



## Assessment of Ferry Accidents on Navigable Waterways of an Urbanized City in Nigeria

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### General Note



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### ABSTRACT

The study aims at assessing ferry accident cases in Inland waterways in Lagos metropolitan Area of Lagos, Nigeria with a view to determine workable solutions for improvement of ferry services. The study was conducted using questionnaire instrument to extract passengers' perceptions on the major causal factors of ferry accidents in the study area. Secondary data was also gotten from relevant authorities to complement results got from primary analysis. Statistically, descriptive analysis was used to analysis the data; while, Likert rating was adopted to rate the major causal factors and determine the proximate causes of the ferry accident. Hypothesis was tested using Spearman's rho Correlation to determine a degree of relationship between condition of navigable waterways and nature of ferry accidents. Findings revealed that the major causal factor of ferry accident in the study area is environmental factor. Bad weather condition involving stormy weather and poor visibility due to fog had the highest rating score. Mechanical factors also contributed to ferry accident taking cognisance of poor maintenance culture of the operator. Challenges faced by ferry services include lack of funding to procure necessary navigation equipment, poor condition of navigable waterways and attitude of users toward transport rules and regulation. It is however recommended that necessary provisions are made to protect water environment and improve safety as a paramount factor and to maximize embedded benefits in ferry operation and services.

**Keywords:** Ferry, Accident, Route, Water and Transport

## 1. INTRODUCTION

Transport plays significant roles in the livelihood of man as well as in functionality of economy of regions, nations and world at large. It links continents to continents, countries to countries and localities to localities. It provides access to locations of relative landuse, economic and socio-cultural activities thereby boosting social and economic developments of nations that involve in it. Despite all these advantages, it has social costs in form of accident that leads to loss of lives and properties. There are different modes of transport, they include: Air transport, Land and Water Transport. This study focuses on water transportation and its challenges in terms of accident.

A water accident is an unintended event involving fatality, injury, ship loss or damage, other property loss, damage or environmental damage that are related to water ventures. Its severity may vary from no vessel damage to the complete loss of the vessel, no cargo damage, to loss of the entire cargo, and no crew injuries to deaths (Talley, Jin, & Kite-Powell, 2005). In the view of this, alleviating marine accidents and fatalities becomes a central mark to global debates most especially on ferry mishaps. Problems associated with transportation safety are of pronounced degree covering all modes of transportation, all economic levels, and all transport purposes. Inland water transport is one of the oldest economically and environmentally friendly and sustainable mode of transportation in moving people and goods; and in some areas the only mode through which commodities get to localities and only means of people's mobility and access to basic services. Safety issue is a major problem that needs a thorough check and balance in ensuring smooth and reliable transport service to satisfy the needs of the users.

In Nigeria, cases of marine ferrying casualties involving personal injury, deaths and property/ environmental damage have grown in tandem with increased vessel traffic associated with oil prospecting activities and other commercial seaborne transportation in inland waterways. A statistics (cumulative figures) based on the study carried out by (Dogarawa, 2012) indicate that between year 2000 to 2009, a total number of five hundred and fifty-two (552) persons died as a result of ferry mishaps in inland waterways of Nigeria. Based on this estimate, annual average rate of fatality is found to be 55 persons. Further damages are attached to loss of life and properties as well as total loss of vessels or water crafts. Obviously, Nigeria's inland waterway is not the only area that experiences these phenomena; similar cases of water crafts or vessels accidents at sea (and in seaports) have also been documented in nations that are involved in water transportation. (Darbra & Casal, 2004) conducted a study on 471 cases of marine accidents that occurred from 1941-2002 in Hong Kong. They observed that 57% of the accidents occurred while vessel was underway at sea and 43% of accident in ports.

