mega PSPs were put in place to render service in 20 municipalities throughout Lagos State. Each PSP agreement was unique, based on the particular need of the area. A new Management Team was appointed for Lagos State Waste Management Agency (LAWMA) in May 2005 with a mandate to get rid of the city of filth and bring about improvement in the delivery of solid waste disposal services to the citizens of Lagos. PSPs oversight responsibilities were delegated to LAWMA for restructuring and effective monitoring. Steps taken by LAWMA to effectively manage the municipal waste program includes:

i. Identify the existing PSP Operator’s coverage areas

ii. Determine PSP technical and financial capacity

iii. Creation of wards based on PSP technical capabilities and regional needs

SWOT ANALYSIS OF THE PSP PROGRAMME (DOMESTIC WASTE COLLECTION) IN LAGOS STATE.

STRENGTHS: Increased the number of households having access to waste management service, and passed environmental law requiring uniform monthly sanitation days to pick up the waste. This waste management system has brought about greater support for government through job creation, cleaner communities, reduced levels of poverty and overall improvement in quality of life for citizens.

WEAKNESS: Ability to consistently maintain and improve the performance level of the PSP, difficulty in waste service charge collection, unreliable service delivery, failure to enforce the law for individuals who refused to properly dispose of their waste due to service charge required to be paid for waste collection and failure in enforcing standards across the state for things such as uniform service fees, waste collection times and quality of service provided.

OPPORTUNITIES: Through the PSP program, the rate of poverty in society has reduced through the creation of jobs, greater availability of recycled materials for industrial use, and income
generation opportunities from the sale of recyclable materials and monetary incentives for residents who participate in sorting and separating of their waste.

**THREATS:** Relationship between LAWMA, PSP and slum communities are not cordial. This is due to the attitude of some Lagosians to waste handling, making it difficult to collect waste service charges from residents. Additionally, there are insufficient numbers of waste compactors available and poor road network infrastructure in these communities.

### 4.2.1 Pre waste collection methods

Pre-collection of waste is the gathering of waste from where it is produced and transferring it to where it can be segregated before being transported for disposal. Pre-collection result in a reduction in quantities of waste, partly through sorting and partly through recycling. The requirement for the pre-sorting of waste through waste management plans saves raw materials and reduces air pollution. A key part of effective and efficient waste management is an appropriate pre-collection system on the premises where waste is produced (Oluwande, 1984). LAWMA, who is in charge of collecting waste from various Lagos districts, have provided various labelled containers accessible to each family unit for proper segregation of waste.

### 4.2.2 Transportation and Collection

Figure 25: Newly acquired LAWMA trucks for transporting waste (LAWMA).

The complex processes and expenses in the collection and transportation of waste are worthy of note in the waste management system. There are two privately owned businesses presently
working with LAWMA for the collection of waste in Lagos State. These private companies collect all types of waste from each home, normally in the range of one to three times each week, depending on van conditions and availability. Some non-sanctioned waste collection labourers go house-to-house gathering waste; they frequently separate recyclable materials and dump undesirable degradable waste around the environment. Subsequently, such non-sanctioned labourers are authoritatively restricted from specific areas, and their trucks are normally seized by authorities when they are caught.

The transportation and collection of waste require extensive capital and labour. It has been calculated that the transportation of waste, including the necessary machinery and labour represents 70% to 90% of the total expenses for managing solid waste in Nigeria (Oluwande & UDBN, 1984).

Heavy traffic congestion frequently interferes with the collection and transport of waste in Lagos State. Collection and transport of waste during the night has been attempted by waste collection agents (LAWMA); however, it was unsuccessful due to the fact that it posed high-security challenges to house owners as hoodlums and armed robbers disguise as LAWMA officials to gain access into their homes and rob them of their valuables.

However, LAWMA introduced an operational plan detailing district collection routes throughout the state, namely the central, eastern and western districts. Utilizing this operational plan, and with the assistance of some other government agencies, such as the state vehicle traffic unit to help organize and minimize traffic on specified collection days and designed routes has helped to efficiently boost the collection and transportation of waste.

The trucks used for transporting household waste are normally weighed before discharging their waste load into the landfill. This is done by using a piece of equipment known as weighbridge introduced by the contracting authorities at the landfill site.
4.2.3 Landfill

Waste can be disposed of primarily using two different methods, which are at dumpsites and landfills.

Landfill: This is a deliberately planned structure built to receive and isolate waste from the surrounding environment. A landfill is built using a liner at the base to act as a barrier between the ground and waste products. The liner is then covered with a small layer of soil. A good and clean landfill uses a mud liner and a synthetic liner (plastic) to protect the environment from the waste as it is with the Lagos state landfill.

Dumpsites: This is a piece of land excavated deep into the earth to accommodate disposed waste. Dumpsites can be accessed by scavengers, (mice, rodents and flying creatures) moving around, though incorrect this is often people's perception of a landfill. A unit supervised by the waste management service handles the management of the dumpsites in the state. Serving the state in terms of waste management are three primary landfills and two known temporary sites, which are listed below:
Abule-Egba Landfill: This landfill is located in the western region of the state occupying about 11.3hect of land within the Alimosha municipal council receiving all waste collected from this overpopulated area of the state. This landfill was built in 2017 and the life span has been approximated to last nine (9) years before expiration.

Olushosun Landfill Site: This landfill is located in the northern region of the state occupying about 43.6hect of land within the Ikeja municipal council and receives about 50% of the waste from that region. This landfill was built in 2017 and the life span has been approximated to last fourteen (14) years before expiration.

