



Inland Water Transport and Urban Mobility in Ikorodu-Ebutte Ero Route, Lagos, Nigeria

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Abstract

Lagos city has abundant navigable inland waterways which if fully harnessed would help minimise road traffic congestion, pollution and provide low cost means of long distance travel within the city. This study examines inland water transport services on Lagos lagoon focusing on Ikorodu-Ebutte Ero route. Primary data were obtained using structured questionnaires. While, secondary data were sourced from relevant government and private agencies. Data were analysed using descriptive techniques including frequency counts, tables and graphs. The results revealed an inadequate provision of terminal facilities and vessels in the area. It was also found that most (67.3%) of the trips via water transport in the were mainly for work purpose. In addition, low patronage was observed and it was found to be mostly due to comparatively high cost of fares and passenger safety concerns, as indicated by 67.4% and 58.7% of the respondents respectively. Furthermore, high income earners were found to patronise this mode than low income earners. The high frequency of use of water transport by the respondents (71.3% travel by water every day) indicates that, this mode has great potential of being widely adopted, if greater attention is given to its development by both the government and private sector. There is, therefore, a need for more investment in water transportation in the area through the provision of modern infrastructure and vessels.

Keywords: urban mobility; inland waterways; transport services; sustainable transportation; integrated transport.

1. Introduction

Modern cities are highly transport dependent and this makes it essential for cities to develop efficient transportation systems that provide effective links within the city and for both the national and global transportation systems (Hoyle, 1993; Kurniasari *et al.*, 2018). A side from being the oldest means of transporting goods and services, inland waterways have been associated with facilitation of commerce, provision of employment and wealth creation among many other benefits (Gray, 2004; Fellinda, 2006; Christodoulou *et al.*, 2019; Dai *et al.*, 2019; Wiercx *et al.*, 2019; Tanko *et al.*, 2019; Hossain *et al.*, 2019). Looking back to the period of the industrial revolution in Europe, waterways played an essential role. They served

as initial corridors of transportation and many of them eventually became important areas of commerce and industrial development. Several cities of the industrial revolution era (such as Oslo, Hamburg and Liverpool among others) had most of their industrial and commercial activities located close to the waterfronts. However, from the mid-20th century, the importance of waterborne transport declined significantly with the increasing development of motorways and the associated inland urban sprawl development (International Association of Public Transport, 2013).

However, in the recent years, increasing congestion on urban roads has directed attention to the development of other more sustainable forms of transportation. In addition, the fact that efficient transportation systems serve as catalyst for sound land use planning is increasingly being recognised. Both of these reasons have provided an opportunity for water transport to play more significant role in urban mobility schemes in many parts of the world (International Association of Public Transport, 2013). Water transport provides the opportunity for improving urban transportation by helping to provide faster (hardly experienced congestion), more efficient and better integrated transport services for the urban area (Hoyle, 1993).

Nigeria has about 8,600 kilometres of inland waterways and an extensive area of coastland of over 800 kilometres (Ndikom, 2013). Up to early 1960s, inland waterways provided important routes for access from the coast to the hinterland and accounted for more than 30% of the total produce transported in the country. However, by the late 1960s the significance of this important means of transportation had declined. At present only about 3,000 kilometres of the country's inland waterways is being harnessed (Badejo, 2011). Although, water transport is known to be comparatively cheaper and most efficient for riverine communities, this mode of transport is currently highly neglected and undervalued in the country (Ndikom, 2013; Adejare *et al.*, 2017).

Lagos, the commercial capital of Nigeria has been observed to possess the necessary inland waterway network capacity to transport commuters to most parts of the city, but the waterways are grossly under utilized. The existing water transport facilities are inadequate both in terms of size and access to commuters (Adejare *et al.*, 2017; Ogunbajo *et al.*, 2017). Ademiluyi *et al.*, (2016) also observe that in spite of the numerous merits of water transport such as the low cost, larger capacity and safety, this mode of transport is yet to be fully tapped to achieve the potential benefits it possesses. They, therefore, called for more attention to water transportation in the State, in terms of greater investment through public or private partnership. It has also been noted that the Lagos State Government's 30 year transportation

improvement plan of integrating the Bus Rapid Transit (BRT) with light rail schemes may not solve the congestion problem, except it also incorporates the water transport mode (Edelman, 2015).

The improvement of water transport in Lagos has the potential to help address the serious road congestion and its associated problems such as extended travel time, loss of man hour, and negative effects on the environment and human health. If well-developed, water transport would help improve mobility since it could easily be organized to have fixed travel time because it hardly experiences congestion (Bayode & Ipingbemi, 2016; Tobias *et al.*, 2019; Tannum & Ulvensøen, 2019; Iamtrakul & Wongbumru, 2019; Łapko & Panasiuk, 2019; Iamtrakul, 2018). Focusing on water transport is important and relevant in Lagos, because of its high potential for developing this mode of transport. It is also more economical and sustainable compared to road transport. This is because, in the long run, it entails less financial investment since it requires less maintenance and has higher capacity for passengers and goods.

Although some other studies (Adejere *et al.*, 2011; Ademiluyi *et al.*, 2016; Ogunbajo *et al.*, 2017) have been carried out on inland water transport in Lagos State, this study is different from the previous ones because it specifically focuses on the Ikorodu-Ebutte Ero route. This study also adopts both quantitative and qualitative methods essential for an in-depth examination of activities on the Lagos waterways. This study examines the operation of inland water transport along the Ikorodu-Ebute Ero route in Lagos City, with a view to recommend strategies for raising its capability as a mode of transportation in the area. The specific objectives are to: examine the available water transport facilities; determine its contributions to passenger movement; examine the characteristics of the passengers; ascertain the problems associated with use of water transport; and to suggest possible strategies to improve water transportation in the area.