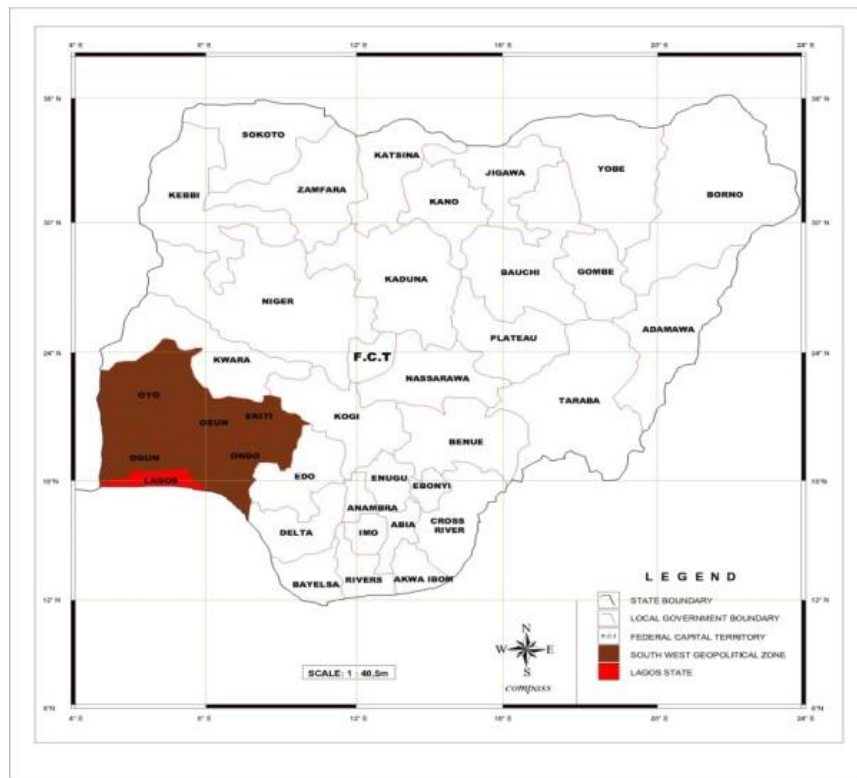
Waterways Authorities in Lagos state, Nigeria has recorded several ferry accidents contributing to fatality rate in Nigeria as a nation. It is noteworthy to say; lives and properties of Nigerians have been lost from this unwanted scenario. Urbanisation process has contributed greatly to the huge population in Lagos state leading to increase in the number of car and other vehicles on intra-city roads. Many people spend longer time on the roads than offices and places of work. Hence, commuters have resorted to finding water transport as an alternative means of transportation in order to reduce time spent on roads, to avoid delay and lateness to places of work. Lagos Metropolitan is a found to be a very busy area where economic activities of Lagos state is concentrated, lands and important locations are been separated by waters. Meanwhile, in order to achieve a balanced and sustainable economic development in Lagos state, water transportation and its safety are central means to greater achievement.

Thus, the correct way to respond to these accidents and casualties and exploit its knowledge potential is to assess and analyse the "mistakes" that caused them and attempt to prevent them from appearing or reoccurring ever again.(Xavier & Ventikos, 2003). Some studies have conducted research analyzing the determinants of accident involving marine vessels in Northern Nigeria's waterways like (Dogarawa, 2012), but never made use of spatial analysis to unveil distribution pattern of ferry accidents. Donatus (2013) wrote on marine vessel accident resulting from oil haulage and other commercial seaborne transportation activities in Niger-Delta coastal regions of Nigeria. The increasing population of Lagos state and corresponding number of cars on roads, Lagos residents resort to water transportation as alternative means of transportation in a bid to escape the traffic holdup. This study involved assessing causal factors of ferry accidents in inland waterways of Lagos, south western Nigeria with a view to suggesting preventive measures that would improve water transport safety. The objectives of the study include: assessing passengers' perception on causal factors of ferry accidents in the study area; examine factors influencing the challenges that confront management and control of marine accidents in Inland waterways of South Western, Nigeria.