The Solous Landfill Site: This landfill is located in the central region of the state occupying an approximate 8.2hect of land within the Solous municipal council of the state and receives about 3,140-m³ waste/day. The life span of this landfill is estimated 4years before expiration. Addition to the three primary landfills there are other lesser-known landfill sites. These landfills are often serving as support for the other three (3) major landfills in the state; they avail the opportunity of storing waste before transferring it to the main landfill sites. These sites are temporary and can accommodate about 1,623.18m³ of waste per day.

Acceptable waste for disposal at these sites are non-hazardous solid waste products from authorised territories and producers who are approved to discard waste at the landfill, for example:

Household waste: These are wastes generated in the household and are often referred to as ordinary waste, food waste, would be an example of household waste. Ordinary waste can also be garbage produced by business organisations and institutions in the form of paper waste and packaging.

Inert waste: This waste is generated from organizations, businesses and institutions; it is considered non-toxic and can be collected and deposited in a landfill. It generally consists of residues from industrial processes such as plastic, scrap, paper, textiles, and dry materials.

4.3 Modernizing waste management system

Environmental safety and Public health is the main concern for waste management. Effective management of waste will reduce health hazards and boost the economy of a nation and that is the aim of the Lagos state government. Sustainability in the waste management system addresses the
issues of future challenges in the management system (WRED, 1997). The environment, economic
development, and social equity must be synergized to have a sound waste management system.
This basically suggests that the administration of waste system has to be:

- Economically affordable
- Socially accepted
- Environmentally functional

Considering each of these pillars equally is necessary for the whole system to have a balance.

Figure 27: Pillars of sustainable development of waste management (McDougall, 2002).

4.3.1 Quantities and types of recoverable solid waste

The primary sources of solid waste in Nigeria amidst others are industrial, commercial, household,
educational and agricultural establishments. The types of solid waste include wood, nylon, paper,
metal scraps, cloth, dust, electronic gadgets, food remnants, bottles, vegetables, plastic packaging,
and so on. Of the total volume of solid waste produced in Lagos state, 68% is domestic, 25.4%
industrial and 10% commercial (Adeji, 2007).

Medical waste generated in Lagos as reported by (Williams et al., 2007) is between 0.625kg per
day and 0.700kg per day. Electronic waste consists primarily of thousands of used computers and
their parts imported into the country. Most of those which get disposed of lost their value within
the time spent during shipment at sea, and they end up as e-waste in the country (Ukem, 2008).
4.3.2 Characterizing recyclable waste

The overwhelmed municipal government is reported to collecting less than 40% of Lagos state waste, and only 13% of this waste is of recyclable materials rescued from the state's landfills, as stated by Weecyclers an NGO committed to promoting the reduction of waste and intensive recycling in Lagos state.

Conserving the environment by reusing resources is perhaps the biggest social issue surrounding waste management. Therefore LAWMA has a commitment to educate and enlighten the people of LAGOS on addressing waste with a mindset toward recovery, recycling and reuse instead of disposal of all types of waste.

LAWMA retrieves recyclable waste materials that have been collected from landfills from authorized scavengers. Materials such as jars, bottles, glass, metals, plastic, textiles, cardboard, nylon and electrical hardware are gathered and manually separated. Some of these recovered materials are recycled and sold back to society. As new finished products shipped to countries and businesses, who are in need of recycled products. Items produced from plastic waste usually are cosmetics and clothing (polyester, nylon, acrylic and fleece).

Plastic Recycling: Plastic from different structures and packaging comprises an enormous segment of waste received at different transfer locations in the state. Most plastics are not biodegradable; therefore, Lagos State is making strong efforts to satisfactorily recover these plastics for recycling and reuse. Plastics, for example, HDPE sachets, drink bottles, shopping sacks, and PET containers are gathered at various locations by certified resource administrators who will arrange and sort them out for transportation to recycling organizations. The

Table 3: The main constituents of household waste (Akindele Michael et al., 2015)
accessibility of reused plastics diminishes the interest for virgin materials for the plastic product creation process, and this will reduce the cost of production.

Papers & Cardboard: LAWMA sorts and collects cardboard and paper from landfills, transports them to tissue/paper manufacturing companies for recycling and are then sold for reuse. They also sell significant quantities of recycled paper to a wide range of industrial and commercial facilities.

Demolition and construction Waste: Demolition and construction waste includes bricks, concrete, rubbles, particleboard, tiles and wood which is collected by LAWMA from development or construction and demolition sites for recycling and reuse.

Special Destruction: LAWMA guarantees secured and safe transfer for the disposal of contaminated and hazardous waste. LAWMA also ensures that materials collected for special destruction are collected safely, stored securely and disposed of carefully to ensure that these types of waste do not get into the environment or get sold to the public for consumption.

E-waste Recycling: E-waste is comprised of electrical and electronic items that are being discarded daily in the city of LAGOS. With advances in technology and the mass production and consumption of an array of electrical/electronic gadgets and various mobile devices, there has been an increase in the volume of e-waste. As a result of the harmful nature of this category of waste which may include hazardous materials, LAWMA in conjunction with PSP has commenced, a collection & recycling program for electrical/electronic waste rather than allowing them to be sent to dumpsites. In addition, those e-waste products which are disposed of by individuals/companies and are mixed with other waste categories are promptly sorted and dismantled for the recyclable components, which are recovered for reuse or refurbishment.

