

Research Article

An Assessment of complimentary role of water transport travel along Ikorodu-Lagos Island areas of Lagos metropolis

Osoja, Adebakin Oluyinka

Lagos State University, Ojo, Department of Geography and planning, Lagos, Nigeria

*Corresponding Author

Osoja, Adebakin Oluyinka

Abstract: Inland waterways are made up of navigable rivers, lakes, coastal creeks, lagoons and canals and advantageous in terms of cost of moving heavy freight. The aim of this research is to assess the complimentary role of water transportation to commuters travelling along Ikorodu-Lagos Island area of Lagos metropolis, in order to examine the significant impact of water transport infrastructure on commuters mobility, in order to determine if the improvement and management of inland water transport infrastructure in the area as attracted commuters away from road travel in the area, in order to suggest ways to further improve inland water ways to enhance patronage by commuters in the study area. To achieve the aim and objectives hypotheses were formulated. In order to validate the hypotheses regression statistical tools was used. Regression estimates the coefficients of the linear equation, involving one or more independent variables that best predict the value of the dependent variable. The first hypothesis reveals a low coefficient of determination. This can be seen from R-squared of 0.6. The R-squared reports that the independent variables can explain about 6 per cent of total variation in mobility along Ikorodu-Marina water corridor. The second hypothesis reveals an average coefficient of determination; this can be seen from R-squared of 0.45. The R-squared reports that improvement and management of inland water transport infrastructure plays 45% significance impact in the attraction of commuters away from road travel along the study area. The third hypothesis reveals a low coefficient of determination. This can be seen from R-squared of 0.12. The R-squared reports that inadequacy of infrastructure has 12% implication on commuters travel comfort in Ikorodu-Marina corridor. The research however revealed that underdevelopment of the inland waterways mode of transport and the stunted growth of inland waterways in the study area can be attributed to lack of funding for the proper provision of infrastructure and appropriate maintenance of Lagos water ways, which plays a significance impact in attracting the commuters to the transportation system.

Keywords: Transport, commuter, Inland water, infrastructure.

Background to the Study

Nigeria possesses the second longest length of waterways in Africa. It possesses 8,600 kilometres of inland waterways and an extensive coastland of about 852 kilometres. Nigerians centre on its longest rivers, River Niger and Benue, which cuts across the country into the cardinal east, west and north sections. The confluence center of both rivers is at Lokoja, which thus flows into the Atlantic Ocean. The coastal waterways outspread from Badagry region through Warri to Calabar; though, water transport scores a distant second to road transport with an average share of about 1.6% of Nigeria gross domestic product i.e. internally generated cargoes, although water transport is considerably slow which makes it unsuitable for passenger movement, an efficient coastal and inland waterways operation and system generally will enhance drastic reduction of the

pressure on a country's rail and road transport infrastructure (Ndikom, 2008).

Inland water transport operation is considered advantageous in terms of costs of moving heavy freight; especially where speed is not put in consideration than cost. For instance, a single 15-barge tow is equivalent to above 225 rail- road cars or 870 tractor-trailer trucks. Similarly, a barge can carry about 100 to 500 containers, which would cause congestion on the road due to heavy truck movement and delay to other vehicles on Lagos roads. Likewise other coastal generated cargoes and passenger movements from and to where they are more value and demand will also enhanced by water transportation in Lagos State. Inland waterways are made up of navigable rivers, lakes, coastal creeks, lagoons and canals (Aderemo and

Quick Response Code



Journal homepage:

<http://www.easpublisher.com/easjehl/>

Article History

Received: 10.02.2019

Accepted: 20.02.2019

Published: 28.02.2019

Copyright @ 2019: This is an open-access article distributed under the terms of the Creative Commons Attribution license which permits unrestricted use, distribution, and reproduction in any medium for non commercial use (NonCommercial, or CC-BY-NC) provided the original author and source are credited.

Mogaji, 2010).

The transportation of goods and services along inland waterways is considered one of the oldest means of transporting goods and services from point to point (Fellinda, 2006). This is attributed to due to its ability to offers the most economical, energy efficient and environmental friendly means of transporting all types of cargo from place to place (Ojile, 2006), and it also safer and cheaper in areas where water exist naturally, as it facilitates commerce, wealth creation, alleviation of poverty, and job creation for youth within such locality. It also generates employment for the boat building industry through active engagement of the youths in welding and fabrication process (Gray, 2004). Furthermore, terminals are the prestige buildings and prestige architectural commissions of our time with most of its structure and relevance valued as 'priceless' and as such no expense should be spared either in the design, construction, renovation or maintenance. They are fast assuming a role in the community that is equivalent to shopping malls, or recreational parks and serve as answers to lifelong mobility and trade within Lagos state. The concerns about terminals especially in Ikorodu and Marina areas of Lagos state have been that of preservation, maintenance and promotion of its ever increasing demands.

The need to encourage and sustain the socio-economic activities between suburbs and the CBD of Lagos metropolis calls for increasing investment in inland water transport infrastructure in order to drastically reduce the problems of traffic congestion in Lagos metropolis and its neighbouring states which thus necessitate attention in the inland waterway operation and erection of terminals. It is pertinent to note that lack of expansion of available infrastructure over the years to cope with the growing population is responsible for traffic congestion within the city.

Commuting within Lagos sometimes takes double or triple the normal time, thereby inhibiting economic development and quality of life in the city. Movements in the state mostly road based accounting for 97% even though there are provisions for other modes like rail and water, but most of the attention is concentrated on the road, so there is need to diversify Lagos transport modes and encourage modal choice for passengers in order to reduce the pressure on the road. For instance, water transportation is a realistic and considerable option in the state, since Lagos has abundant water bodies that could be utilized to offer fast, safe, comfortable and cheaper means of transportation. In comparison with other major urban development's near or situated close to the sea or river and lagoon systems, the water transport in Lagos is under-utilized which is well below 1%.

The state government has however made it its policy to rapidly develop the water transportation routes

in the state in order to arrest the decline in the quality of life in Lagos and also sustain economic development in the state and the country at large. The state government has made significant investment in water transport in order to reduce congestion on Lagos road, but the impact is too significant as the infrastructure and the capacity to manage the water resources to optimize sustainable growth and provide reliable water services is not sufficient (LAMATA public transport report 2004-2010). It is against this backdrop that this study intends to address the complimentary role of water transport to road travel within Lagos metropolis, Nigeria.