### Study Area

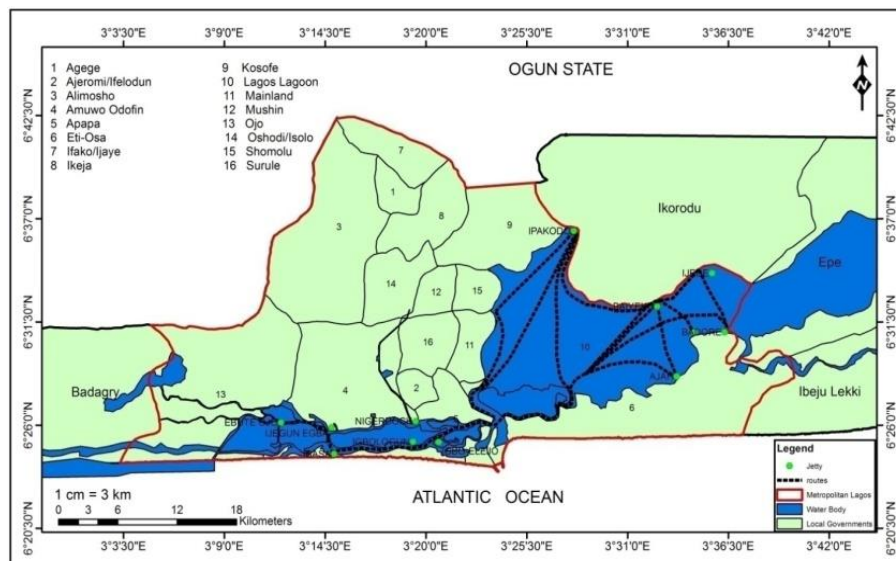
Lagos state is located in the south west geopolitical zone of Nigeria, precisely within latitudes 6° 23'N and 6° 41'N and longitudes 2° 42'E and 4° 00'E. Lagos is one of the African mega cities. Figure 1 shows the regional location of Lagos state in south west geopolitical zone of Nigeria. Lagos state is bounded on the western part by Benin republic, on the south is Atlantic Ocean (Bight of Benin) where it has a link to international waters and sea borne trade, to the north is Ogun state while on the east is partly Ondo

state. Figure 2 shows the major navigational routes in the study area. The study was carried out along these routes. There are 10 navigable routes identified for the study and the list is shown in table 1.



**Figure 1: Map of Nigeria showing southwest geopolitical zone and Lagos State**

**Source:** Digitized map by the author (2019)



**Figure 2: Map showing the water routes in the study area**

**Source:** Akinbamijo et al, 2016.

Several studies have been conducted on watercraft accidents and incidents. (Talley, Jin, & Kite-Powell, 2005) investigate determinants of the property damage and injury severities of cruise vessel accidents. In his study, detailed data of individual cruise vessel accidents for the 11-year time period (1991-2001) that were investigated by U.S Coast Guard were used to estimate cruise-vessel accident property damage and injury severity equations. The estimation results suggest that cruise vessel damage cost per

vessel gross ton is greater for: allusion, collision, equipment-failure, explosion, fire, flooding, and grounding cruise vessel accident than for other types of accidents and human cause.

Yip (2008) investigates port traffic risk employing historic accidents records involving oceanic ships which visited Hong Kong port. Using negative binomial regression model, it was found that collision accidents are the frequent incidents in heavy port traffic situations. Passenger-type vessels were found to have higher potential for injuries during accidents. Among the variables tested which explain occurrence of accidents; vessel's port of registry, type of vessel, type of waterway were found significant. Accident analysis, which always implies an accident model (Hollnagel, 2004), is a very important process for providing input to the development of proactive and cost-effective regulations (Psarros *et al.*, 2010).

## 2. METHODOLOGY

The study involved acquisition of data through primary data. Questionnaire was administered to passengers that patronise the ferry services along some selected corridors in Lagos Metropolitan area. This was done in order to assess the perception of respondents with respect to causes of ferry accidents and incidence. Personal interview was conducted in form of Focus Group Discussion (FGD) in order to extract basic information from the respondents especially government officials. Relevant agencies and authorities were visited and relevant information regarding inland waterway transportation was collected, such as LAMATA, National Inland Waterways Authority (NIWA) and Lagos State Waterway (LASWA).

Presently, there are a total number of 29 jetties operating commercial activities across inland water routes in Lagos state with attendant population of commercial operators among which are Metro ferry, Origin, Sea coach, Texas, Goodness, Sea cat and so on. The research population for this study is based on daily average population of ferry passengers in the study area.

