International Journal of Modern Developments in Engineering and Science
Volume 2, Issue 8, August 2023
https://www.ijmdes.com | ISSN (Online): 2583-3138


# Modernizing Lagos State's Inland Waterways Infrastructure and Passenger Transportation

Usman Abdullahi Saheed[1*], Asenime Charles[2], Ibraheem Forson[3], M. Giwa Olayiwola[4]
[1,2,3,4]*School of Transport and Logistics, Lagos State University, Ojo, Lagos State, Nigeria*

***Abstract*: This is an evaluative study of effect of inland water transport infrastructural modernization on passenger patronage in Lagos, Nigeria using Structural Equation Modelling (SEM). This study examined factors relating to influence of infrastructural development and modernization in the maritime transport sector. A cross-sectional survey research design with a quantitative method was adopted. A purposive sampling technique was employed to select 10 jetty locations in the study area. The reliability of the adopted SEM model was confirmed with a Cronbach's Alpha α value of .879; while convergent validity as well as discriminant validity were established. Conclusively, the findings of the study revealed trends of infrastructural modernization significantly predicated passenger patronage of about 40%. Infrastructural modernization was also observed to predict passenger patronage by about 35% while public-private partnership predicted patronage by 20%.**

***Keywords*: Moderation, Water transport, Infrastructure, Partnership, Passenger.**

## 1. Introduction

Nigeria boasts Africa's second-longest waterway, comprising 8,600 kilometers of inland lakes and 852 kilometers of coastline. The Niger and the Benue, Nigeria's two longest bodies of water, intersect near Lokoja and divide the nation into three regions: the east, west, and north. Water transport has been employed on rivers, including those described above. As a result, Nigerian water transportation is classified into three types: ocean, coastal, and inland (Nigerian Bureau of Statistics, 2018). The coastal waterways connect Badagry to Calabar via Warri. These coastal waterways see a lot of traffic, especially when expense trumps speed. Waterways connect the most agricultural commodities from rural areas to massive processing plants in metropolitan regions. This strategy is less expensive and boosts commercial agricultural product supply in flood-prone locations. The ease with which people, goods, and services may move from one place to another is a fundamental driver of society's quality of life. Many megacities throughout the world today rely on a variety of modes of transportation, and Lagos will be no exception. Cities throughout Africa have witnessed massive population growth for decades. Rapid urbanization and significant rural migration are the primary causes of this. By 2020, cities are expected to host 55% of Africa's population (African Association of Public Transport). Serious infrastructure and transportation capacity challenges are based on the rapid population expansion in these locations. This is a sobering reality given that the vast majority of municipal infrastructure in Africa is woefully insufficient for the current transport demand. Additionally, as a result of the adjustments and regulations required for compliance with development aid linked to international agencies, virtually all publicly owned and run transport services in African cities have been shut down since the 1990s.

Furthermore, the dominance of these services has sped up economic development at the expense of citizens' quality of life due to high levels of localized pollution, insufficient levels of security and safety, and traffic congestion and parking issues caused by the large number of vehicles required to meet demand. Bassey and Nsa (2018); Tanko, Cheemarkurthy, Hall Kihl, and Garme (2019). Given their significant dependence on transport, modern cities should have effective infrastructure systems for this sector that connect them both to local, national, and international transport systems (Hoyle, 1993; Kurniasari et al., 2018).

### *A. Statement of Problems*

In Nigeria, there have been several studies done in water transportation. Lagos Metropolitan Area continues to be a focus of water transportation studies as a result of the state's advantageous geographic location concerning nearby water bodies. The majority of the material looked at initiatives and difficulties in improving Nigeria's water transportation system Hence the neglect of Nigeria's water transportation infrastructure and human capacity has led to a sharp rise in boat accidents and death rates nationwide. Anyam (2003) lamented the fact that potential investors have yet to take advantage of the enormous business opportunities offered by Nigeria's interior waterways. He concluded that inland water transportation has enormous potential but hasn't yet developed into a viable substitute for land and air travel, allowing for the efficient and sustainable transportation of people and goods. Therefore, this study aims to examine the effect of efforts by the Lagos State waterways t and the private sector to modernize the sector to attract more patronage from commuters in the metropolis. With the following objectives': Evaluate the trend of infrastructure modernization in Lagos inland waterways; Analyse measures to improve inland waterways infrastructure modernization in Lagos metropolis.