Statement of the Problem

Terminal is described as a centre in a town used by passengers departing for or arriving from a given destination. From the inception of the world, transportation of one form or another has been in existence. Even today, when we can go anywhere quite easily by railways, car or air craft, travel and transport by water still has one big advantage; it is relatively cheap" (Fellinda, 2006). The few existing private ferry transportation operators including state owned in Lagos state right from the time past are faced with the challenges of dilapidated infrastructures abandoned water ways, zoning and circulation challenges within their respective terminals.

This gross shortcoming in these terminals has been hampering their effectiveness and has also failed to create the much needed flexibility and convenience which help to promote a friendly environment for the mobility of commuters on one hand and goods and services on the other. However the government of Lagos state has being addressing these problems by building world class terminals in the five regions of Lagos state with Ikorodu and Marina having a mega status. Furthermore, water transport in the study area is increasing recent period especially during construction of BRT facilities along Ikorodu road etc.

Aim and Objectives

- The aim of this study is to assess the complimentary role of water transport travel along Ikorodu-Lagos Island areas of Lagos metropolis. In order to achieve the aim, the study will adopt the following objectives which are:
- To examine the effect of inland water transport infrastructure on commuters mobility along Ikorodu-Marina water corridor of Lagos state.
- To determine if the improvement and management of inland water transport infrastructure as attracted commuters away from road travel along the study area.
- To determine if the present improvement and management of inland water transport infrastructure has positively enhance water transport operation along Ikorodu- Marina in

Lagos State

- To examine how the development of inland water transport infrastructure in Ikorodu-Marina corridor impacted on commuter mobility safety.
- To analyse the implication of inadequacy of infrastructure on commuters travel comfort in Ikorodu-Marina corridor.
- To suggest ways for further improvement of the inland water ways to enhance patronage by commuters in the study area.

Research Questions

- What is the effect of inland water transport infrastructure on commuter's mobility along Ikorodu-Marina water corridor of Lagos state?
- Has the improvement and management of inland water transport infrastructure attracted commuters away from road travel along the study area?
- Has improvement and management of inland water transport infrastructure positively enhance water transport operation along Ikorodu-Marina in Lagos State
- Has the development of inland water transport infrastructure in Ikorodu-Marina corridor impacted on commuter mobility safety?
- What are the implications of inadequacy of infrastructure on commuters travel comfort in Ikorodu-Marina corridor?
- What are ways to further improve the inland water ways to enhance patronage by commuters in the study area?

Statement of The Research Hypotheses

Hypothesis One

H0: Inland water transport infrastructure does not influence commuter's mobility along Ikorodu-Marina water corridor of Lagos state.

H1: Inland water transport infrastructure influences commuter's mobility along Ikorodu- Marina water corridor of Lagos state.

Hypothesis Two

H0: The improvement and management of inland water transport infrastructure has not attracted commuters away from road travel along the study area.

H1: The improvement and management of inland water transport infrastructure has attracted commuters away from road travel along the study area.

Hypothesis Three

H0: Inadequacy of infrastructure does not have implication on commuters travel comfort in Ikorodu-Marina corridor.

H1: Inadequacy of infrastructure has implication on commuters travel comfort in Ikorodu-Marina corridor.

Scope of The Study

This research is centered around the analysis of water transportation in Lagos state, with special emphasis on the complimentary role the water transport has played in the alleviation of pressure on the road transportation system, to analyse if the sector is fully utilized or not, and what are the factors inhibiting the smooth operation of the water transport operation, in order to recommend to the public on the advantage of the sector and also recommend to operators and government agencies on the sensitization or ways of improving the sectors in terms of safety and provision of world class infrastructures in the terminal to encourage patronage by commuters.

Significance of the Study

Water transportation can be a suitable mode of transportation in dense urban areas and has proved to achieve environmental and social benefits. This study aims at identifying the significant role the water transportation has played in complementing the road transportation. The research will be of immense benefit to many people, organization and government.

It will be of immense benefit to the Lagosians, as the outcome of the research will contribute to their knowledge on the significance of inland water way transportation in Lagos as it will provide an alternative means of entrance and exit from and to some of the busy areas since most Lagos roads are constantly bedeviled with traffic jam and accident, the research will expose commuters to water transportation as an alternative, the research will also recommend better ways to improve inland water way transportation system, infrastructure improvement and management in Lagos state.

The Study Area

Lagos Island contains many of the largest markets in Lagos, its central business district, the central mosque, and the Oba's palace. Though largely derelict, Tinubu Square on Lagos Island is a site of historical importance, it was here that the Amalgamation ceremony that unified the North and South took place in 1914. Ikoyi situated on the eastern half of Lagos Island, housed the headquarters of the federal government and all other government buildings.

Lagos is one of the Federal Republic of Nigeria (2007) 36 states, notable for her population and commercial activities, and is located in the southwest. It lies approximately between longitude 2°42'E and 3°42'E and latitude 6°22'N and 6°52'N. The Atlantic coastline of about 180km forms the boundary at the south, to the west it is bounded by Benin Republic and Ogun State in the northern and eastern part by Ogun state. The state possesses one of the largest urban agglomerations, having an explosive growth rate of 5.7% annually; growing 2,000 inhabitants averagely daily, which decipher into population growth of about

275,000 persons annually; and a population density of 2,594 persons per sq. km. The state's population at present is estimated around 21 million dwellers

(Fashola, 2012, cited in Daily Independent, 2012). Due to the closeness of the area to the ocean, the area enjoys coastal weather.