2. Area of Study

Lagos state is located between Longitude 2° 42' East and 3° 42' East and Latitude 6° 22' North and 6° 52' North, in the Southwestern Nigeria. It occupies an area of 3,475.1 km² with 22% of the total land area consisting of creeks and lagoons. It lies entirely within the coastal plain and the land does not rise over 650 m above the sea level. Most of its land area lies below 320 m above sea level and this subjects most of the areas to floods and beach erosion.

According to the 1991 national census the State had a population of 5,725,116, which had increased to 9,113,605 by 2006. The population was estimated to have risen to 11 million by 2011 and to 12.5 million in 2016 (Nigerian Bureau of Statistics (NBC), 2008 and 2013). The city’s metropolitan area which had a population of only 290,000 in 1950 is now estimated to have a population of over 12 million and it is expected to grow to be the world’s third largest city by 2050.

Seventeen out of the twenty Local Government Areas (LGAs) in the State fall within the metropolis while twelve LGAs encompass riverine communities (Figure 1). Lagos State operates 12 ferry routes under the supervision of Lagos State Water Authority (LASWA). The routes as identified by Ademiluyi (2016), Bayode & Ipingbemi (2016) are Ikorodu-Marina/CMS; Marina-Mile 2; Ikorodu-Addax/Falomo; Ikorodu-EbuteEro, Marina-IjegunEgba-EbuteOjo; Mile 2-Marina/CMS-Mekwen-Falomo; Badore-Ijede; Badore-Five Cowries; Marina- Oworonshonki; EbuteOjo-IjegunEgba; Oworonshonki-Five Cowries; and Baiyeku- Langbasa.

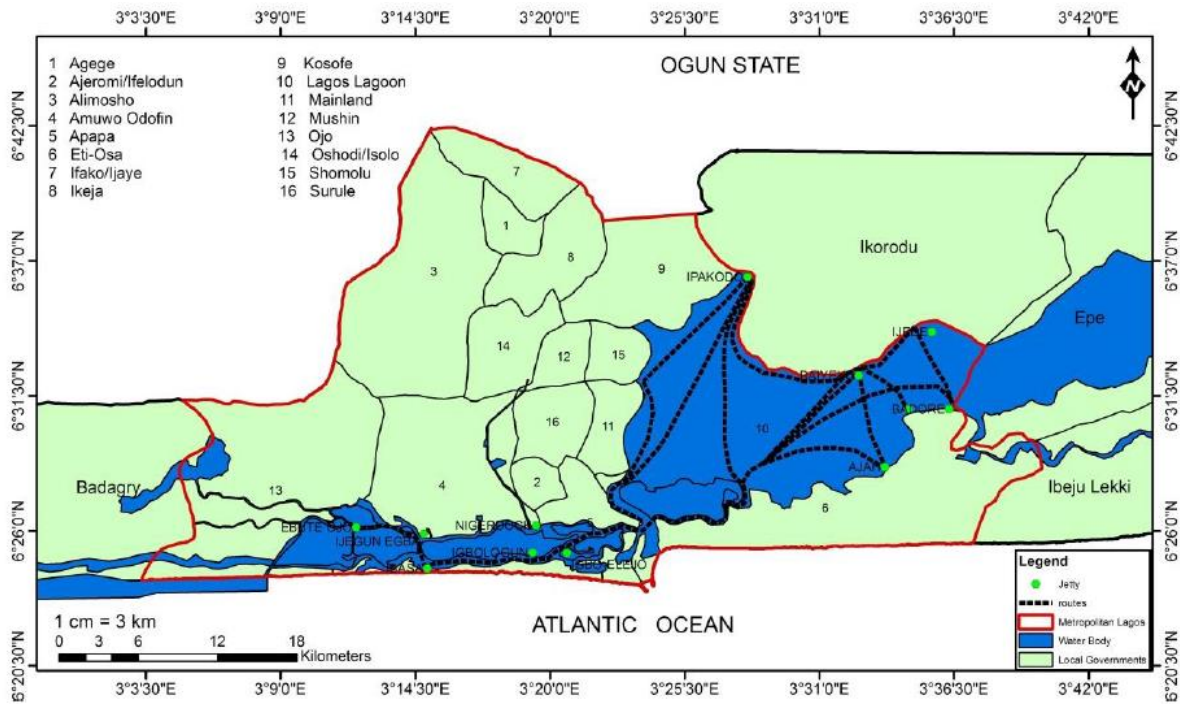


Figure 1. Lagos Inland Waterways Routes

Transportation in the study area is mostly by road which accounts for about 90% of traffic flow in the area. Despite the abundance of waterways in Lagos, waterborne transport is not as popular as road transport to get around the city. Apart from the few regular ferry

services between Lagos Island and the Mainland, fibre-covered motorised boats and canoes also operate passenger services on the lagoon and some of the creeks.

3. Methods

Data used for this study include data on available water transport facilities, socio-economic and travel characteristics of the passengers, passenger movement and challenges militating against the development of inland waterways in the area. Secondary data were obtained from transport departments of riverine Local Government Areas. Official data were also obtained from the Lagos State Ministry of Works and Transport, Lagos Metropolitan Area Authority, Lagos Water Authority and Lagos Ferry Corporation.