All these waterway corridors are located within Lagos Metropolitan Area and they are major waterway corridors in the Metropolitan Lagos. Along these selected corridors are Jetties such as Origin, Metro Jetty, CMS/NIWA Jetty, Ipakodo Jetty, Ajah, Badore Jetty, Ijede, Igbologu Jetty, Igbo Elejo Jetty, Ibaso Jetty, Ijebu-Egba, Ebute Ojo and Niger Dock. The jetties were selected based on waterway zones. The result of the analysis was used to develop general research inferences. Table 1 shows the breakdown of number of identified waterway routes and selected terminals (Jetties) in the study area.

**Table 1: Breakdown of selected waterway corridors and terminals (Jetties) in the study area**

Selected waterway corridors (waterway Routes)		Jetties along the corridors	
1.	Lagos Central (Marina, EbuteEro) to Ikorodu;	1.	Metro Jetty
2.	Badore-Ijede;	2.	Origin Jetty
3.	Ikorodu to Agboyi (Oworonshoki);	3.	Ipakodo Jetty
4.	Lagos Central (Marina, Ebute-Ero) to Agboyi (Oworonshoki);	4.	Ajah Jetty
5.	Ikorodu to Victoria Island;	5.	CMS/NIWA Jetty
6.	Ikorodu-EbuteEro;	6.	Badore Jetty
7.	Agboyi (Oworonshoki) to Victoria Island;	7.	Ijede
8.	CMS to Origin/Metro Jetty Ikorodu	8.	Marina
9.	Victoria Island to Lagos Central (Marina, EbuteEro)	9.	Maroko Jetty
10.	EbuteOjo-IjegunEgba	10.	Igbologu Jetty
		11.	Igbo Elejo Jetty
		12.	Ibaso Jetty
		13.	IjebuEgba
		14.	EbuteOjo and
		15.	Niger Dock.

**Source:** Author's field work, 2019

The study area is considered suitable for the study because of its huge and distinctive human and vehicular traffics in the Lagos state. It is characterized by heavy population with a wide area occupied by water bodies (such as lagoons, waterways, rivers and creeks), Lagos metropolitan area is located in the this fastest growing city of the nation 'Nigeria', and most heavily motorized urban area with its corresponding effects on other modes of transports; such as an overflow of traffics from road to water transportation. Hence, the research population was determined with the use of passenger manifest. However, the magnitude of daily patronage of passengers on one-trip travel was determined precisely morning trip and evening trip. Seven-day passenger/trip survey was

conducted and the total number of passengers for the seven days in the selected jetties was 32,855 passengers on morning and evening traffics between 6:30am and 6:00 pm. This gave a daily average passenger population to be:

$$\text{Daily average passenger population} = \frac{32855}{7} = 4694 \text{ passengers}$$

Hence, the research population used for this study was 4694 ferry passengers. The sample size can be determined by the introduction of the statistical formula postulated by Yamane (1967). Estimated Passenger Population size (N1) is **4694**. Hence, 196 passengers were sampled. The data collected was analysed descriptively and statistically. A Likert rating was used to establish the major causal factors of ferry accidents on passengers' perception. Spearman's Correlation was used to test Hypothesis statement to show relationship between Waterway routes/corridors and Nature of ferry accident occurrence in Lagos inland waterways. The Hypothesis stated that: 'Waterway routes/corridors do not have significant relationship with Nature of ferry accident occurrence in Lagos inland waterways.

### 3. RESULTS AND DISCUSSION

Study revealed a total number of ferry passengers interviewed to be 196. Hence, Table 2 indicates the sex distribution of ferry passengers who also responded to certain questions in the questionnaire administered. Out of One hundred and ninety-six (196) ferry passenger 119 (60.7%) ferry passengers were male while, 77 passengers (39.3%) were female. The statistic reflects that male patronise water transportation than female passengers. Therefore, male are more exposed to ferry accidents, Incidents and fatalities. The questionnaire administration was an absolute administration; all passengers found in each ferry were administered while in transit. All passengers found in each of the ferry were given opportunity to answer questionnaire.