Document Destruction: LAWMA is committed to providing reliable destruction of confidential and security documents that may not have been destroyed properly by individual companies and has been sorted by waste administrators. This is done in a secured manner with the aim of protecting the confidentiality of these records. They ensure the secure collection and destruction of sensitive documents, including business records, personnel records, office files, contract and tenders, medical and health records.
Organics Recovery: The LAWMA actively collects organic waste from markets and industries for the production of composite fertilizer, thereby returning needed carbon and nutrients to the Lagos state soil.

4.4 Supporting existing waste management policies

With the expanding populace of the state, the issue of increased waste generation and its management underscores the necessity of a progressive, proficient and compelling arrangement for solid waste administration. The PSP administrators have failed in their effort to keep the state and its environment free of waste litter due to a lack of both technological and financial capacity. This implies that the waste management system for the collection and transportation of waste is inadequate and not sustainable to support the vision of securing a clean state. This has led to the creation of a “Cleaner Lagos Initiative model” which will address these challenges and future concerns on waste. (Mukaila Sanusi, 2018).

This model offers a solution to the inefficient waste management system of the state through additional contractual agreement with the municipal Visionscope Sanitation Solution Waste Management Limited, and includes services such as the management of street and highway sweeping.

Another issue of concern is the poor attitude of citizens to the is bagging and sorting of waste, and the preference for indiscriminate dumping, thereby magnifying the need for additional education and outreach on environmental issues. For instance, in an effort clean up heavily polluted communities, where waste is has been indiscriminately, Visionscape has evacuated over 80,000 tons of waste in more than 1000 illegal dumpsites across the state within a period of six months and as such has been instrumental in supporting the existing waste management systems in Lagos state (Mukaila Sanusi, 2018).
Chapter 5: Challenges and Obstacles

5.1 Government land Constraints

Across the globe, port efficiency is seen as one of the most significant catalysts to economic growth and development of trade activities. However, for many years, the users and operators of the port of Tin-Can in Nigeria have been facing enormous and lingering challenges in conducting business, most notably, in the Port Reception Facilities and Waste Management. This was a result of a series of bottlenecks including, inconsistencies in policies and regulations, the decay of infrastructures and serious duplications of responsibilities among the different agencies of government that operate within Nigerian ports. Moreover, these shortcomings among the Ministries, Departments and Agencies (MDAs) became more evident through a series of complaints from the Masters of multiple ships, the port users and other issues raised like moral deficiencies from some unscrupulous officials of the MDAs.

These difficulties occur in every strata of the Nigeria system, which involves both the private and public sectors including MDAs whose officials have been accused of creating artificial barriers to progress. Meanwhile, they make use of this opportunity to demand un-authorised payment in order to enrich themselves; private industry actors are also to blame because of their connivance with some of the government officials. Such illegal payment comes as a means of inducement, fraudulent dealings, conflict of interest and lack of functionality of the system in the port (especially in the area of MARPOL Convention and Protocols on PRF). This has led to administrative gaps, institutional failure and operational breakdown.

There are predictions that Nigeria’s ports have the potential for rapid growth and becoming a maritime hub in West Africa, IMF and World Bank, (World bank 2016) (IMF 2011). However, the constant artificial barriers being created by corrupt officials are inhibitive factors stifling the development of Nigeria ports and including the Port of Tin from achieving their desired growth in port reception facilities and waste management, while deterring shipping companies/agents from maximising their business opportunities. Furthermore, the collection of unofficial tolls being experienced by the ACPML truck drivers outside the gate of Snake Island on their way to the Lagos State waste disposal centres has become a serious issue. Additionally, poor bad road
networks and unending gridlock on Lagos roads now pose a menace to the smooth operation to the Africa Circle Pollution Management Limited.

Furthermore, in the World Bank report, the Annual Ease of Doing Business indicates that Nigeria ranks 169th while a country like Mauritius is ranked 32nd among Africa nations globally (World Bank, 2016). As a result, shipping companies now prefer to divert their vessels to neighbouring counties in West Africa. This underscores why relevant authorities must take steps to develop and reform port operations, by equipping port reception facilities and waste management hub in accordance with the MARPOL convention and its national regulation.

5.1. Government Land Constraints:
Land constraints could mean a scarcity of land available for the development and expansion of waste management facilities. It could also mean a long and tedious process one needs to go through to obtain permission for the lease or purchase of such land. It is essential to mention that Nigeria is a Nation of thirty-six states including the federal capital territory in Abuja. The states along with the federal capital territory were all subsumed inside the North and South of the Nation in 1914 by the then Governor General of Nigeria Lord Fredrick Lugard.

However, in 1900, the British government promulgated a proclamation, which made all land property of the British government. At the time, the colonial government of the Northern (region) or Nigeria set up a committee called land committee in 1908 to discuss and prescribe an appropriate land tenure for the locals. The committee report, which was accepted and adopted by the British government, gave birth to the "Land and Native Right Proclamation" that was enacted in 1910.

Subsequently, in 1916 Land and Native Right ordinance replaced the statute of the proclamation of 1910. Immediately after gaining independence in 1960, the Northern Nigerian House of Legislature enacted the "Land Tenure Law, of 1962. The law now empowered the government to give land titles to its citizens. The government held the land in trust and ensured that such land was under its control and management, based on this, the citizen has the right to the Certificate of Occupancy of the land. This only happened upon the consent and approval of the regional governor (Nwocha, M. E., 2016).