Primary data were obtained through questionnaire survey using two types of questionnaire. Questionnaire (A) was used to derive information from the Union officials of vessel operators at the two operational jetties in the area, Association of Tourist Boat Operators of Nigeria (ATBOWNATION) and Sea Coach water Transport Union. The data included number, types and capacity of vessels and number of trips made per day. Other jetties in the area which are Ikorodu Terminal (Operated by Lagos State Government) and Metro Ferry Water Transport were not in operation at the time of the survey. Questionnaire (B) was used to gather information from users of water transport services. After it was estimated through a reconnaissance survey that about 3,000 passengers are transported through the two sampled jetties per day, five percent (150) of the passengers were sampled for the study. This is at 7.8 margin of error and 95% confidence level. Systematic random sampling was used to select the passengers on whom the questionnaire was administered. The questionnaire survey was conducted with the aid of four research assistants who were adequately trained for the survey. The data collected were analysed using descriptive techniques including frequency counts, tables and graphs.

4. Results and Discussion

4.1 Water Transport Facilities Available in the Area

There are four jetties at Ikorodu area of Lagos state. These are the Ikorodu terminal Jetty (owned by the Lagos State Government), Association of Tourist Boat Operators and Water Transporter of Nigeria (ATBOWNATION) Jetty, Metro Ferry Water Transport Jetty and Sea Coach Water Transport Jetty (all privately owned). However, only two of them; ATBOWNATON and Sea Coach Water Transport Jetties were functional at the time of the study in June 2017. The main consequence of inadequate number of operational jetties in the

area is that people were greatly restricted from accessing water transport mode in the area. The ATBOWNATON jetty had a total of 56 vessels while Sea Coach jetty had 13 vessels operating from it as shown in Table 1.

Table 1. Available water transport vessels in the area

Name of jetty	Number of vessels	Capacity of vessels
ATBOWNATION Jetty	56	20
Sea Coach :		
1. Shutter	1	2
2. Cruiser	2	31
3. Coaster	10	35
Total	69	88

As also shown in Table 1, the vessels are of different capacity and quality. While the ATBOWANATION use standard vessels of 20 passenger capacity, Sea Coach jetty operators use a variety of vessels with capacity between two to 35 passengers. Most of the vessels were fibre covered locally manufactured vessels while a few were imported standard vessels which were more expensive.

An examination of other supporting facilities in the area covered the car parking facilities, passengers’ lounge and other facilities. For instance ATBOWNATON jetty has a car parking facility with the capacity of 80 cars while the Sea Coach’s facility has a capacity of 50 cars. The Sea Coach jetty has other facilities such as restaurant and restrooms which were not available at ATBOWNATON jetty (Table 2).

Table 2. Other facilities at the jetty area

Facilities	Condition of facilities at sea coach jetty	Condition of facilities atbownation jetty
Car Park capacity	50 cars	80 cars
Passenger’ lounge capacity	40 passengers	50 passengers
Jetty structure	Wooden	Wooden
Other facilities	None	Restaurant and rest rooms

4.2 Contributions of Inland Water Transport to Passengers Movements in the Area

The study further examined the impact of water transport on movements of the people in the study area. The average number of passengers moved per day was estimated using the number and capacity of available water vehicles and the average number of trips made per day. It was found that on average, up to 2,842 passengers were transported by water per day along the Ikorodu – Ebutte-Ero axis of Lagos State (Table 3).

Table 3. Average number of passengers moved per day

Operators	Number of vessels	Capacity of vessels	Average trip per day	Total number of passengers per day
ATBOWNATION	56	20	2	2240
Sea Coach :				
1. Shuttle	1	2	2	4
2. Cruiser	4	31	2	248
3. Coaster	10	35	1	350
Total				2842

Table 3 shows that ATBOWNATION jetty had a high number of passengers movement because of its larger number of water vessels (56) compared to the 15 vessels at Sea Coach jetty. In addition, the ATBOWNATION jetty had a bigger car park, larger waiting room and a restaurant as other facilities that could be attracting more passengers. It could however be deduced that the low number of passengers moved could not be adduced to shortage of vessels, but may be explained by a problem of low patronage. The fact that the vessels do not make more than two trips per day is a clear evidence of this problem.

4.3 Characteristics of Water Transport Passengers in the Area

4.3.1 Socio-Economic Characteristics

Majority (68%) of the respondents were found to be males. The preponderance of males among the passengers may be because males were more likely to take risk than females as travelling by water was perceived to be more dangerous than by road in Nigeria. The long term neglect of water transport by successive governments has been observed to be responsible for travel safety concerns among the people (Adeniyi, 2017). It was also found that most of the passenger fell within the middle aged group. For instance, 75.6% were between 26 – 45 years, while 58% of the passengers were married. In addition, a very high proportion (96.7%) of the respondents had secondary education and higher (Table 4). This indicates that most of those who patronise water means of transport in the state were educated. Furthermore, most (84%) of the passengers were employed with about 60% of them earning at least ₦80,000 per month.

Table 4. Social-Economic characteristics of respondents

Characteristics	Characteristics	Frequency	Percentage
Age	18 – 25	5	3.3
	26 – 35	66	44
	36 – 45	47	31.3
	46 and above	32	21.3
	Total	150	100
Marital status	Single	46	30.7
	Married	87	58
	Separated	5	3.3
	Divorced	4	2.7
	Widowed	8	5.3
Level of education	No formal education	5	3.3
	Primary education	-	-
	Secondary education	8	5.3
	Tertiary education	83	55.3
	Others	54	36
Occupation	Private sector	73	48.7
	Self employed	29	19.3
	Government worker	24	16
	Apprentice	0	0
	Student	10	6.7
	Unemployed	13	8.7
	Others	1	0.7
Monthly income	Below ₦18,000	9	6
	₦18,000 - ₦49,000	21	14
	₦50,000 - ₦79,000	24	16
	₦80,000 - ₦109,000	27	18
	₦110,000 and above	61	40.7
	No Reponses	8	5.3

4.3.2 Travel Characteristics

The study also examines the travel characteristics of the respondents in the study area such as passengers preferred means of water transport, regularity of use of water transport and purpose of trip of the passengers among others.