**Table 2: Socio-Economic Characteristics of ferry Passengers in the study area**

	Variable	Frequency	Percent
Gender	Female	77	39.3
	Male	119	60.7
	<b>Total</b>	<b>196</b>	<b>100.0</b>
Occupation of Ferry passengers	Trader	56	28.6
	Artisan	34	17.3
	Civil servant	55	28.1
	Farmer	3	1.5
	Others- students, seaman, company worker	48	24.5
	<b>Total</b>	<b>196</b>	<b>100.0</b>
Years of Patronage	0-5 years	64	32.7
	6-10 years	69	35.2
	11-15 years	42	21.4
	16 years and above	21	10.7
	<b>Total</b>	<b>196</b>	<b>100.0</b>
Reasons for patronising Water transport	Save and cheaper	26	13.3
	Faster	147	75.0
	no alternative choices	23	11.7
	<b>Total</b>	<b>196</b>	<b>100.0</b>

**Source:** Author's field survey, 2019

Traders constituted 28% of the ferry passenger patronage, 17.3% are Artisan, Civil servants are 28.1, farmers are 1.5% while, other category of occupation such as seamen, students, company worker represent 24.5% of the total number of ferry passengers interviewed. Inference from this statistics revealed that traders and Civil servant constitute the majorities of passengers (users) that patronise water transport services. Company workers and students also represent 24.5% of sampled ferry passenger respondents.

Passengers who have been patronising water transportation for 16 years above till date were much despite series of ferry accidents/incidents experienced in the area. This however shows the significance roles of water transport services to socio-economic development of people in the study area. Table 3 indicated that 35.2% of the ferry passengers have been using ferry transport service for 6-10 years; this is followed by 32.7% of ferry passengers who have been using ferry as means of commuting for 0-5 year while 21.4% depend on water transport means since 11-15 years. As shown in the table 1, 147 (75%) revealed that they patronise water transport services because it is a faster. They added that they resorted to using ferry transport services in order to avoid problem associate with delays on road transport. 26 (13.3%) of ferry passengers made it known that ferry transport service is safe and cheaper to their destinations; while 23 (11.7%) responded that they have no alternative means other than water transportation to their destinations. This category of passengers revealed their feelings that accident scenarios on these corridors are major factors that discourage them from using ferry services but there is nothing they could do since their residences is located where water transportation cannot be avoided.

#### **Ferry Passengers' perception on Major cause(s) of the accident or incident witnessed.**

As shown in table 3, 88 (44.9%) passengers claimed that human errors are major cause of ferry accidents/incidents. Environmental influence associated with submerged objects and weather actions was described as major cause of ferry accident/incidents representing 33.7% of ferry passengers' response. 17.9% ferry passengers revealed that Mechanical faults contribute ferry accidents/incidents in inland waterways. 3.6% passenger respondents attributed ferry accident causes to Government faults. They claimed that socio-economic problems which has cumulated to ferry robbery/piracy and use of substandard, improvised and low technology are all function of economic and political imbalance in the country. Human related errors have the highest frequency of response, followed by Environmental factors and mechanical faults.

**Table 3: Ferry Passengers' perception on Major cause(s) of the accident or incident**

S/N	Major causes	Frequency	Percent
1	Mechanical fault	35	17.9
2	Human Error	88	44.9
3	Environmental -submerged object(s) and weather	66	33.7
4	Government fault	7	3.6
	<b>Total</b>	<b>196</b>	<b>100.0</b>