The State House of Assembly enacted law called "Lagos State Government Land Use Charge Law 2001", intending to protect and increase the internally generated revenue of Lagos State. Also on
the 29th January 2002, the new Land Use Charge Law was passed by the state Assembly, (Lucl, 2018) which replaced the old Land use charge law, number 11 of 2001. The rapidly expanding growth of industries, expansion in road networks, and ever growing population has placed an enormous burden on the state government in allocating land to companies or individuals who are in need except in very extreme cases.

The representative of the Africa Circle Pollution Management Limited said the company desires to have and develop a private dumpsite, where the company can dispose of wastes that cannot be recycled or treated. Instead, the company have been given approval to use government owned dumpsites due to non-availability of land. ACPML is further challenged with land constraints because recently, the port of Tin Can has witnessed a surge in the volume of ship traffic it receives, which has increased the production of waste that must be processed to do this effectively need more space which would enable them to acquire and install more equipment to address this growing concern.

5.2. Renewal of Licences and Certificates from Various Government Organisations

ACPML is facing numerous challenges in executing its function because of the proliferation of government agencies that come into the port of Tin-Can to supposedly carry out their supervisory role but in reality have ulterior motives. This situation has caused avoidable delay to PRF customers and has created unnecessary slowdown to PRF operations. There are many government’s ministries and agencies that enforce marine pollution regulations on ACPML. Such agencies organ include FMOT, FMENV, NOSDRA, NPA, NIMASA and LAWMA, in which all of them are causing avoidable delays due to inefficiency, bureaucracy and in some cases corruption and inter agency power struggles.

- **Federal Ministry of Environment**: The ministry was created in 1999, to enhance effective and proper coordination of all environmental issues, which hitherto were divided and resided in various departments. One of the main purposes of its creation was to have a detailed National Policy to protect the environment and to consider natural resources owned by the country. Moreover, it aimed to have a sound system in place that would have oversight on all environmental projects with the goal of standardizing them, under the ministry.
The National Oil Spill Detection and Response Agency (NOSDRA) was established by Act No. 15 of 2006 as a deliberate attempt to respond to continuous environmental degradation and devastation of the coastal ecosystem, especially resulting from oil pollution in marine areas. Statutorily, NOSDRA is empowered to prevent and respond to oil pollution or any oil-related environmental matters by organizing and implementing the National Oil Spill Contingency Plan (NOSCP), thereby complying with member state obligations to the International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC) 1990, which is stipulated in section 5 of the Act, (NOSDRA, 2006).

The Federal Ministry of Transportation is the ministry responsible for the formulation of marine transport policy, it is directly in charge and oversees the activities of the agencies under its purview which include:

The Nigerian Ports Authority (NPA) was established in 1954 by the Port Act (cap155 of the law of the Federation of Nigeria, as amended in 1999). With the Act of 1999 No.34 Cap 126 law of the Federation of Nigeria; NPA was vested with the responsibilities and functions to improve, maintain, and regulate the use of ports and all matters related to it. These responsibilities include marine incident and pollution prevention, response and investigation in line with section 7(1) of the Act which says, the authority shall "control pollution arising from oil or any other substance from the ship". Furthermore, it states that no person shall deposit or discharge into the waters of the port any ballast, bottles, dirt baskets, ash rubbish, oil or any dangerous or offensive liquid.

The Nigerian Maritime Administration and Safety Agency (NIMASA), was established by the NIMASA Act of 2007. The Agency also derives its power from merchant shipping Act, 2007 and the Coastal and Inland Shipping (Cabotage) Act, 2003. The main purpose for its establishment was to ensure smooth administration of maritime safety matters pertaining to seafarer’s standards of training and watch keeping, marine security and shipping regulations. More so, to ensure pollution prevention and control the marine environment. The Agency is also saddled with the responsibility to create and
implement domestic maritime regulation to meet its member state obligation to IMO Conventions. The Agency is the only regulatory body in the maritime industry. To achieve its mandate, the Agency created a branch called Marine Environment Management (MEM), bestowing upon it the statutory responsibility to ensure that the ocean and port environment are clean from any types of pollution. The department draws its power from Merchant Shipping Act, 2007 part XXIII, section 335 and NIMASASA Act, 2007, section 22(2), 23(9)(b) and IMO Conventions like MARPOL 73/78, London Convention 1972, protocol 1996 etc.

The Lagos State Waste Management Authority (LAWMA), which was formerly known as Lagos State Refuse Disposal Board (LSRDB) came into existence in 1977 via edit NO.9 of the state environmental law, however, the Lagos State Waste Management Authority was formally established by Edit NO.55 in December 1991. This expanded the responsibility of the Agency, which was no longer restricted to the collection of the waste, but also tasked, to transport, treat, store and dispose of local & industrial waste. Due to this new legal status, LAWMA officially became a regulatory agency for the state and mandated to monitor, supervise and enforce sanitation regulations.

During a state mandated review and audit of the numerous government agencies operating within and around the port, it was discovered that many of them are having overlapping roles. It was also discovered that the periodic inspection and supervision engaged in by these agencies was often a ploy to obtain unnecessary government funds for their respective agencies and to bolster their relevance.

Moreover, it was observed that with these legions of inspections being carried out by different regulatory bodies, unnecessary red tape and cumbersome documentation were being levied against PRF operators as well as on vessels calling the port. The time and hours ACPML staffs could have used for official duties were instead being devoted to obtain or renew certificates, licences or permits. This has greatly affected prompt service delivery to the ships that call at the port of Tin Can.