4.3.2.1 Preferred Type of Vessel

This involved the examination of the respondents most preferred means of water transport among canoes, non-covered motorised vessels, fibre covered motorised vessels and ferry.

Results show that as high as 71.3% of the respondents preferred fibre covered motorised vessels while none of the respondents used canoe as shown in Table 5. The

preference for fibre-covered motorized vessel by majority of the respondents as shown in Table 5 was expected because, it was faster and cheaper than other water vehicles in the area. Meanwhile the preference for ferry by significant proportion of the respondent (23.3%) was because of its safety and better comfort when compared to the other available vessels.

Table 5. Travel characteristics of the respondents

Characteristics	Frequency	Percentage
Preferred vessel type		
Canoes	0	0
Non-covered Motorised vessel	0	0
Fibre-covered Motorised vessels	107	71.3
Ferry	35	23.3
No response	8	5.3
Total	150	100
Regularity of travel by water		
Everyday	107	71.3
At least once a week	10	6.7
At least once a month	7	4.7
Occasionally	19	12.7
No respond	7	4.7
Purpose of trip		
Commerce and shopping	27	18.0
Education	0	0
Family and social purposes	14	9.3
Work	101	67.3
Others	0	0
No response	8	5.3
Duration of journey		
Less than 15 minutes	17	11.3
15-30 minutes	57	38.0
31-45 minutes	69	46.0
46 mins-1 hour	0	0
Above 1 hour	0	0
No response	7	4.7
Cost of journey		
Less than ₦200	0	0
₦200-₦500	0	0
₦501-₦700	91	60.5
₦701-₦1,000	53	35.3
Above ₦1,000	0	0
No response	6	4.0

4.3.2.2 Regularity of Travel by Water Transport

Regarding the regularity of use of water transport by the respondents, it was found that 71.3% of them travelled by water transport everyday. Meanwhile, another 6.7% used it at least once a week as shown on Table 5.

4.3.2.3 Purpose of Trips

An examination of the purpose of trips shows that 67.3% of the respondents depended on water transport to travel to work, while 18% of the respondent's used water transport for commercial and shopping journeys as also shown on Table 5. Most (71.3%) of the respondents were found to use water transportation on daily basis (Table 5).

4.3.2.4 Duration of Journey

The results further show that 46% of the respondents spent 31-45 minutes on their journey while the duration of trip for 11.3% was less than 15 minutes per trip as shown on Table 5. It could be seen that travel time by water in the area was shorter than by road.

4.3.2.5 Cost of Trips

The monetary cost of trips incurred by passengers who travelled by water was however found to be higher than that of road transport. For instance it was found that 60.7% of the respondent paid ₦500 - ₦700 per trip, while 34.7% of them incurred between ₦701 to ₦1000 per trip as also shown in Table 5.

4.4 Problems Associated with Use of Water Transport in the Area

The users of inland water transport in the area faced some challenges associated with their usage of water transport in the area. They indicated problems such as inadequate number of water vessels, poor quality of vessels, lack of adequate security and inadequate safety equipment among others.

4.4.1 Insufficient Number of Water Vessels

The study found that as high as 68% of the respondents opined inadequate supply of vessels as a problem militating against the development of water transportation in the area as shown in Figure 2. As a result intending passengers often had to join long queues at the jetties to get on boats or ferries.

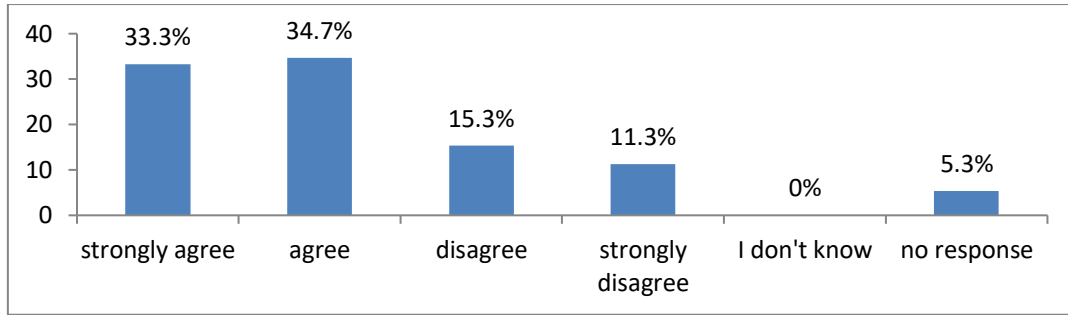


Figure 2. Respondents' opinion on inadequate number of water vessels as a problem

4.4.2 Poor Quality of Vessels

The results show that a high proportion of the respondents (62.6%) held an opinion that most of the vessels were of poor quality while 14.7% of the respondents strongly disagreed that poor quality of vessels was a problem of water transport in the area as shown in Figure 3.