**Source:** Author's field survey, 2019

#### **Analysis of Ferry Passengers' Likert Rating of the Proximate causes**

Table 4 indicated the result from five-point likert ratings in which 72.4% of ferry passengers strongly agreed that rainstorm is the major and common cause of ferry accident on the inland waterways corridor in the study area, 27.6% ferry passengers 'agreed' that rainstorm contributes to causalities and fatalities in water transportation. No passenger either disagreed or strongly disagreed with this assertion that rainstorm contributes immensely to ferry accidents in the study area. Rainstorm (weather factor) was rated highest with a total score of 730 (93.11%) out of aggregate score of 784 as shown in Table 4. This is followed by Inadequate Maintenance with total score of 670 (85.46). 48.0% of ferry passengers strongly agreed that it is inadequate maintenance of watercrafts that usually cumulate into engine failure and other vehicle defects. Hence, it is one of the major and common causes of ferry accident on the inland waterways in the study area, 45.9% ferry passengers 'agreed' that poor maintenance culture of the ferry operators is the major problem that causes many ferry accidents and contributes to causalities and fatalities in water transportation. 6.1% were undecided in their response to the question. Also, no passenger either disagreed or strongly disagreed with this assertion of the accident cause in the study area. Water tides/turbulence was also rated third with a total score of 636 (81.12%).

Based on data gotten from Nigeria Inland Waterways Authority (NIWA), the incessant and high frequency of ferry accidents associated with turbulence and high tide is noticeable around Ikorodu axis of the Study area. The high turbulence in Ikorodu water corridor was attributed to frequent wave actions. Wave actions in Ikorodu axis are much more violent than wave turbulence around Apapa axis despite its distance to the shore of Atlantic Ocean. The study however gathered that there are rivers from different locations in the south west, Nigeria that flow into Lagos lagoon at Ikorodu. The lagoon is fed in the north by Ogun River (Solarin, 2003). River Ogun took its source from Igboho, Oyo River with many tributaries and empties its large volume of waters into the lagoon. Other rivers that empty their waters into Lagos lagoon in Ikorodu axis are Ogbere River, River Majidun, Ogudu river and Agboti creek (see figure 4). The situation is responsible for the high tide/turbulence at the Ikorodu axis of Lagos Lagoon coupled with the ocean currents from the Atlantic Ocean. Vehicle Defects (engine failure, hull leakage had a percentage score of 80.74; while,