Furthermore, this delays experienced by ship that call at the port were found to be a result of the numerous government agencies that go on board every vessel, often for repetitive functions. Officials often come on board with piles of documents, which must be filled out either by the
captain or crewmembers who have little or no time because of the need to get in and out of port as quickly as possible. It was also established that the frequent interface of government officials with the ships, has led to high level of extortion, which has been reported by the captains. This ugly experiences can be drastically reduced, or eliminated if the government can implement a “One Shop Inspection system” where all the agencies required by law to board the vessel will go on board at the same time and disembark at the same time. Alternatively, the main regulatory body in the maritime industry (NIMASA) will be the only Agency to board the ship. This approach would incorporate other agencies requirements on its boarding checklist, and report back to them as necessary.

5.3. Community Lobbyist
The Act of lobbying is a vital instrument used by a group of people to influence the decision-making process in society. The lobbyist is a group of people trying to pressure on decision-makers, legislators or government officials to carry out their wishes or plans. Moreover, the lobbyist is a group of opinion leaders that come together to support a bill or mobilise support for either local or international bills or agenda items in the state or the international forum. Community Lobbyists in Lagos are often campaigning for the protection of the ecosystem, the safety of the waterways from pollution and contamination and welfare of human beings. However, in this context, the Community Lobbyist often view issues from the minority perspective and engaging in unorthodox methods of actualising their objectives. One ACPML official informed us that community lobbyist in Lagos have made some unimaginable demands from the company and if they refuse compliance it will lead to unwarranted protest and destruction of the company's properties which had led to the stoppage of operations on many occasions. The official also mentioned that occasionally this community lobbyist group organised “local thugs” to set up illegal checkpoint to extort money from their truck drivers.

5.4. Funding.

According to the MARPOL Convention, all member states should ensure they provide adequate PRF. The convention does not make it mandatory for every port to establish PRF; and it is optional for any member states have port reception facilities run by the government or they can contract the
operations to privately owned company. The funding for PRF can be obtained through the federal government or state/municipal government authorities, while the charging of vessels is based on the amount and type of waste discharged.

In other countries, especially in Europe, whenever a vessel is entering into port, and decide to dispose of waste, the vessel needs to pay a certain amount of money as service fee. For example, any vessels entering the port of Tin Can would be charged a compulsory environmental fee by the port authority. The fee is accessed as per the gross tonnage of the ship. The port management, in turn, reimburses the PRF provider using the service fees collected from the vessel for the expenses incurred in the process of collecting, treatment, storing and processing of such waste. Apart from this reimbursement, ACPML also makes money from the selling of recycled waste, which further offset their running cost. The investigation further revealed that whenever the ACPML wants to invest in capital projects, the company would approach the management of NPA and some banks to fund such projects.

5.4.1. Controlled System of Waste Management.

Waste management control is seen as all associated activities deliberately designed to manage waste from the point of generation to its final disposal. This encompasses the point of collection, transportation, treatment and disposal of the waste and it includes the formulation of policies to regulate, monitor, and enforcement of the process. To keep the waste managers in check from dubious activities, there is what is called "Command and Control system. It is common in industrialised nations where the government uses the C & C through regulations designed to monitor and enforce the stakeholders to comply with environmental laws. The waste control system enables the government to maximise its authority and to exercise control on how resources will be expended to achieve a safe environment. Controlling the waste management system effectively depends on the regulatory abilities of the state. The state must have a working instrument to guard and manage the totality of units and sub-units that make up the system. For example, issuance of certificates and the renewal of licenses and permits. These instruments if judiciously implemented and enforced, will act as an inducement to compliance and lead to improved waste management.
Interestingly, in some societies there are three arms of government, all of which plays critical roles in ensuring that the waste management functions correctly. While in other countries, the national or state subsumed the rest arm of governments in managing waste. However, in Nigeria, the National or Federal level has only a small role to play when it comes to waste management except in the Federal Capital Territory. The system is a bit different because it operates the federal system of government in a manner where all the federating units are relatively independent of the centre. The states have the power to establish and maintain standards for waste disposal systems and to ensure adequate inspection, including the abilities to monitor the level of compliance. To maintain oversight of both the private and public actors in the industry, the states employs various mechanisms, such as making adequate and relevant policies, issuance of certificates, renewal of licenses and permits, and regular inspection and enforcement.

Local or Municipal Government: The municipality plays significant role in maintaining and operating waste management. At the local government level, they are tasks forces that move around and monitor the sanitary level of the locality, however, many municipalities do not have their own waste management Instead they execute the state waste management master plan as directed by the head of the government because they are like appendages to the State.

5.4.2 Upgrade of Infrastructures:
Despite several government initiatives aimed at restructuring the port system and to improve their efficiency. Nigerian ports still face a host of challenges including deteriorating infrastructure, wreck removal, congestion of vessels, security, and inadequate space to store cargo, dredging of channels, maritime labour unrest, insufficient navigational tools and aids, and so on. Moreover, the Port of Tin-Can is yet to fully comply with the international standards by adopting electronic inspection of containers and other consignments, computerisation of custom duty payment, lack of technology for Ariel security surveillance, for security and intelligence gathering, and so on. Currently, the arrangement of cargo inspections and other related activities are not fully utilizing the automated scanning system. According to Hoffman in his book, "Nigeria's Booming Borders, the drivers and Consequences of unrecorded trade, London” explained that the examination of containers are primarily done manually and this accounts for 47%, while 27% done
through electronic scanning in some of the other terminals. (Hoffmann, L.K. et al. 2015) (USAID, 2015).