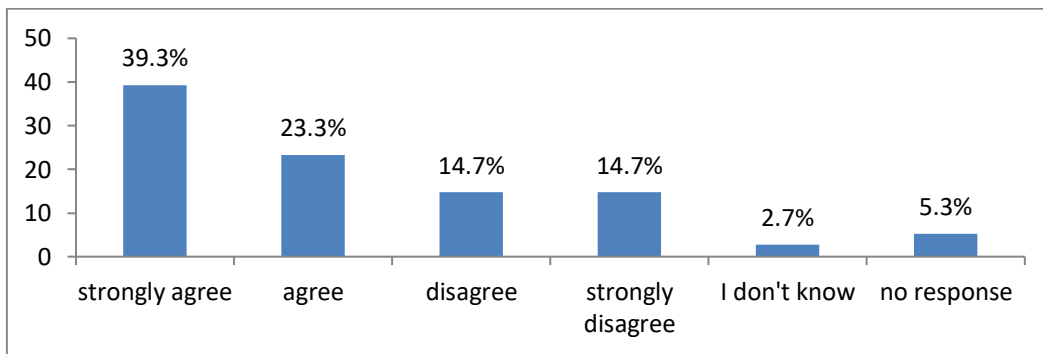


Figure 3. Respondents' opinion on poor quality of vessels as a problem

4.4.3 Inadequate Security

Inadequate security was seen to be a problem by 61.3% of the respondents as seen in Figure 4. As a feed transport mode that did not provide door to door service, it required passengers using other modes of transport to get to the jetty from home. This may require people to park their personal cars at the jetty car park for the duration of office hours.

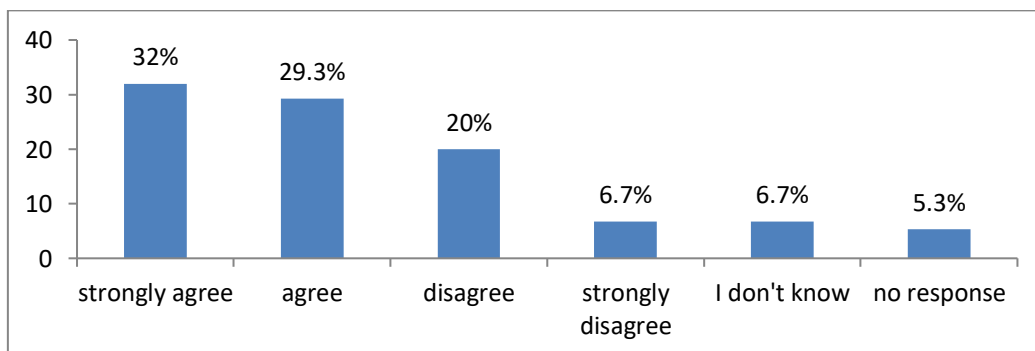


Figure 4. Respondents' opinion on inadequate security as a problem

4.4.4 Inadequate Transport Safety

Results show that 58.7% of the respondents perceived transport safety as a problem of water transport in the area (Figure 5). The main issues related to safety raised by the people included inadequate safety equipment particularly life jackets, poor boat condition and reckless driving by the operators.

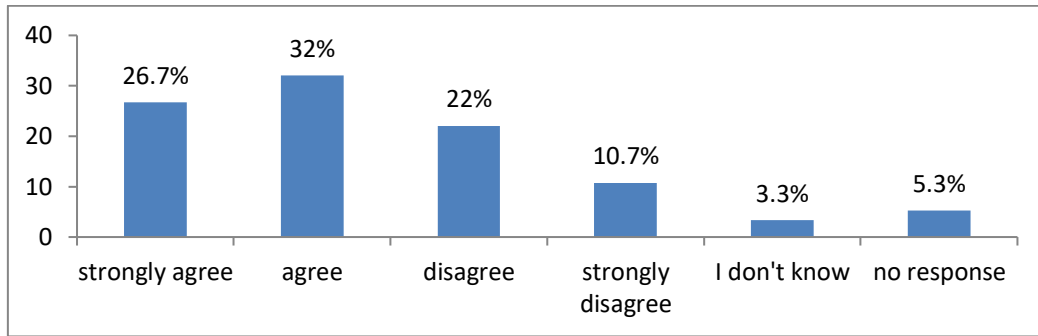


Figure 5. Respondents' opinion on transport safety as a problem

4.4.5 High Cost of Transport

Cost of transport was seen as a problem by as high as 67.4% of the respondents, as seen in Figure 6. For instance, a trip that would normally cost about ₦300 by road cost would cost between ₦500-₦700 by water.

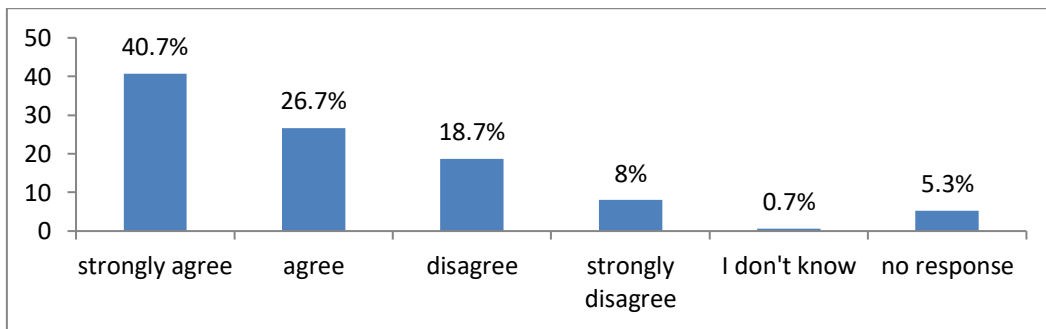


Figure 6. Respondents' opinion on high cost of transport as a problem

The results indicate that there was a gross inadequacy of terminal facilities and vessels for water transportation in the area. With only two out of five terminals in operation, the capacity of water transport to facilitate movements in the area had been greatly reduced. This was because access to this mode was denied or made difficult for many people in the area. In addition, the availability of other supporting facilities was very important because these could attract or discourage prospective passengers. This was in line with the findings of Chukwuma (2014); Bassey & Nsa (2018) who noted that inadequate water transport facilities was a major factor impeding the development of inland water transport in Nigeria. For

instance, the adequately available car parking facilities allows people with personal cars to keep their cars safe while travelling by boat on a part of their trips, thereby avoiding traffic stress on Lagos roads.