*Corresponding author: usman.a.saheed@gmail.com

*Hypothesis-$H_{01}$: Inland waterways equipment modernization has no effect on passenger patronage.*

### *B. Study Area*

Lagos is situated at latitudes 6°25′ and 6°40′ N and longitudes 3°5′ and 3°30′ E, respectively. It is one of Nigeria's 36 states (see Figure 1). This study was conducted on a few chosen jetties in the Nigerian city of Lagos. The reason for choosing Lagos for this study was because of the accessibility of water transportation. Another consideration for its choice was the complicated landscape of traveling within the metropolis, which is characterized by significant traffic congestion and extended transportable times.

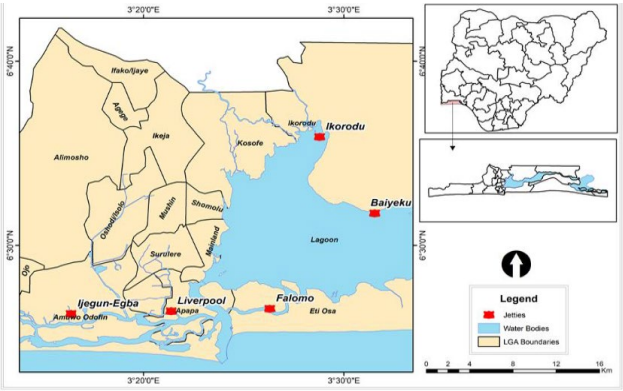


Fig. 1. Lagos State map with selected jetties
Source: Author's Analysis, (2023)

Fig. 2. Image of the study area
Source: Authors, (2023)

## 2. Literature Review

The advantages of water-based travel are un-ending; it is familiar, accessible, relatively cheap and convenient, hence providing a transport system that is effective and seamless while serving local needs. It also has the potential to address isolation thus minimizing the impact on the environment. In other words, water transportation is very important, not just for its own sake, but because it has the potential to reduce traffic gridlock, eliminate poverty and reduce isolation. Water transport plays a vital role in urban growth and development, in clearer terms, it is pivotal to growing and development of all sectors in the economy. It has equally played a very significant role in bringing different parts of the world closer and is indispensable to foreign trade (Afolabi et al, 2016). Inland water transportation disaster is an event which usually involves capsizing, hull damage, overloading, boat leaking, steering fault, armed robbery, submerged by fiber boat, engine fault, drowning, misstep, hit wrecked, piracy and accident in general which affects the confidence of passengers to harness the opportunity of water transportation and their competitiveness level. All these issues have been distinguished as major consequence of human error; hence, the e-navigation has been developed to integrate human involvement with navigational advancement to increase the reliability of inland water transportation operation and consequently improving the competitiveness of sea transport (Jagan et al 2020).

To address the urban challenges, LAMATA (2014) highlighted positive steps proposed for dealing with traffic congestions contained in the 30-years transportation improvement plan. Essentially, the steps include light rail schemes and BRT bus services in Lagos state. However, according to (Edelman, 2015) given the existing land use structure of Lagos, the integration of light rail schemes and BRT services is not likely to ameliorate the problems of traffic congestion. He suggested a system which will include non-land based systems as a more assuring way to solve the problem. Moreover, Lagos state is naturally endowed with navigable creeks (Lighthouse creek, Badagry creek, Five Cowries creek, Agboyi creek) and lagoons (Ologe Lagoon, Ogun River, Majidun River, Lagos lagoon, Kuramo water) that are suitable for urban transit services (Adejare et al, 2017).