Consequently, the bad condition of the road within and around the Port of Tin-Can axis calls for urgent attention from government and stakeholders to quickly carry out the temporary repairs to ameliorate the sufferings of the port users. They must also implement a long-term solution by initiating proper physical infrastructural development for functional road networks that will last for many years. In this vein, the government should also reactivate and revamp old rail systems, which will facilitate the smooth evacuation of cargoes and solid waste from shore side to the snake island processing facilities.

The deplorable state of roadways has grown concern amongst stakeholders and port users because of its negative impact on the economy, the citizens, and largely on the private sectors. For example are containers regularly falling off trucks, which endanger the lives of the citizens. Additionally, because of overstaying consignments at the port due to the deplorable state of the roads that lead to in and out of the port, PRF facilities are forced to pay accumulated demurrage. Moreover, traffic congestion caused by the inefficiency of the port system and the dilapidated roadways often leads to severe traffic jams within Lagos Metropolis, ultimately affects ACPML trucks on their way to dumpsites.

Figure 28: This picture shows the deplorable road conditions around the port axis.
5.5. Better Alignment of Federal Regulation with International Standard:

There is an international legal framework designed to respond to and prevent vessel source pollution, stipulated in the United Nations Convention on the Law of the Sea, Part XII, and Sections 5 & 6 (UNCLOS). This section provides the basis for legislative authority of a state over a vessel and delineates enforcement power depending on whether the country is acting in the capacity of a port state, flag state or coastal state. In addition, the convention established standards that are uniform, and which seek to safeguard and protect the freedom to navigate and to preserve the marine environment that falls within their jurisdiction. Furthermore, part of IMO responsibility is to set international standards through MARPOL 73/78 for the prevention of pollution at sea, from ships including the dumping of oil and oily substance and exhaust pollution. It is also designed to ensure the preservation of the marine environment by elimination of harmful substances, contamination by oil pollution and to minimise any accidental discharge.

Regarding the national legislations, many legal frameworks in Nigeria concentrate on the prevention of oil pollution in the country; such laws includes:

(a) Oil in Navigable Waters Regulation 1968.
(b) Petroleum Drilling and Production Regulation 1973,
(c) Mineral Oil Safety Regulation 1963.
(d) Petroleum Regulations 1967.
(e) Petroleum Refining Regulation 1974.
More of the regulatory measures were put in place in other to combat pollution, especially from oil-related industry, which was catalyst that helped, established some of these federal agencies, in order to address oil pollution issues. One such example is the Federal Environmental Protection Agency (FEPA), which in 1999 evolved into the Federal Ministry of Environment; FEPA set the standard to regulate land, water, air and oil company activities. The National Oil Spill Detection and Response Agency (NOSDRA) is an agency under the Ministry of Environment saddled with the responsibility of coordination and implementation of the National Oil Spill Contingency Plan. The Department of Petroleum Resources (DPR) was a department carved out of the ministry of petroleum and it oversees the Nigerian National Petroleum Corporation (NNPC) by issuing guideline and setting the standards for Nigeria Petroleum sector.

The Nigeria Ports Authority (NPA) was created in 1954, and was given primary responsibilities for the development, oversight and management of Nigerian ports and has an institutional mandate to provide port reception facilities. The NPA maintains a completely pollution-monitoring department even though it has contracted out its waste management responsibility to a private company. The Nigeria Maritime Administration and Safety Agency (NIMASA) was established by the Act of 2007 as amended, being the only parastatal with the specific mandate to ensure pollution prevention and control in the maritime industry. The Agency is equally empowered to implement all related international conventions and treaties into domestic regulations.

Moreover, all flag States are encouraged by the convention to adopt laws and regulations for the prevention, reduction and control, of marine pollution from ships of their registry or vessels flying their flag (Dzidzornu D.M. et al. 1991). It is also important to mention that according to article 211 (2) UNCLOS says, "All Member States shall adopt laws and regulations for the prevention, reduction and control of pollution of the marine environment from vessels flying their flag or of their registry". Such regulations and laws shall at least have the same effect as that of generally accepted international standards and rules established through competent international organizations or general diplomatic conference. Based on this, NIMASA is the only Agency by all parameter and standard that is saddled with the responsibilities of enforcing flag state, port state and coastal state mandate. The administrative systems in place to administer pollution control in Nigeria are very cumbersome and complex.
because there are too many agencies presently involved in pollution regulation in the country. Hence, there is the need for Nigeria government to urgently, address the issues arising from the overlapping of functions among the aforementioned agencies, because currently the system is taking a toll on shipping companies, port users and other companies’ activities within the Port of Tin-Can, like ACPML.
Chapter 6: Recommendations for Improvement

Considering that waste generated from ships is the main source of marine pollution around the world, the improvement and provision of adequate PRF, appropriate waste handling and adequate reception plan with close participation between the Central and West Africa Member states will help in decreasing pollution from ship-generated waste in Africa in general and in the port of Tin Can in particular. This will result in greater protection of the marine environment and the coastal region of the central and West Africa district. In such manner, the port of Tin Can ought to implement and ensure the adherence to best practices on PRF and follow the lead of administrations that are in compliance with applicable global practices, for example, the MARPOL convention.

The port of Tin Can should endeavor to continuously observe and check the systems quality, environment and health, including the safety and adequacy of the PRF to meet the client’s waste disposal needs in accordance with national regulations and the MARPOL convention within the international maritime Organization (IMO). To actualize this objective the port of Tin Can is expected to continually be in communication with ship operators and the captains of client vessels and the port state officers before and after the arrival of the vessel. The Port of Tin Can should ensure that the advance notification form for waste delivery to PRF is readily made available 24hours before the arrival of the vessel in port and all parties involved should understand the terms and conditions, to ensure the operation of the waste disposal is executed safely and in accordance with local and international regulations for the protection of the environment and security of the crew and vessel. Upon completion of the waste disposal, the port of Tin Can must ensure that the correct format for the waste delivery receipt has been filled out and forwarded to the vessel captain.