On the daily basis, water transport contributed to the mobility of almost 3,000 people within the Ikorodu-Ebute Ero axis of Lagos City (see Table 3). This was very low considering the hundreds of thousands of Lagos commuters who continued to travel by road on daily basis. This was an evidence that the potential of water transport had remained mostly untapped in the area. This was in line with the observation of Ademiluyi *et al.* (2016); Bayode & Ipingbemi (2016) that water transport moves only a small proportion of the total traffic in Lagos State. However, while the number of commuters travelling by water in the area was low, one should still appreciate the fact that these were people that would have added to the road traffic chaos in the area, either as public transport or personal cars passengers. Improved access is therefore a major issue that needs to be addressed to maximise the utilisation of water transportation in the area.

The two most preferred water vessels in the area were fibre-covered motorised vessels and ferries (Table 5). The preference for fibre-covered motorised vessel by the commuters was expected because; it was faster than other water vehicles in the area. Meanwhile, the preference for ferry was because of its safety and better comfort when compared to the other available vessels. This implies that the potential of this modes as an alternative to road transport will be greatly increased if more of these modern vessels are introduced into service in the area.

The consistency in the use of water mode of transportation by most (71.3%) of the commuters using this mode as seen in Table 5 is a further indication of the great potentials of water transport in the city. This also in line with the findings of Ademiluyi *et al.* (2016) who found a consistency in the use of water transport by most of the commuters traveling by water in Lagos city. This further indicates that the patronage of water transport would likely increase with the provision of more jetties and other supporting infrastructure such as car parks that will provide more access to a larger number of people in the area.

Most of the trips via water transport in the area were based on work purpose. Based on the Urban Transportation modelling system (UTMS) (Flugel & Flotterod, 2015) categorisation of the purpose of trip in the area into trip distribution based on origin and purpose, majority of the respondents fell within the home-work category. On the average travel to work by road in Lagos took not less than 2-3 hours because of the prevalent traffic congestion. This resulted in Lagos being regarded as the city with the highest level of road

traffic congestion in Nigeria. Therefore, travelling by water at least part of the trip, allows commuters to avoid traffic congestion and reduces travel time though at higher financial cost.

The higher rates charged per trip compared to road travel can be attributed to the near monopoly enjoyed by the few private water transport operators. This is in line with the findings of Ogunbajo *et al.* (2017) who also noted that high cost of travel is a major problem of water transportation in Lagos city. However, while on the surface it may seem more expensive because it implies substituting higher monetary cost for time, in the real sense it is more economical for the city because of the significant man-hour losses attributed to traffic congestion in Lagos City. For instance, it was estimated that Lagos commuters spent an average of 30 hours on traffic per week which was 75% of weekly working hours (Business Day Online, 2018). However, for the fact that most of water transport users were of the high income earners, it can be deduced that the cost of transport likely plays a significant role in people's decision to travel by this mode. The implication is that road travel may still continue to attract more Lagos commuters because of the relatively lower rates charged.

Most of the problems associated with the use of water transport in the area are direct result of poor level of investment in this mode of transport. The long term neglect of inland water transport by successive governments has led to the handover of the mode of transport to the hands of few private individuals and enterprises. The high cost of acquisition and maintenance of vessels became a major restriction to entrance into this line of business. This was largely responsible for the inadequate supply in the sector. For instance, a locally manufactured 15 seater open (without roof) motorised vessel cost between ₦200,000-₦300,000 depending on whether it was made of wood or fibre (Nwakunor *et al.*, 2016). Although, the wooden boats were more common because of their lower cost, they were still not affordable to many people who may be interested in joining the business in the area.

The poor quality of water vessels in the area was another evidence of the low level of development of this mode of transportation, particularly, when compared to road transport. This was another important factor that may discourage prospective passengers. For instance, while most of the boats were without roof (passengers were exposed to the elements), passengers also often had to sit on wooden planks with no backrest. Only the roofed fibre-covered boats and ferries were equipped with comfortable chairs while also providing protection from the sun/rain. Exposure to rain in particular has been observed to be a major complaint of water transport passengers in Lagos (Nwakunor *et al.*, 2016). This is not surprising since it will be a serious discomfort to be soaked by rain while commuting to and from the office or school.

While piracy was not identified as a problem to inland water transport in the area, traffic robberies, theft and other vices were known to be common around Lagos jetties due to the presence of touts and other miscreants within and around their vicinity. Therefore, passengers were sometimes exposed to some of these problems, such as breakage of their parked cars resulting in loss of valuables. In addition, operation of inland water transport in the area was largely dominated by informal business units and individual operators who were often uneducated, rash and aggressive just like their road transport counterparts. Therefore, the passengers also often had to put up with verbal abuse and other forms of aggression.