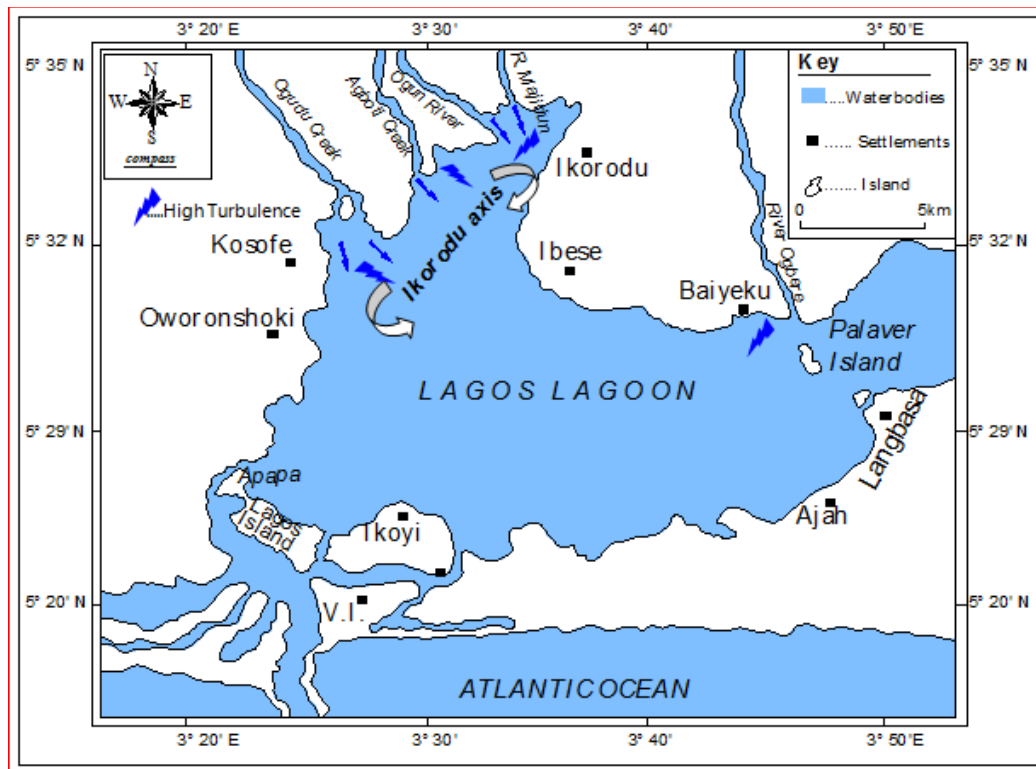


Traffic violations/ mooring violation and overloading scored 80.61%. Study revealed that some ferry passengers are found of travelling without lifejackets on despite overloading of the watercraft in transit. Figure 3 shows an overloaded passenger boat carrying passengers without safety jackets. Second rated class of factors of ferry accident causes is Mechanical problems with 78.95 percentage score; this is followed by Environmental factors in terms of Submerged objects - derelicts logs/ferry wreck with percentage scored 602 (76.79%).



**Figure 3: Passenger Boat in transit overloaded with passengers without life jackets**

Source: Author's survey, 2019



**Figure 4: Map showing inflow of rivers into Lagos lagoon at Ikorodu axis.**

Source: Digitized by the author, 2019

Table 4: Analysis of Ferry Passengers' Likert Rating of the Proximate Causes

Major Causal Factors	Proximate Causes	Strongly Agree Score (Sc) = 4		Agree Score (Sc) = 3		Undecided Score (Sc) = 2		Disagree Score (Sc) = 1		Strongly Disagree Score (Sc) = 0		Aggregate Score = 784	
		(f)	Scores F*Sc	(f)	Scores F*Sc	(f)	Scores F*Sc	(f)	Scores F*Sc	(f)	Scores F*Sc	Total Score	Percentage Score
Human Factors	Drivers impairment	0	0	49	147	111	222	27	27	9	0	396	50.51
	Fatigue/tiredness/sleep/deafness	31	124	86	258	61	122	6	6	12	0	510	65.05
	Traffic violations/ mooring violation, overloading	94	376	52	156	50	100	0	0	0	0	632	80.61
	Over-speeding	67	268	81	243	30	60	9	9	9	0	580	73.98
	Distractions/ unawareness	10	40	49	147	83	166	30	30	24	0	383	48.85
	Miscalculation/ infringements	3	12	77	231	80	160	24	24	12	0	427	54.46
	Other road users mistakes	48	192	79	237	59	118	10	10	0	0	557	71.05
Mechanical Factors	Inadequate Maintenance	94	376	90	270	12	24	0	0	0	0	670	85.46
	Vehicle Defects (engine failure, hull leakage)	87	348	76	228	24	48	9	9	0	0	633	80.74
	Vehicular faults	27	108	68	204	98	196	0	0	0	0	508	64.80
	Other Mechanical problems	99	396	39	117	48	96	10	10	0	0	619	78.95
Environmental Factors	Bad weather (rain, fog)	142	568	54	162	0	0	0	0	0	0	730	93.11
	Bad road/water condition (tide)	78	312	96	288	15	30	6	6	1	0	636	81.12
	Bad road designs (narrow/shallow waterway)	0	0	51	153	87	174	49	49	9	0	376	47.96
	Signal failure	52	208	77	231	13	26	42	42	12	0	507	64.67
	Submerged objects (logs/ferry wreck)	88	352	67	201	22	44	5	5	14	0	602	76.79
Socio-Economic Factors	Government policies	19	76	40	120	50	100	65	65	22	0	361	46.05
	Low technology level	10	40	29	87	51	102	58	58	48	0	287	36.61
	Corruption of safety/jetty personnel	26	104	18	54	3	6	59	59	17	0	223	28.44

Source: Author's survey, 2019

Note: **Strongly Agree** = 4; **Agree** = 3; **Undecided** = 2; **Disagree** = 1; **Strongly Disagree** = 0

### Research Hypothesis Testing

**Ho:** Waterway routes/corridors do not have significant relationship with Nature of ferry accident occurrence in Lagos inland waterways.