The State government has also put in place several projects to assist the waterways transportation systems, since the inauguration of LASWA act in 2008, amongst the developmental project are the Ijegun – Egba jetty, Ebute-Ojo ferry terminal, Badore ferry terminal, Mile-2 ferry terminal, Osborne ferry terminal and the Ikorodu ferry terminal. The jetties and terminals have several facilities such as Floor spaces, Car Park, Bus park, Fuel Dump, Slip way, Retail outlets (Shops, banking Hall, restaurant etc.) and Disability Access, while the Ijegun and Ebute-Ojo jetties also have a water treatment plant in addition. (LASWA, 2015d).


Fig. 3. Selected routes of study area

### *A. Boat Tracking System*

Waterways Information Services is the harmonized information services through Global Positioning System (GPS) to support traffic and transport management on inland navigation, including interfaces to other transport modes. The system aims at contributing to a safe and efficient transport process and utilizing the inland waterways to its fullest extent

Table 1
Accident record on Lagos waterways between 2014-2020 (Source: LASWA; 2021)

| Year | Boat Type | No. of passengers involved | Injured | Rescued | Death | Cause of Accident |
|---|---|---|---|---|---|---|
| 2014 | Ferry, Fiber & Wooden | 56 | 22 | | 41 | Various |
| 2015 | Ferry, Fiber, Bristol Helicopter & Wooden | 71 | 30 | | 42 | Various |
| 2016 | Fiber, Open | 32 | 12 | | 10 | Various |
| 2017 | Open Fiber, LASWA boat, suicide, ferry, open banana boat, jetty side | 22 | 4 | | 18 | Various |
| 2018 | Open Fiber boat, Wooden, God bless marine | 95 | 31 | | 25 | Various |
| 2019 | Fiber, Wooden, Tug/barge, Commercial | 139 | 9 | 93 | 34 | Various |
| 2020 | Fiber, Open Fiber, Lagferry, Wooden, | 176 | 8 | 106 | 32 | various |
| 2021 (JAN) | Open fiber. | 4 | 1 | 1 | 1 | Head on collision |

Source: Journal of Maritime Affairs

(Brian, 2018). Tracking a boat, ship or vessel has never been so easy. Going together with a new technology, GPSWOX presents reliable and high - quality GPS Trackers for Boats/Yachts and other vehicles. Most of the trackers are based on the GPS satellite positioning system and the GSM/GPRS network that allow all of the tracking functions work. Tracking a boat or yacht with tracking devices includes monitoring surveillance, real time tracking sending emergency alarms in the cases of theft or if the amount of fuels is too small. Track ships, vessels, boats with boat or ship GPS Tracking device and connect it with your smart phone, computer or tablet online. Supported GPS Trackers for boats - ability to track a boat in the easiest and most convenient way (GPSWOX, 2020).

## 3. Methodology

This research adopted a conceptual structure within which the research study was conducted in order to provide for the collection of relevant information with minimal expenditure of effort, time. The sampling procedure adopted for this study was probability approach and the method that was used for this research study is the simple random sampling. The approach to this method is carried out by giving the members of the population equal chance. Thereafter, the participants were randomly selected.

## 4. Results

Data collected were analysed through the use of linear regression model which was done to examine whether trends of inland water transport infrastructure modernization could predict the level of passengers' patronage in metropolitan Lagos. A scattered diagram plotted showed that the relationship between waterways infrastructure modernisation and passengers' patronage was positive and linear and did not reveal any bi-variate outliers and it is independent of residual errors. This was confirmed using Durbin-Watson test (d = 1.896) and SEM model output of $R^2 = 0.65$ and P>0.000 at both 95% and 99% confidence level.