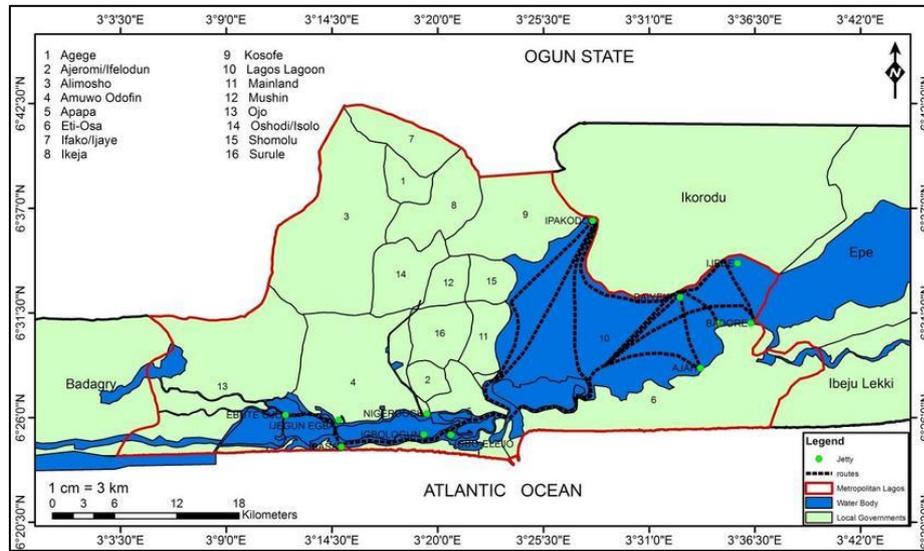


Figure-1: Map Showing Lagos Administrative boundaries and the water ways
 Source: Extract from LAMATA publication (2009)

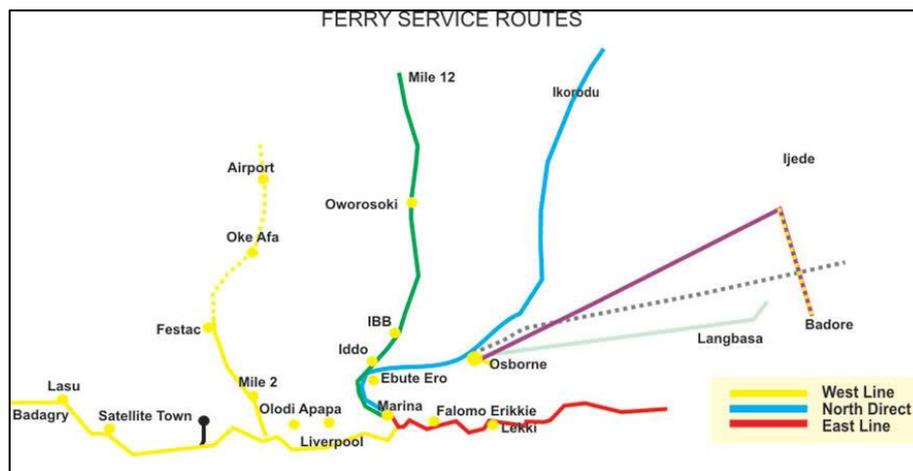


Figure-2: Map showing Inland water way routes in the Study Area
 Source: Extract from LAMATA publication (2009)

LITERATURE REVIEW

According to Ofoedu (1990) "water in its very ordinariness, is extraordinary, it is everywhere in form of oceans, ice fields, lakes, rivers and covers nearly three quarters of the earth's surfaces." Fellinda (2006) is of the opinion that "water is viewed as a highly variable and mobile resource in the widest sense". Of all the substances that are necessary to life, as we know it, on earth, water is by far the most important, the most familiar and the most wonderful.

Transport is a service industry responsible for carrying or transferring people and goods from one place to another. Historically, water transportation has been as old as the early period of man's existence. The exact time in which maritime activities started cannot be ascertained, however, Egyptian civilization which is

one of the world's early civilizations is related to transportation on the river Nile. Bowen (1972) highlighted that: scientific network of established sites and findings has clarified and augmented the ancient literary sources which first provided clues as to early maritime activities. Evidence gleaned from numerous archaeological sites illustrates the ingenuity of prehistoric navigators who avoided sailing around stormy headlands in the frail- skin boats by disembarking on one side of the peninsula and then moving overland to the other side before resuming their journey by water. Ever since he devised the primitive boats, man has made use of winds, tides and currents in order to migrate explore and initiate trading routes on a scale that over land travel would not permit.

World Developments in Water Transportation

The pre-historic man learnt that floating logs could be used collectively as a raft. He further learnt that by attaching animal skins to one or more poles and fastening it to his raft, he could move across a river using the wind as the propellant. In those days men constructed canoes and ships from an assemblage of wood carcasses which they paddle over water as means of transport. These wooden canoes were later transformed larger cargos and passenger vessels most of which were powered by slave men of those days. Water transportation is a sector of transportation which can be seen as the pioneer in man's quest for civilization. This fact is evident in the fact that ancient civilization was found in places that were either located on a river bank or within close proximity to a river. These waterways were generally used as a means of communication between the people that dwell close to it. Although communication between people were generally slow which led to gradual civilization process, this medium was still a mile stone in man's quest for it. This fact is further evident in that a large number of major cities in the world today were popularly identified by their ports or river estuaries near the sea or at river crossings. Long before railways were built, travel on water was much easier than cross tarred country of forest, swamp and mountains "Even today, when we can go anywhere quite easily by railways, car or air craft, travel and transport by water still has one big advantage; it is relatively cheap" (Eric de Mere, 1965).

All over the world where navigable rivers existing; they have always been used for travel and commerce, and with this towns and cities located along rivers flourished with activity and transformed into trade centres. Thus, at the dawn of civilization man had already developed the sail boat. Subsequent important contributions to water transportation were also made by the four great civilizations of early human which evolved in close dependence on rivers and fertile/easily worked soils of their flood plains. These four were the Sumerians on the Tigris and Euphrates river of ancient Iraq (4000BC), the Chinese on the Hwang Ho (that is yellow river) 2500BC, the Harrapans on the Indus River in Pakistan (3000BC) and finally the Egyptians on the famous River Nile (3500BC). The Greeks and the Romans civilization (8th century BC) also made improvements in terms of size and efficiency. The Spanish scientists in the 14th century invented the mariner's compass which boosted water transportation. Modernization in water transportation was further boosted by the introduction by the Americans of the float boats and keel-boat (1804), which were followed by the steam boat between 1811 –1812. These early boats were rowed, paddled, poled or sailed. After the Second World War in 1945, Americans introduced the pontoons and assault rafts. Today, not only do we have pontoons, but also various passengers, cargo and military ships as well as sophisticated navigation equipment and high skilled personnel in the water

transportation sub-sector making travelling more enjoyable.