As seen in Figure 5 the issue of safety was a problem to almost 60% of the commuters. Passengers were particularly at risk due to non-adherence to government regulation on provision of life jackets by most operators. Even when life jackets were provided they were often the cheapest ones in the market that were highly unreliable (Bayode & Ipingbemi, 2016). There were also other serious risks attached to navigation on the Lagos lagoon such as collusion with other boats or floating logs and risk of fishing nets getting caught on propellers (Adeniyi, 2017). For instance, a boat mishap which resulted in the loss of many lives was attributed to poor visibility during a night journey (Punch, 2019). These hazards were particularly associated with night journeys which eventually made the State Government to ban night travel on the Lagos lagoon. Poor condition of vessels was also reflected in form of rickety boats, for instance it is not uncommon to find vessels leaking water while travelling on the waterway. The safety issue was further compounded by the problem of overloading and over speeding and other reckless behaviour. For instance, Bayode & Ipingbemi (2016) attributed about 70% of accidents on the Lagos waterways to human error. There was also the problem of hyacinths which often clog waterways, affecting engines and making it difficult to navigate.

The high cost of water transport when compared to road mode of transport in Lagos State was attributed to factors such as low supply compared to the present demand for their services and high cost of maintenance of vessels (Nwakunor *et al.*, 2016; Bayode & Ipingbemi, 2016). While this observation may be true for some parts of the Lagos inland waterways, this conclusion cannot be deduced from this present study. This was because there was low patronage in the area which could be seen from the low number of trips made by the available vessels. The most likely reason was probably the influence of union control which was usually very strong within the transport industry in the country. The transport unions often fixed rates and made their members abide through force and intimidation. High

cost of transport may however be a great obstacle to widespread adoption of water transportation in the area, except measures are adopted to reduce cost of travel by this mode of transport.

4.5 Possible Strategies to Improve Water Transportation in the Area

Based on the findings of this study the following strategies are suggested: (1) to address the problems of gross inadequacy of terminal facilities and vessels for water transportation in the area, the Lagos State Government should invest more in inland water transportation. This will require the provision of more jetties and making abandoned ones functional. The State Government can also provide ferry services to this area and other routes not presently served by government ferry services. This will go a long way in improving the capacity of this mode of transport to facilitate movement and ensure access to more people in the area; (2) There is a need for the operators to acquire modern boats and ferries that will be more reliable, safe and also provide greater comfort in terms of seating and protection from the sun and rain. This will attract more people to travel by this mode of transportation; (3) Government should also provide incentives such as tax relief and as well as develop policies that would help facilitate access to credit for individuals and corporate organisations willing to invest in the this sub-sector. This will go a long way to attract investment in water transportation; (3) In addition, safety on the waterways can be improved through the strengthening of the Lagos Waterways Authority (LASWA), so that it can effectively perform the duty of enforcing safety regulations on the waterways.

Regulations such as the use of life jackets by all passengers and crew members, banning of night travels and adequate maintenance of vessels should be strictly enforced. This will help reduce the rate of accidents and fatalities often recorded; (4) Security is a major issue that must be addressed to improve water transportation in the area. Security on the waterways, areas around and within the jetties must be enforced to encourage more people to utilize this mode of transportation. In particular, car parking facilities around the jetties must be well protected so as to attract the patronage of car owners who commute partly on the road; (5) There is also the need for public enlightenment on the need to adopt this mode of transportation, focusing on the advantages. This should mostly be directed at reducing the widespread sense of apathy concerning the use of water transport because of safety concerns among people in the area.

5. Conclusion

This study examined inland water based transportation in the riverine parts of Ikorodu area of Lagos state. It was found that the capacity of water mode of transport was greatly reduced due to inadequate provision of jetties and other necessary facilities. Therefore, access to this mode was largely denied or made difficult for many people in the area. However, despite the poor infrastructure, water transport played an important role by enhancing mobility in the area. Particularly, it provided a fast and more sustainable means of movement within a city with a high level of road traffic congestion. In addition, the frequency of use by the commuters who travel by water is an indication that this mode of transport has a great potential of being adopted by a greater proportion of the population. However, relatively higher cost of journey compared to road travel, poor quality of vessels, safety related issues and poor security in the vicinity of jetties are the major obstacles that may discourage general adoption of water transportation in the area. Therefore, while water transportation has great potentials in the area, there is the need for greater attention from both government and the private sector, to significantly raise its capacity to fully compliment the road transport mode. This could be facilitated through a greater investment in water transport infrastructure and provision of modern vessels.

Conflict of Interest

The authors declare that there is no conflict of interest with any financial, personal, or other relationships with other people or organizations related to the material discussed in the article.

References

- Adejare, Q.A; Olusina, J.O. and Olaleye, J.B. (2017). Empirically Determined Passenger Ferry Navigable Routes within Lagos Lagoon. *Nigerian Journal of Technological Development*, 14 (2): 74-79
- Ademiluyi, I.A; Fashola, O.K. and Afolabi, O.J. (2016). Analysis of Intra-City Water Transportation in Lagos. *International Journal of Innovative Research and Advanced Studies*, 3 (8): 246-254
- Adeniyi, K. (2017). "Lagos waterways passengers decry safety measures". Premium Times Online, November, 8, 2017.
- Badejo, B. A. (2011). *Transportation Removing the Clogs to Nigeria's Development*. Anchorage Press and Publishers: Lagos, Nigeria