After the waste disposal service is finished, the port should initiate a method for filing supposed inadequacies of the PRF to the ship owner and vessel captain so as to continuously observe and access the service rendered by the PRF.

The goal of the port of Tin Can should be to synergize with all the PRFs globally and collaborate with them in pursuit of an environmentally friendly and productive service with the aim to advise, accompany and ensure that their clients receive adequate services.
Although the numerous but fragmented waste management plans in the port expresses the aim of preventing pollution, there is no solid uniform procedure for an integrated waste management system within the port of Tin Can.

Overcoming national inadequacies and shortcomings for an efficient port requires the implementation and development of a system that is designed with waste prevention and control as top priority. For example, the size of incinerators used in the PRF at the port of Tin Can have the capacity to handle only a relatively small volume of waste at one time, constructing an enormous incinerator would encourage more efficient management of all types of waste and provide support for national energy needs as incinerated waste can be used as a source of light energy as it is in some countries such as Sweden. This system will require a long term planning and a huge financial investment. Notwithstanding the long term investment, the outcome will be beneficial not just to the port but to the country at large. However, in developing a long term strategy it is important to redesign the present national administrative framework to accommodate critical issues of concern on PRF and waste management systems in Nigeria.

6.1: Developing an Integrated Framework

As highlighted in chapter 2 the authorities regulating ACPML includes: the Federal Ministry of Transportation (FMOT), Federal Ministry of Environment (FME), Nigerian Ports Authority (NPA), Nigerian Maritime Administration and Safety Agency (NIMASA), Federal Environmental Protection Agency (FEPA), National Oil Spill Detection and Response Agency (NOSDRA) and Lagos state agencies each of these agencies have an obligation to control the operations of PRF and waste management through various legislative Acts. The duplication of responsibilities and functions amongst them facilities conflict of interest and over-regulation. Furthermore, the port authorities have no direct control over the institutional framework of the PRF since it contracts a third party commercial company to run the operations (ACPML) which is additionally self-checking. Due to these challenges, an integrated management system for supervision of ACPML activities which consolidates and clarifies the role of all partaking ministries in order to meet international obligations for best PRF performance practices should be developed. A policy statement which provides understanding of oversight roles and identifies relevant legislation, environmental concerns, and waste management activities that will promote the reputation of the state in terms of waste management control is also necessary.
A universal management framework is a strategic plan that will showcase acceptable management practices, prioritize goals and strategies and highlight mechanisms for the arranged improvement of the waste management system, such a plan is necessary so that it can be referenced as the foundation for waste management practices in Nigeria and can be used by all involved stakeholders such as the port authority and other government agencies, as well as ACPML so that they have a clear understanding of the roles and responsibilities of the agencies tasked with oversight of their operations.

Lastly a review and audit system which assesses the effectiveness and adequacy of the universal management framework to determine if the system has been structured properly and being implemented effectively must be utilized. As it stands presently the Port of Tin Can needs extensive improvement in efficiency in the following areas:

- Reporting the present condition of their PRF more regularly through the IMO developed GISIS database which is available to the public.
- Oversee PRF preventive maintenance for sustaining relevant machines and equipment.
- Exchange and share important information and data on port gathering offices among Central and the West Africa States
- Educate PRF users, shipping companies and all relevant organizations so as to encourage and facilitate the utilization of these facilities.

6.2: The need for recycling

The Lagos state government needs to see waste as throwing away resources and recognize the potentials of managing waste adequately. There is need for the Lagos state government to promote and facilitate the separate collection of recyclable materials from total waste generated; the direct result of doing so will the creation of more jobs, and more resources for the local economy. Lagos state can reduce unemployment figures if they adopt a Zero waste strategy. The first step in implementing zero waste strategy is to encourage and promote waste entrepreneurs to develop businesses aimed at recycling, who will in turn create employment opportunities and reduce waste in the environment. The government should promote recycling in every possible way at all levels of administration. Imagine the number of plastic chairs, road signs, decorative materials, bill boards and speed bumps that can be produced from 85% of our waste. Unfortunately, the vast majority of that plastic ends up as waste in our oceans, landfills and incinerators. Many countries
across the globe have now realized the long term implications of not managing waste adequately. Most countries have also adopted a strategy based on the zero waste model whereby sorting of waste must begin at each household where it can then go to a recycling plant for further processing and reuse. Zero Waste programs are beneficial tool to support circular economy and maximize recovery of resources that would otherwise be discarded as trash. They concurrently minimize reliance on new primary raw materials. This minimizes the need for new resources and the fight to grab them across the world. The government must analyze shortcomings in the current waste management strategy, set goals, determine priorities, and meet deadlines in order to generate revenue through re-cycling. Additionally they must prioritize waste reduction, set targets for the amount of waste produced, ban unnecessary items like many single-use plastics, and redesign products to be durable, repairable, and re-usable. Furthermore they must provide outlined guidance and educate the population on how to manage better any waste produced, and make the separation of different waste types compulsory. Finally ensuring recycling takes place as close as possible to where the waste is produced, will help in reducing transport costs.
Chapter 7: Conclusion

7.1: Summary

Due to concerns for a cleaner and safer marine environment, the IMO focus on the need for member states to provide adequate Port reception facilities for the purpose of collecting, processing and disposing of the ship-generated waste and to control and prevent marine pollution. This study focused on the functionality of the implemented international regulatory instruments in the port of Tin Can and waste management control in Lagos state, Nigeria. The research revealed that the port of Tin Can is the second-largest port in Nigeria. Worthy of note is that since 2006, when the port was concessioned, there has been a tremendous increase in ship traffic that call at the port of Tin Can. This has resulted in a significant increase in ship-generated waste to the port, which has posed serious challenges to the ACPML (the PRF provider for the port of Tin Can) and the Management of the Port in providing adequate reception facilities and associated equipment necessary for receiving the waste as recommended by MARPOL 73/78.