Port Terminal Evolution and Development

The evolution of transport terminal development has been examined most extensively in port site studies. Port terminals and activities, as documented by Bird's any port, (2001), tend to expand away from their original sites towards locations offering better maritime and land access. The site of the port is thus the object of a process of valorisation through capital investments in infrastructures, the convergence of inland and maritime transport networks with their flows as well as the complex management of the concerned supply chains. According to Kisho, (1994), "port development can be perceived within a sequential perspective, where each phase builds upon the previous, from port cities of the 19th century to the emerging port logistics network of the 21st century". Conventionally, port terminals were located close to city cores as many were the initial rationale for the existence of the city. The proximity to downtown areas also insured the availability of large pools of workers to perform the labour intensive transshipment activities that used to characterize port operations. But these activities tended to have low productivity levels as a stevedoring team could handle 10 to 15 tons per day and a berth could handle 150,000 tons per year. At their peak in the early 1950s ports such as London and New York each employed more than 50,000 dock workers. Over time, changes in ships and handling equipment gave rise to new site requirements.

Ducruet C. (2010) opined that by the post World War II period a growing specialization of vessels emerged, especially the development of bulk carriers. These ships were the first to achieve significant economies of scale, and their size grew very quickly. For example, the world's largest oil tanker in 1947 was only 27,000 dwt., by the mid 1970's it was in excess of 500,000 dwt. There was thus a growing vessel specialization using semi-automated transshipment equipment and increase in size which resulted in new site requirements, especially the need for dock space and greater water depths. The mechanization of cargo handling and the storage requirements because of greater vessel capacities have greatly extended the space demands for port activities. Many ports, such as Rotterdam and Antwerp are larger in area than the cities they serve, and even more space-intensive ports, such as Montreal, are in excess of 500 hectares in area.

The expansion of Chinese ports, such as Shanghai, has required altogether the use of entirely new sites outside central areas. Further, growing ship sizes have implied several new constraints for port sites such as deeper waterways, larger terminal space, both for ship handling and warehousing, and more efficient inland road and rail access. Modern port infrastructures are often intensive in capital and several port authorities

are struggling to keep up with large infrastructure investment requirements. However, in their contribution, Tolley R. and Turton B, (1995), explained that the presence of infrastructures does not necessarily guarantee traffic as maritime companies can select the ports they service as business opportunities changes.

Advantages of Water Transportation over Other Forms Of Transportation

Energy efficiency

Water transport is inherently more energy efficient than either rail or truck. Inland waterways are the most energy efficient way to move bulk commodities such as coal, grain, iron, steel, aggregates, petroleum, and chemical products. In the United States, barges move one tonne of cargo an average of 576 miles per gallon (245 km per liter) of fuel. Railroads can move the same amount of cargo an average of 413 miles per gallon (176 km per liter), and a truck only 155 miles per gallon (66 km per liter) (Kruse *et al.*, 2007). Because of this efficiency, transporting freight by water generates fewer air emissions than rail or truck (Kruse *et al.*, 2007).

Safety

Safety is another advantage of IWT. Accidents on the waterways are rare, and IWT has a very low injury and fatality record compared with the rail and truck transport of freight. Safety statistics in the United States for all modes of freight transport show one injury in the inland marine sector for every 125.2 in the rail sector and for every 2,171.5 in the highway sector. Fatality statistics are much the same, with one fatality in the inland marine sector for every 22.7 in the rail sector and for every 155 in the highway sector (Kruse *et al.*, 2007). IWT also moves hazardous materials safely. Although spill rates are low in all transport modes, inland waterways have the best record. While trucks have a spill rate of 6.06 gallons per one million ton-miles (22.9 litres per 1.4 million tonne-kilometres), rail cars lose only 3.86 gallons per one million ton-miles (14.6 litres per 1.4 million tonne-kilometres) and barges lose 3.6 gallons per one million ton-miles (13.6 litres per 1.4 million tonne-kilometres) (Kruse *et al.*, 2007).

Relief of highway congestion

Road congestion is reaching crisis proportions in many urban areas. Total congestion costs for 2005 for urban areas in the United States were \$78 billion, including 4.2 billion hours of delay and 2.9 billion gallons (11.02 billion liters) of excess fuel consumed (Schrack and Lomax, 2007). In addition to the obvious delays, congestion exacerbates other externalities of truck transport by increasing air emissions and the rate of accidents. Longer commutes can also have a negative impact on labour productivity and quality of life. Congestion also leads to higher costs of truck freight operation through driver wages and has a negative impact on manufacturing industry and the service sector by reducing the reliability and predictability of

deliveries (Sudar, 2005). One 15-barge tow carries the load of 216 rail cars and 1,050 large truck tractor-trailers (Kruse *et al.*, 2007).

In more developed countries, where road and rail networks move the majority of the freight, inland waterways alleviate congestion by transporting significant amounts of cargo that would otherwise be on roads. And in most cases, inland waterways have unused capacity and could accept more cargo and thus relieve even more of the congestion. The annual traffic on America's inland waterways carries the equivalent of 58 million truck trips each year (Kruse *et al.*, 2007).

Inland Water Transportation and the Environment

The use of rivers for navigation can have environmental impacts, particularly when improvements are made to facilitate navigation. Dams change free-flowing rivers into reservoirs, and can prevent fish movements. However, fish ladders can overcome these problems, and the reservoirs themselves generate valuable benefits for hydroelectric power, boaters, anglers and for general riverside recreation. Navigation also requires dredging in order to maintain safe depths in channels, which in the past has been seen as an environmental problem. But in recent years this thinking has turned around and dredged material is viewed as a valuable resource, which can be used to create wetlands and wildlife habitat and to nourish beaches.

Inland Water Transport in Solving Transport Problems of Towns and Cities

Another domain, where the transport-related problems are accumulated, is towns and cities. The implementation of rules of sustainable development of transport in urban logistics is essential to improve the living standard of citizens. Here, as well inland water transport may be widely used and often without the great investment. Towns and cities situated near waterways can, as is the case in many EU countries, implement passengers and goods transport, thereby decreasing congestion and facilitating the access to areas closed for transport. Commuting may be an important field of using inland water transport in the areas of maritime ports and shipyards. Shipping often ensures the most favourable connections in these regions, and using passenger ships for such transport would considerably decrease rush hour traffic and its inconveniences. Such transport is relatively easy to plan, as the demand for it is predictable and can be accomplished in cooperation with economic entities it concerns. Inland water transport may play a significant role as a part of **public communication**. The premises for this type of transport are as follows:

- Location of the most of big cities near waterways;
- Low requirements of passenger ships for waterways (there is a strong possibility to adapt fleet to local conditions);

- Relatively low requirements as regards passenger harbours;
- Parking problems in the city centres;
- High parking costs;
- Low road safety;
- Closure of many city centres for passenger traffic.
- Waterways, as mentioned above, run through the most populated parts of towns and cities, their centres, which create possibilities to use them for public transport on selected routes. The success of this solution depends, however, on treating inland water transport the same way as other branches of transport, both when it comes to prices and coordinating timetables with the transport needs.