**Table 5:** Spearman's rho Correlation

Spearman's rho Correlations <sup>c</sup>		Nature of the accident	Waterway routes
Nature of ferry accident	Correlation Coefficient	1.000	.110
	Sig. (2-tailed)	.	.126

**Source:** Author's survey, 2019

Result: There is a weak negative correlation between waterway routes/corridors and nature of ferry accidents. There association is not statistically significant since,  $r_s = .110$ ,  $p = .126$  which is higher than  $p < .05$  (a common threshold for statistical significance for 95% confidence interval). Hence, the Null Hypothesis is accepted, while the alternative is forgone.

It can be inferred that waterway routes/corridors do not have significant relationship with nature of ferry accidents in inland waterways.

#### 4. CONCLUSION

Lagos state has an increasing population with a corresponding increase in the number of vehicles on roads. Movement of traffics has become problematic as vehicles on road face huge traffic jams on a daily basis. Hence, Lagos residents resorted to water transportation as alternative means of transportation in an attempt to avoid unnecessary delays from daily the traffic holdup that has become the order of the day in the state. Despite these advantages, the country is yet to maximize the opportunity in water transport systems and make it a sustainable and reliable alternative means of transportation to road and air. High frequency in fatalities in ferry accidents is taking a negative toll on water transportation in the country. Prospective passengers are now avoiding this means of transportation and sticking to road transportation in Lagos Metropolitan area thereby further stretching the road infrastructure.

There is no doubt that a perfect well planned transport system is an essential task to determine the quality of life enjoyed by the people and the functioning of trade, economy, and many other essential services. It is therefore necessary that a national policy and statutory institutional framework, effect control on management and direction of funding process and a manpower development strategy be adopted for water transport services

#### Recommendations

The way forward is focused on the part of Ferry passengers and Management authorities saddled with safety and management responsibilities pertaining to waterways. The recommendations include:

- 1.The Authorities in charge of inland water transport safety as a matter of importance should have a full attention on safety to reduce the rate of accident\incidents particularly overloading and other traffic violations by ferry passengers and ferry personnel. This study revealed that some ferry passengers are found of travelling without lifejackets on. Study also revealed that most of the engine failure on the waterways has been attributed to throwing of garbage or trashes into water by ferry passengers. This activity need to be discouraged by relevant authorities. Relevant authorities should treat this attitude as serious offences and treat all traffic offenders accordingly. Meanwhile, ferry operators who operate at their whims and caprices should be prosecuted. Information gathered confirmed that, overspeeding is a causal factor ferry accidents/incidents. This has been attributable to lack of stalled speedometer in the watercrafts (ferries) and reckless driving. Since. Ferry that are not fitted with necessary installations like speedometer, headlights etc should not be registered to operate on the waterways. Speed limits sign post should planted along the waterways and that all ferry operator must obey all posted signs. New regulations by NIWA stating that ' All commercial ferries must adhere to a speed limit of six knots around jetties and a maximum of 15 knots as service speed as well as provide manifest of passengers on board may not be effective if speed devices like speedometers are not stalled in the watercrafts in transport operations and services.
- 2.Weather forecast department ashore needs to be well equipped with new sophisticated weather equipment so that correct and accurate weather report can be sent in due time. There is need to embark on repairs and construction of terminal facilities along some routes to help shorten or make water commuting safer. Water transport terminal/Interchange infrastructure should be provided for communities heavily dependent on water transport to move farm produce and people. The available jetties in other areas of inland water coverage are dilapidated and not fit for loading cargoes and boarding passengers. During raining season, few dilapidated jetties usually submerge or collapse into water. An instance of this was a jetty collapse at Ajah, Lagos state which claimed the lives of 5 people and injured 3 people on the 27<sup>th</sup> of May, 2007. NIWA report, 2007.

3. There should be constant clearing and maintenance of the waterways to free the transits corridors from all manners of obstacles such as garbage/wastes, derelicts, logs, wrecks and abandoned properties. This will curb ferry accidents associated with submerged objects. Most of the accidents fatalities in Lagos Metropolitan area are attributed to 'ramming' unto submerged objects. Weather forecast department ashore needs to be well equipped with new sophisticated weather equipment so that correct and accurate weather report can be sent in due time.

### Conflict of interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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### Peer-review

External peer-review was done through double-blind method.

### Data and materials availability

All data associated with this study are present in the paper.

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