Further, residual plots showed homoscedasticity and normality of the residuals which suggested that trends of waterways infrastructure modernisation is statistically significant in predicting passengers' patronage, F (1, 699) = 467.73, p>0.001, accounting for 40.1% of the variability in passengers' patronage with adjusted $R^2$ of 4%. The correlation between infrastructure modernisation and passengers' patronage of water transport services was statistically significant, r (699) =.63, p <0.001. The regression equation for predicting passengers' patronage from infrastructure modernisation was = 1.7 +.576x. The confidence interval for the slope to predict passenger patronage from infrastructure modernisation is 95% CI [.634, .518] with a B =.576. Furthermore, the correlation between trends of public-private partnership and passengers' patronage was statistically significant, r (699) =.45, p>0.001. The regression equation for predicting passenger' patronage from public-private partnership was = 2.411 +.426x. The confidence interval for the slope to predict passenger' patronage from public-private partnership was 95% CI [.49,.363] with a B =.426. This suggests that public-private partnership has a statistically significant effect on passengers' patronage.

### *A. Measurement Models*

#### *1) Convergent validity*

Table 2 shows the standardized loading values of the constructs, which are all significant as they exceeded the cut-off point of 0.50. Similarly, the Average variance extracted (AVE) of latent constructs exceeded the recommended value of 0.50, with the values ranging from 0.574 to 0.655. This signifies that more than one-half of the variances observed in the items were accounted for by their stated constructs (Hair et al., 2010, cited in Abdul-Azeez, 2020). This affirmed that the scale measured what was intended to be measured; therefore, the Convergent validity of the instrument is confirmed.

#### *2) Discriminant validity*

Fornell-Larcker criterion used by Abdul-Azeez (2010) was used to confirm the discriminant validity of the research instrument. The process involved comparing the shared variances between constructs with the square root of Average Variance Extracted (AVE) for each construct. The Pearson correlation coefficients were used to generate a composite score to establish the shared variances between the constructs by using the multi-items in each construct to generate a composite score. Table 3 shows that all shared variances of one construct with others were lower than the square root of AVE of the individual factors. These values confirmed that the discriminant validity of the construct has been confirmed. This explains that the level of the construct and its indicators were different from other constructs and their respective indicators (Hair et al, 2017 cited in Abdul-Azeez, 2020).

Further analysis of the table shows that public private partnership has the strongest correlation with passenger patronage (r = 0.657, p<0.01), followed by modern equipment

Table 2
Validity analysis

| Constructs/items | Standardized loading | Average Variance Extracted (AVE) |
|---|---|---|
| **Modern equipment** | | |
| A1 | .627 | |
| A2 | .598 | |
| A3 | .593 | |
| A4 | .661 | |
| A5 | .640 | |
| A6 | .642 | **0.611** |
| **Modern Infrastructure** | | |
| B1 | .638 | |
| B2 | .633 | |
| B3 | .580 | |
| B4 | .714 | |
| B5 | .617 | |
| | | **0.675** |
| **Public Private Partnership** | | |
| C1 | 0.575 | |
| C2 | 0.648 | |
| C3 | 0.507 | |
| C4 | 0.536 | |
| C5 | 0.610 | **0.574** |
| **Infrastructure development and patronage** | | |
| D1 | 0.638 | |
| D2 | 0.545 | |
| D3 | 0.558 | **0.587** |

Source: Data Analysis 2023

Table 3
Discriminant validity

| **Inter-construct correlations and square root of AVE** | | | | |
|---|---|---|---|---|
| | **A** | **B** | **C** | **D** |
| Modern equipment (A) | **0.781** | | | |
| Modern Infrastructure (B) | 0.582** | **0.822** | | |
| PPP (C) | 0.497** | 0.467** | **0.758** | |
| Passenger Patronage (D) | 0.631** | 0.486** | 0.657** | **0.766** |
| Mean | 4.19 | 4.30 | 4.16 | 4.15 |
| Kurtosis | 5.924 | 3.2712 | 4.840 | 5.504 |
| Skewness | -1.528 | -0.8716 | -1.002 | -1.185 |

Source: Author's Computation of Field Data, 2023.
Note: (**p<0.01). Diagonal elements shown in bold are square root of AVE. off diagonal elements are correlation coefficients.