Inland Waterway System in Lagos State

The history of ferry service in Lagos State can be traced to the 1970s when Lagos was still the federal capital. Then the Federal Inland Revenue Service (FIRS) operated ferry services to Apapa, CMS, Ebute-Ero and other locations. Later, the state government under the Lateef Jakande administration also came up with its ferry service when it purchased its ferry boats "Baba Kekere" and "Ita Faji". The Ferry Services Corporation was established to run the service. The effective and efficient service run by the corporation has still continued to be a reference point in the state well over 25 years after.

The State Ferry Service Corporation is no more in operation as the National Inland Waterways Authority Act (Repeal) Law 2008 created the Lagos State Waterways Authority, which is already functional with a supervisory board inaugurated by the then Governor, in person of Governor Fashola to monitor the private operators and ensure they operate within the provisions of the Inland Waterways Law. The ferry operation along the Ikorodu-Marina corridor began at the end of February 2009, but was actually commissioned by the then Governor of Lagos state, Governor Babatunde Fashola on April 21, 2009. As in most of its developmental projects, the state government partnered with the private sector to actualise the noble vision for the transport sector. The nature of the partnership was that the state government created an enabling environment while the private sector provided the necessary infrastructure in terms of jetties, terminal, ferries, etc., as well as engages in public enlightenment campaigns and generally creates the environment that will make people comfortable with water transportation.

Transportation by water has been one of the major means of inter-state movement in Lagos State. The most commonly used water automobile for this movement is the ferry system. Ferry system involves the use of large vessels such as pontoons, launches (consisting of one or more decks) and other passenger

catamarans for transporting persons and goods on water. The Lagos State Government over the years has been responsible for the development of terminals for ferry and other water transportation systems. This section of the state's transportation sector yields a reasonable amount of revenue to the government and this basically forms the basis for the government's direct handling of its administration and revenue management. The Lagos State Government presently allow the use of speed boats and few pontoons for water transportation service from the marina ferry terminal to Mile II (though Mile II is presently out of service) and its environment and to Apapa and Osborne respectively. Presently, the marina ferry terminal serve as the main administration and maintenance service centre for all; government vessels which usually leave the base daily to other creeks in Mile II, Badagry, Ibeshe etc. These vessels then join other owned by private entrepreneurs for trips to other riverine areas and back. At the end of each day's business, government vessels return to marina terminal where they are anchored till the next journey. Charter services are also operated in Lagos State ferry transportation system making it possible for any vessel to ply other routes not designated for it.

RESEARCH METHODOLOGY

Introduction

Methodology is the systematic, theoretical analysis of the methods applied to a field of study. It comprises the theoretical analysis of the body of methods and principles associated with a branch of knowledge. Typically it encompasses concepts such as paradigm, theoretical model, phases and quantitative or qualitative techniques. This chapter focuses on the description of the techniques used by the researcher in carrying out this study. It includes the methods, the instrument used for data collection, the procedure for the instrument distribution, and method of data analysis.

Types and Sources of Data used

The data for this study were primary data and secondary data. The primary was sourced from field survey conducted between February and March, 2018, on the commuters of Ikorodu-Marina inland water ways corridor. The instrument of data collection was structured questionnaire, which was carefully prepared through the consultation of journals and other relevant information's on inland water transport. The questionnaire was constructed by the researcher aimed at providing answers to some of the research questions, First section comprises of demographic question where the participants were asked to furnish information with regards to their gender, educational level, age, marital status, monthly income, the second section is aimed at identifying commuters travel characteristics, the third section comprises of questions on safety, Influence of Inland water transport infrastructure on commuters patronage. The secondary data consisted of Maps of the study area which was extracted from LAMATA publication.

Sample and Sampling Techniques

The sample size for the field survey was 100 respondents; simple randomly distributed to the commuters as they arrive the jetty for fair representation, the instrument dissemination was carried out in the morning and evening which is the peak period for a period of 3 days. Statistical sampling is an important research tool for a number of disciplines, because it allows people to learn more about a population without studying every single individual in the population. For the purpose of this type of research that involve selected few commuters, their opinion was sort through the questionnaire, and carefully sorted out.

Research Instrumentation and administration

Research instruments are tools used in obtaining, gathering, measuring or assessing information. The critical research instrument which was used for this study is questionnaire, which was distributed to the sample population, aimed at generating information from them based on the research objective.

The questionnaires were designed into 4 sections, A, B, C, and D. Section "A" of the questionnaire focused on the demographic information of the respondents, such as the Gender of respondents, Age, marital status, qualifications, occupation, marital status, monthly income and size of household. Meanwhile section B focused on commuters travel characteristics, the C comprises of questions on safety, and D which is the final one focuses on the Influence of Inland water transport infrastructure on commuter's patronage.

Techniques of Data analysis

The data collected was sorted out in order to identify the ones that were not correctly filled, that might constitute problem during analysis. The data analysis was based on the questionnaire computed for the research work, as the research questions was analyzed using Statistical Package for Social Sciences (SPSS) computing software. Both descriptive and inferential statistical analyses were utilized in the study. The generated frequencies of the answered questions from the respondents were presented in simple percentages in a tabular form and graphs for easy interpretation.

Afterwards, the earlier stated hypotheses were tested using Regression analysis. In statistics, regression analysis is a statistical process for estimating the relationships among variables. It includes many techniques for modelling and analyzing several variables, when the focus is on the relationship between a dependent variable and one or more independent variables. More specifically, regression analysis helps one understand how the typical value of the dependent variable (or 'criterion variable') changes when any one of the independent variables is varied, while the other independent variables are held fixed.

This sought to investigate the impact of infrastructure on commuters patronage water transport. The basic idea behind survey methodology is to measure variables by asking people questions and then examine relationship among the variables, in order to draw conclusion from the generated responses of the respondents, thereby using the generated data to test the earlier stated hypothesis in order to validate it and decide if the null hypothesis is to be accepted or forgone in order to go for the alternative hypothesis.