The incident involving the vessel Probo Koala in Abidjan – Cote D’Ivoire was a wakeup call to the public, the business communities, civil societies and most importantly national government leadership. That far greater attention and focus must be given to the issues of pollution control, and waste management; both for the protection of the environment and safety of citizens from diseases and toxic contamination exposure. Also, it exposed the urgent need to develop policies and ways to manage ship-generated waste. The Basel Convention 1989 highlighted the importance of the convention as it relates to the transboundary movement of hazardous waste and its emphasis on strict methods followed while transferring hazardous waste. In a similar vein, countries that are signatory to international instruments designed to address environmental and marine pollution issues must ensure strict adherence to the terms and conditions of these conventions for effective compliance. Examples of such primary conventions, which have been discussed in this paper, are the MARPOL and UNCLOS conventions respectively.

These International conventions have been integrated into the national regulations in Nigeria through policies, ministerial decrees, acts and laws. The African Circle Pollution Management Limited has been contracted and relied upon to ensure full implementation of international standards in the provision of PRF in the port of Tin Can and its waste management system.
Since the time ACPML has been the PRF provider for the Port of Tin-Can, research has shown marginal improvement in port reception facilities and waste management system in the Port of Tin-Can in comparison to previous years. However, there remains significant challenges within the port of Tin Can such as not having a clear understanding of the policy system of the various government agencies that supervise the company’s activities and operations. Additionally the ACPML is in dire need of more land space for expansion. Furthermore, raising funds to acquire new modern trucks and equipment that will enhance operations and facilitate the movement of ship-generated waste for disposal from the facility to the final dumpsite is an ongoing struggle. Therefore, it is crucial to have a proper government policy framework that will outline and streamline the functions of all relevant government agencies and stakeholders involved in the operations of port reception facilities to achieve the desired objective of providing adequate port reception facilities in the port of Tin Can.

7.1 Limitations and future research areas

Some limitations encountered in this research are listed below:

**Lack of time and funds:** Due to the unfriendly attitude put up by the staff of NPA and ACPML in releasing some vital information, we were somewhat limited in our data analysis efforts. We strongly believe that if we have gotten additional time to extract more information from all relevant organisations involved in the operations of the PRF, it would have yielded a more detailed report on the operations of the facilities. Additionally, availability of funds to travel when necessary for a proper follow-up would also help researchers to conduct detailed investigations and productive research work. Moreover, some of the data utilized for this research was not expansive enough as most of the prior research and analysis only covered a timeframe of approximately 2 to 3 years. Notwithstanding, future researchers can make use of a more extended period concerning the subject.

**Lack of Cooperation:** The staff of the Nigerian Port Authority and ACPML were unwilling to provide certain necessary information such as the volume of recyclable materials recovered from the total waste collected in an average year. Furthermore, our request to obtain information from ship operators who have used the port reception facilities in port of Tin Can were declined, due to a lack of available staff to accompany us on an unofficial visit to a ship. To ask direct questions on their experiences in the port and to have a first-hand information on how the operation was
conducted. In addition, their unwillingness to release information about specific issues as they relate to Port Reception Facility activities, such as the billing system of the port users; i.e. how they make payments for services rendered for waste collection and if there are, any incentives received from the Nigerian government to the PRF provider.

As a result of this research, it was discovered that several issues are calling for further studies, such as:

Adequate funding as a much-needed catalyst for enhancing port reception facilities.

This study have shown that for ACPML to meet the challenges posed by the high influx of ships entering the Port of Tin-Can there must be a substantial investment capital in the procurement of modern equipment and technologies that will enhance the adequacy port reception facilities.

There is also a lack of dedicated literature with respect to PRF in Nigeria as most of the studies currently published are on European Union directives on PRF within Europe and its result. The adequacy of PRF is scarcely written about in most African ports, and the future of ship-generated waste in autonomous ships is not discussed.

The desire preceding this investigation was to determine if there is a relationship between ship-generated waste in the port of Tin Can and the municipal waste management system in Lagos state.
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APPENDIX

RECORD OF GARBAGE DISCHARGES

Name of ship______________________________________________________________
Distinctive number or letters_________________________________________________________________
IMO No._________________________________________________________________________

Garbage Categories
A. Plastics
B. Food wastes
C. Domestic wastes (e.g. paper products, rags, glass, metal, bottles, crockery, etc.)
D. Cooking oil
E. Incinerator ashes
F. Operational wastes
G. Cargo residues
H. Animal carcasses
I. Fishing gear

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<tr>
<th>Date / Time</th>
<th>Position of the Ship</th>
<th>Remarks (e.g., accidental loss)</th>
<th>Category</th>
<th>Estimated Amount Discharged into Sea or Incinerated (m³)</th>
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