- Bassey, S. I. & Nsa, M. E. (2018). Problems and Prospects of Developing Inland Water Transportation in Nigeria: The Case of Calabar River. *IOSR Journal of Human and Social Sciences*, 23 (7): 27-37
- Bayode, T. & Ipingbemi, O. (2016). Safety and Operational Characteristics of Water Based Transportation in Lagos State. *SCIREA Journal of Traffic and Transportation Engineering*, 1 (1): 13-31
- Business Day Online (2018). "Lagos commuters lose 75% of weekly working hours to traffic". December 11th, 2018. Retrieved on 06/02/2019 from <https://businessday.ng/news/article/lagos-commuters-lose-75-of-weekly-working-hours-to-traffic/>
- Christodoulou, A., Christidis, P., & Bisselink, B. (2019). Forecasting the impacts of climate change on inland waterways. *Transportation Research Part D: Transport and Environment*, doi:10.1016/j.trd.2019.10.012
- Chukwuma, O. M. (2014). The Characteristics of Inland Water Transport in Nigeria. *IOSR Journal of Humanities and Social Science*, 19 (3): 119-126.
- Dai, B. L., Sheng, N., He, Y. L., Mu, F. H., Xu, J. M., & Zhu, A. F. (2019). Development of an inland waterway traffic noise prediction model considering water surface adsorption and embankment shielding influences. *International Journal of Environmental Science and Technology*, 16(10), 5927-5936. doi:10.1007/s13762-018-02186-2
- Edelman, D.J. (2015). An Environmental Plan for Lagos, Nigeria. *International Journal of Social Science*, 3 (1): 201-279
- Fellinda, L. (2006). World's Water Transport Needs Further Development. *Transport and Development*, 1: 68-72
- Flugel, S. and Flotterod (2015). Traffic assignment for strategic transport model systems. Paper presented at International Transport Economics Association (ITEA) conference, June 17-19, 2015, University of Oslo, Oslo, Norway.
- Gray, L. (2004). An Examination of the Problems of Water Transportation in Old Degama Province. *Journal of Waterways, Africa*, 33: 20-26
- Hossain, N. U. I., Nur, F., Jaradat, R., Hosseini, S., Marufuzzaman, M., Puryear, S. M., & Buchanan, R. K. (2019). Metrics for assessing overall performance of inland waterway ports: A bayesian network based approach. *Complexity*, 2019 doi:10.1155/2019/3518705
- Hoyle, B.S. (1993). Water Transport and Urban Development: Some Geographical Perspectives and Propositions. *Geojournal*, 31 (4): 439-448
- Iamtrakul, P., & Wongbumru, T. (2019). Exploring eco-friendly travel towards sustainable water transport in bangkok. Paper presented at the *IOP Conference Series: Earth and Environmental Science*, , 398(1) doi:10.1088/1755-1315/398/1/012014

- Iamtrakul, P., Raungratanaamporn, I., & Klaylee, J. (2018). Contribution on water transportation for resilient and sustainable lowland cities. *Lowland Technology International*, 20(3), 341-350
- International Association of Public Transport (2013). Waterborne Transport, a Unique Contribution to Enhancing Mobility for Cities on Water. A Position Paper of Waterborne Transport Committee May 2013.
- Kurniasari, E. and Pramesty, D.A. (2018). The Effects of Vehicle Intensity in Summersari Jember Regency. *Geosfera Indonesia*, 3 (3): 50-58
- Łapko, A., & Panasiuk, A. (2019). Water tourism as a recipient of transport services on the example of szczecin. Paper presented at the *Transportation Research Procedia*, , 39 290-299. doi:10.1016/j.trpro.2019.06.031
- Ndikom, O.B.C. (2013). A Critical Assessment of the Inland Waterways Operation and Management on the Development of the Nigerian maritime Industry. *Greener Journal of Environmental Management and Public Safety*, 2 (2): 99-107
- Nigerian Bureau of Statistics (2013). *Annual Abstract of Statistics, 2011*. Federal Government of Nigeria, Abuja. Retrieved on 11/06/19 from http://istmat.info/files/uploads/53129/annual_abstract_of_statistics_2011.pdf
- Nigerian Bureau of Statistics (2018). 2017 Demographic Statistics Bulletin, May.
- Nwakunor, G.A., Ajeluorou, A. and Salau, G. (2016). Lagos waterways: A hidden treasure untapped. Retrieved on 06/11/2018 from <http://m.guardian.ng/features/weekend/lagos-waterways-a-hidden-trasureuntapped/>
- Ogunbajo, A.B., Akinpelu, T.A. and Odubela, C.A. (2017). The Prospects and Problems of Water Transportation in Lagos Metropolis. *LASPOTTECH Journal of Scientific, Engineering and Technology Research*, 1 (1): 1-12
- Punch (2019). 12 bodies recovered in Lagos boat mishap, five still missing. July 2nd, 2019. Retrieved on 03/09/2019 from <https://punchng.com/lagos-boat-accident-12-bodies-recovered-five-still-missing/>
- Tanko, M., Cheemarkurthy, H., Hall Kihl, S., & Garne, K. (2019). Water transit passenger perceptions and planning factors: A swedish perspective. *Travel Behaviour and Society*, 16, 23-30. doi:10.1016/j.tbs.2019.02.002
- Tannum, M. S., & Ulvensøen, J. H. (2019). Urban mobility at sea and on waterways in norway. Paper presented at the *Journal of Physics: Conference Series*, , 1357(1) doi:10.1088/1742-6596/1357/1/012018
- Tobias, M. S. G., Ramos, R. A. R., & Rodrigues, D. S. (2019). Use of waterway transport integrated to urban transportation systems in amazonian cities: A vision of sustainable mobility. *WIT Transactions on Ecology and the Environment*, 238, 615-625. doi:10.2495/SC190531

Wiercx, M., van Kalmthout, M., & Wiegmans, B. (2019). Inland waterway terminal yard configuration contributing to sustainability: Modeling yard operations. *Research in Transportation Economics*, 73, 4-16. doi:10.1016/j.retrec.2019.02.001