DATA PRESENTATION AND RESULT DISCUSSION

Data Presentation

This chapter is aimed at carrying out a comprehensive analysis of generated data, using a statistical package popularly known as SPSS through coding, computation and analysis, and information generated later presented in tabular form for easy interpretation. For the purpose of this research, a research questionnaire was the major tool of generating information's from the respondents; since the sample population is relatively small, random sampling was however adopted for fair representation. A total of hundred (100) questionnaires were administered, retrieved and scrutinized for the research.

The analysis is divided into three categories, the first category contains the demographic characteristics of the participant, while the second category contains research questions aimed at analyzing the factors attracting the commuters from the road to the water, they are all aimed at providing answer to the research questions, in order to test the null hypothesis if to be forgone or uphold. The generated tables and figures that elucidate each question are presented as follows:

Table.1- Analysis of Socio demographic variables

Age:		
Below 18 years	6	6.0
18-25 years	13	13.0
26-35 years	50	50.0
36-45 years	21	21.0
46-55 years	8	8.0
Above 55 years	2	2.0
Total	100	100.0
Sex:		
Male	66	66.0
Female	34	34.0
Total	100	100.0
Marital Status:		
Single	17	17.0
Married	54	54.0
Divorced	13	13.0
Widow/ widower	16	16.0
Total	100	100.0
Occupation:		
Business	37	37.0
Trading	33	33.0
Civil servant	30	30.0
Total	100	100.0
Education level:		
Primary 6	7	7.0
WAEC	20	20.0
OND/HND/BSC	36	36.0
Post Graduate/ M.Sc.	37	37.0
Total	100	100.0
Income level monthly		
Less than N50,000	39	39.0
N 51,000 – 100,000	25	25.0
N 101,000-150,000	17	17.0
N 151,000 – 200,000	10	10.0
N 201,000 – 250,000	3	3.0
N 251,000 – 300,000	4	4.0
Over 300,000	2	2.0
Total	100	100.0
Size of household:		
1-5 people's	10	10.0
6-10 people's	53	53.0
11-15 people's	37	37.0
Total	100	100.0

Source: Field work, 2016

The table presented above is aimed at revealing the age of the respondents, the research revealed that 6% are below 18 years, 13% are between 18-25 years, 50% are between 26-35 years, 21% are between 36-45 years, 8% are between 46-55 years while 2% are above 55 years respectively, it thus revealed that larger percentage of the respondents are between the age of 26-35 years, it also reveals the sex of the respondents, 66% are male while 34% are female respectively, it thus revealed larger percentage of the respondents are male, the research also reveals the marital status of the respondents, it reveals 17% are

single, 54% are married, 13% are divorced, 16% are widow/widower respectively, and the research thus revealed the married respondents dominated the sample population.

The table presented above also reveal the occupation of the respondents, as it reveals 37% are self-employed, 33% are trader, 30% are civil servant, the research thus revealed that larger percentage of the respondents are into one business or the other, the research also reveals the education level of the respondents, it thus reveal 15.5% are primary 6 holder,

20% are SSCE holder, 36% are OND HND/ BSC holders, while 37% are Post Graduate/M.Sc. holder respectively, it thus revealed majority of the respondents are OND/HND/BSC holders, the research also reveal the income level on monthly basis of the respondents, it reveals 39% get less than 50,000, 25% earn between 51,000 – 100,000, 17% earn between 101,000-150,000, 10% earn between 151,000 – 200,000, 3% earn between 201,000 – 250,000, while 4% earn between 251,000 – 300,000 respectively, it thus revealed majority of the respondents earn less than 50,000 monthly, it also reveal the size of the household of respondents, it reveals 10% are between 1-5 people's, 53% are between 6-10 people's, while 37% are between 11-15 people's respectively, it thus revealed larger percentage of the respondents are between 6-10 people's as represented with table 4.2 above.

Research Questions

The research reveals 53% are heading to Marina, 20% are going to Ikoyi, 11% are going to Lekki, 14% are going to Ajah, while 2% are going to Ebute Ero, the research thus revealed majority of the respondents are going to Marina in order to avoid the traffic encounters when heading to the Highland, the research reveal the purpose of respondents trip, 8% are going on medical purpose, 15% on education, 24% for shopping, 24% for trading, 23% are going to their respective offices while 6% are going for leisure, the research thus reveal larger percentage of the respondents are going for shopping and trading, it also reveal how often the respondents travel while using the medium, the research shows 62% travel daily, 29% on weekly, 6% on monthly, 3% on yearly basis, the research reveals majority of the respondents travel on daily basis using the medium, the research also reveals if the respondents use other alternative mode of trips, 89% said yes, while 11% said no, it thus reveal majority of the respondents have other alternative mode use aside water way, for those that use alternative mode of transportation, the research reveals the mode use by the respondents, 15% use car, 55% use Danfo, while 30% use BRT, the research thus reveal majority of the respondents use Danfo alternatively, the research reveals how majority of the respondents get to know about the availability of water transport for their trip, 7% said through media, 6% through the boat operator, 35% said through colleague, 36% through friends, while 16% through neighbours, the research thus reveal majority of the respondents get informed through colleague and friends.

The research also reveal the difficulties commuters face while using the mode of transport, 21% complained of high travel cost, 18 complained of long waiting time at the jetty, 39% complained of overloading of the boat which often cause panic for the commuters, 6% complained of water hyacinth while 16% complained of unreliable ferry service. The

research thus revealed majority of the respondents are not happy with the overloading of the boat, the boarding and debarking difficulties, 73% complained of impatience of boat operators, 3% complained of narrow entrance/exits, while 24% complained of shoving and pushing by the commuters, it thus revealed the boat operators are impatient which often results to excessive rushing to meet up trips, the research reveals if the respondents considered the inland water way safe for their trip, 37% strongly agree, 38% agree, 10% undecided, 11% disagree while 4% strongly disagree respectively, it thus reveal that majority of the respondents consider the medium safe for their trip, the research reveals if the respondents considered the inland water way safe for their trip based on the safety measure put in place, 37% strongly agree, 38% agree, 10% undecided, 11% disagree while 4% strongly disagree respectively, it thus reveal that majority of the respondents consider the medium safe for their trip.

The research reveals if adequate safety kit such as (Life jacket, life buoys etc.) are provided by the boat operators, 17% strongly agree, 42% agree, 26% undecided, 9% disagree while 6% strongly disagree respectively, it can however be concluded that there is adequate safety kit such as (Life jacket, life buoys etc.) provided by the boat operators for their trip, the research reveals if the equipment are properly maintained to respondents satisfaction, 3% strongly agree, 6% agree, 25% undecided, 29% disagree while 37% strongly disagree respectively, it can however be concluded that The equipment are properly maintained to their satisfaction for their trip, the research reveals if the boat operators ensure that the passengers put on their life jacket to guarantee safety while on, after, or before leaving the jetty, 40% strongly agree, 27% agree, 13% undecided, 12% disagree while 8% strongly disagree respectively, it can however be concluded that the boat operators ensure that the passengers put on their life jacket to guarantee safety while on, after, or before leaving the jetty for their trip, the research reveals if the respondents prefer the water way to the road transport 32% strongly agree, 33% agree, 12% undecided, 13% disagree while 10% strongly disagree respectively, it can however be concluded that respondents prefer the water way to the road transport for their trip due to the traffic gridlock on the road.

The research reveals if the respondents experience minimal waiting before the boat arrives, 23% strongly agree, 25% agree, 22% undecided, 12% disagree while 18% strongly disagree respectively, it can however be concluded that respondents experience minimal waiting before the boat arrives for their trip, the research reveals if the present state of inland water transport infrastructure is satisfactory enough to fit respondents need, 3% strongly agree, 6% agree, 25% undecided, 29% disagree while 37% strongly disagree respectively, it can however be concluded that present state of inland water transport infrastructure is

satisfactory enough to fit their need for their trip, the research reveals if respondents do not experience difficulty while using inland water transport jetty platform, 40% strongly agree, 27% agree, 13% undecided, 12% disagree while 8% strongly disagree respectively, it can however be concluded that respondents do not experience difficulty while using inland water transport jetty platform for their trip, the research reveals if Government effort at reducing traffic congestion has worked, 32% strongly agree, 33% agree, 12% undecided, 13% disagree while 10% strongly disagree respectively, it can however be concluded that Government effort at reducing traffic congestion has worked for their trip.

The research reveals if there is provision of adequate infrastructure at the jetty for commuters travel comfort in Ikorodu-Marina corridor, 23% strongly agree, 35% agree, 22% undecided, 12% disagree while 18% strongly disagree respectively, it can however be concluded that there is provision of adequate infrastructure at the jetty for commuters travel comfort in Ikorodu-Marina corridor for their trip, the research reveals if the continual improvement and management of inland water transport infrastructure attracted me away from road, 51% strongly agree, 36% agree, 13% undecided, respectively, it can however be concluded that continual improvement and management of inland water transport infrastructure attracted me away from road for their trip.

Test of Hypotheses

The earlier formulated hypothesis shall be tested using regression statistical tools. Regression estimates the coefficients of the linear equation, involving one or more independent variables that best predict the value of the dependent variable. It will be used to test the impact of the independent variable on the dependent variable.

Hypothesis one

H₀: Inland water transport infrastructure does not influence commuter’s mobility along Ikorodu-Marina water corridor of Lagos state.

H₁: Inland water transport infrastructure influences commuter’s mobility along Ikorodu- Marina water corridor of Lagos state.

Variable	Value
R2	0.006
Adjusted R2	-0.010
F-statistic	0.003
p-value	0.956

Source: Field work, 2016

The coefficient value of the regression result presented above reveal the significant impact the variables have on infrastructure influence on commuter’s mobility in the study area. According to the result R-squared measures the success of the regression

in predicting the values of the dependent variable within the sample. It may be interpreted as the fraction of the variance of the dependent variable explained by the independent variables. The statistic will equal one if the regression fits perfectly, and zero if it fits no better than the simple mean of the dependent variable. It can be negative for a number of reasons. A close inspection of the table above indicates that the specified model has a fairly high coefficient of determination. This can be seen from R-squared of 0.006. The R-squared reports that the independent variables can explain about 6 percent of total variation in the influence of infrastructure in the influence of commuter’s use of the water way while 94% are accounted for by other variables other than the infrastructure in the study area.

Considering the coefficient statistics results in order to validate the earlier stated hypothesis, the initially stated null hypothesis will be rejected if the p-value is less than $0 \leq .05$. the result thus reveal a p-value of 0.956, which is over $0 \leq .05$, it is however pertinent to accept the earlier stated null hypothesis which states that Inland water transport infrastructure does not influence commuter’s mobility along Ikorodu-Marina water corridor of Lagos state.

Hypothesis Two

H₀: The improvement and management of inland water transport infrastructure has not attracted commuters away from road travel along the study area.

H₁: The improvement and management of inland water transport infrastructure has attracted commuters away from road travel along the study area.

Variable	Value
R2	0.450
Adjusted R2	0.194
F-statistic	24.895
p-value	0.000

Source: Field work, 2016

The coefficient value of the regression result presented above reveal the significant impact the variables have on the travel behaviour of the respondents. According to the result, it was to ascertain if the improvement of the inland water transport infrastructure has attracted commuters from the road travel along the study area. The coefficient value thus is 0.450, improvement and management of the inland water ways infrastructure will have 45% influence commuters attraction while the other 65% is not accounted for by the variable.

Considering the coefficient statistics results in order to validate the earlier stated hypothesis, the initially stated null hypothesis will be rejected if the p-value is less than $0 \leq .05$. The result thus reveal a p-value of 0.00, which is below $0 \leq .05$, it is however pertinent to reject the earlier stated null hypothesis which states that

The improvement and management of inland water transport infrastructure has not attracted commuters away from road travel along the study area, we therefore go for the alternative hypothesis which states that the improvement and management of inland water transport infrastructure has slightly attracted commuters away from road along the study area, the acceptance of alternative hypothesis is because it receives statistical support.

Hypothesis three

Hypothesis Three

H₀: Inadequacy of infrastructure does not have implication on commuters travel comfort in Ikorodu-Marina corridor.

H₁: Inadequacy of infrastructure has implication on commuters travel comfort in Ikorodu-Marina corridor.

Variable	Value
R2	0.122
Adjusted R2	0.113
F-statistic	13.620
p-value	0.000

Source: Field work, 2016

The coefficient value of the regression result presented above reveal the significant impact of the infrastructure on the comfort of the respondents. According to the result, it was to ascertain if the improvement of the inland water infrastructure has given the commuters desired comfort. The coefficient value thus is 0.122, improvement and management of the inland water ways infrastructure will have 12% influences on the comfort of the commuters while the remaining 88 percent is accounted for by other variables other than infrastructure.

Considering the coefficient statistics results in order to validate the earlier stated hypothesis, the initially stated null hypothesis will be rejected if the p-value is less than 0≤.05. The result thus reveal a p-value of 0.00, which is below 0≤.05, it is however pertinent to reject the earlier stated null hypothesis which states that the Inadequacy of infrastructure does not have implication on commuters travel comfort in Ikorodu-Marina corridor. We therefore go for the alternative hypothesis which states that the continual improvement of the inland water way infrastructure will continually give the commuters comfort which will attract them to the water ways.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

This research had undertaken the examination and analysis of the impact of inadequate inland water ways infrastructure in attracting commuters to the Ikorodu-Marina water corridor of Lagos. It focused on

the activities and operations of the boat operators and the commuters along the Ikorodu-Marina water transport corridor.

CONCLUSION

Despite the commercial use of inland water ways since the beginning of this century, the tremendous potentials of these water ways are yet to be fully exploited. Consequently the inland water ways transportation in Lagos state when compared to other states of the developed countries is still on its embryonic stage.

The factors responsible for the stunted growth of this mode has been found to be the inadequate infrastructural provision for water transport development. Nonetheless, the finding of the study is that several factors militate against the proper development of inland water transportation in the study area which is itemized as follows:

- Lack of ‘adequate funding by previous past government, meanwhile their attention was on other form of transportation not considering the relief it will bring to the road mode of transport.
- Lack of improvement of water ways, which leads to complete neglect by past government
- Inability to stall and maintain buoys, lights, signals, remove wrecks and water hyacinth on water ways.
- Absence of boat maintenance/service centres that that is economical enough to ensure the continuous service of the boat operators.
- Inadequate public awareness and commuter’s education on the advantages of using water transport.
- In conclusion, it can be seen that the underdevelopment of the inland waterways mode of transport and the stunted growth of inland waterways in the study area and Lagos state in general is the lack of funding for the proper provision of infrastructure and appropriate maintenance of Lagos water ways.

RECOMMENDATIONS

Since waterways transport is used for urban intercity services, it has been observed the continual improvement of the sector will reduce congestion on Lagos roads, it is important to develop, fund and provide necessary infrastructure for its growth. Therefore, the following recommendations are deemed helpful.

- The Lagos Inland Water Way Agency should improve the navigability of the waterways in the study area through effective dredging and removal of wrecks and water hyacinth.
- Should try in the area of installation and improvement of navigational aid on the water ways like navigational buoys to aid navigation at night, as it the sector does not operate effectively at night.

- Also, adequate funds should be made available to inland waterways development in the state's budget for the promotion of inland water transport infrastructures which should be judiciously expended for the continuity of the projects embarked upon by Governor Babatunde Fashola administration (SAN).
- Private water transport operators should be encouraged with the needed significant investments on floating jetties, maintenance workshops and personal training to ensure their sustainability.
- Proper monitoring of the activities of the operators should be carried out, to ensure the operators do not use boats that will endanger the lives of the commuters.
- The funds earmarked to the sector for the provision of infrastructure should be monitored to ensure it is judiciously used.
- Continuous awareness of the commuters should be carried out by government in both print and mass media, as majority of the respondents only gets to know about the use of the service through colleague and friends.
- Enforcement on the procurement of life jacket by all boat operators and ensuring all commuters put on theirs before leaving the jetty to ensure their safety.
- Overloading by the boat operators should be checked to enhance their confidence in the transport sector.
- Furthermore, a programme of improvement in navigational aids together with annual dredging to widen and strengthen some identified narrow and tortuous water channel sections in the state should be put in place.
- Also, various private operators should be encouraged to register with the LASWA, which in turn should be responsible for the standardization of facilities like boats, jetties, safety at sea.

6. Gray, L. (2004). "An examination of the problems of water transportations in old Degama Province, Nigeria". *Journal of Waterways, Africa*, (33), 20-26.
7. Kisho, K. (1994). New wave Japanese Architecture. *Academy Editions Ernst & Sohn. Lexington Books, Massachusetts & London.*
8. Kruse, S., & Louis, K. S. (1995). Teacher teaming opportunities and dilemmas. Brief to Principals, *Center on Organization and Restructuring of Schools*, (11), 2-7.
9. Ndikom, B. (2008). Maritime Transport Management and Administration in Nigeria.
10. Ofoedu E.N. (1990). Institute of Marine technology, *Port Harcourt. Unpublished M.sc Arch.*
11. Ojile, M. (2006). Draft Report of the Socio-Economic Characteristics for the Idealization of the Port Harcourt Warri Roads Submitted to Messer allots Nigeria Limited on behalf of the Federal Ministry of Works, Abuja-60.
12. Schrank, D., & Lomax, T. (2007). *The 2007 Urban Mobility Report*. College Station, Texas, *Texas Transportation Institute and Texas A & M University.*
13. Sudar, A. (2005). Measuring non-traditional benefits and costs of inland navigation. *Journal of the Transportation Research Board*, No. 1909. *Washington, D. C., Transportation Research Board of the National Academies*, page 47-53.
14. Tolley, R., & Turton, B. (1995). Transport Systems, *Policy and Planning: A Geographical approach, Burnt Mill, Harlow, Essex: Longman.*

REFERENCES

1. Aderemo, A. & Mogaji, S. (2010). "Rural Transportation of public Facilities in Nigeria: a case study of Education Local Government Area of Kwara State" *Journal of Human Ecology*, 29 (3), 171-179.
2. BowChorley R. J. (1969). Water, Earth and Man, Matheus and company Ltd London.
3. Ducruet, C., & Notteboom, T.E. (2010). "The evolution of maritime networks: Implications for port hierarchies", Annual Conference of the Association of American Geographers (AAG), *Washington DC, April 14-18.*
4. Eric, D. M. (1965). "Your book of waterways" Faber and Faber Ltd., London. 4 -7
5. Fellinda, L. (2006). "World's Water Transport needs further Development". *Transport and Development*, 68-72.