(r = 0.631, p<0.01). and modern infrastructure (r = 0.582, p<0.01) in that order.

### *B. Structural Model*

Before assessing the Structural model for overall explanatory power through $R^2$ and path coefficient β values, the overall fit was tested using a chi-square goodness-of-fit test to test if the set of the observed values matches the expected values under the applicable model (Turney, 2022). To measure the GoF, many researchers supported using this equation: GoF = $\sqrt{AVE} \times R^2$. The $\sqrt{AVE}$ means the geometric mean value of AVE. Wetzels, Odekerken-Schröder, & Van Oppen (2009), as cited in Abdul-Azeez (2020) suggested these cut-off values as: $GoF_{small} = 0.1$; $GoF_{medium} = 0.25$; $GoF_{large} = 0.35$. Tenenhaus et al (2005) as reported by Farooq (2018) opined that a large value of GoF or a good model fit shows that a model is plausible and reasonable. This result of this study goodness of fit (GoF) is presented in table 4.

Table 4 shows the calculation of the GoF index using a method adopted by Abdul-Azeez (2020). The results indicate that the GoF index of 0.586 means the model used in this study has a good model fit and a significant explanatory and predictive power.

Table 4
Calculation of Goodness of Fit (GoF) index

| Construct | Average Variance Extracted | $R^2$ |
|---|---|---|
| Modern equipment | 0.611 | |
| Modern infrastructure | 0.675 | |
| Public private partnership | 0.574 | |
| Passenger patronage | 0.587 | |
| Average score | 0.612 | 0.56 |
| $AVE \times R^2$ | 0.343 | |
| GoF = $\sqrt{AVE} \times R^2$ | 0.586 | |

Source: Author's Computation of Field Data, 2023

### *C. Hypothesis Testing*

To provide answers to objectives two, three and four, a structural model was constructed using the SEM approach. The output from the model was used to test the hypothesized paths of Navigational equipment upgrade for safety & security of waterways, Terminal facility and ferry car modernization and public-private partnership for infrastructure modernization in order to increase passengers' patronage. The result is presented in table 5.

Table 5 shows the standardized path coefficients (estimates) of the structural model under investigation. The estimates indicate the strength of the relationship between the dimensions. These results indicate that the proposed model has an average explanatory power of 65% with $R^2 = 0.648$. The

Table 5
Hypothesis assessment using path analysis

| Hypothesized Path | Estimated $R^2$ | Critical ratio/betta value | P-value: Coefficient of determination | Decision |
|---|---|---|---|---|
| H1: Navigational equipment upgrade for safety & security of waterways | 0.615 | 0.375 | 0.000* | Rejected |

Source: Author's Computation of Field Data, 2023

information in the table revealed that public-private partnership has significant impact on infrastructure modernization and passenger patronage with predictive strength of 0.654 and significant value, p<0.000. Likewise, terminal facilities and ferry car modernization have significant relationship with passenger patronage, with $R^2$ value of 0.675 and p<0.000. Lastly, navigational equipment upgrade for safer waterways has significant relationship with passenger patronage because the $R^2$ value is 0.611and the p>0.000. This indicates that all the three variables have significant relationship with passenger patronage of inland water transport services in metropolitan Lagos.

### *D. Discussion of Result*

This study evaluates the effects of infrastructure modernization on passenger patronage of inland water transport in metropolitan Lagos using variables such as navigational equipment upgrade, modern terminal and ferry cars, safe and secured waterways and public-private partnerships for inland water infrastructure modernization. Inland waterways which include rivers, lakes, canals, and other navigable bodies of water, play a crucial role in connecting various regions, promoting trade, and providing recreational opportunities the citizens and visitors.

It was discovered that improved and modernize infrastructure, such as functional and efficient terminals structures will enhance the convenience and accessibility of passengers to water front boarding zone. More so, upgraded terminals with comfortable waiting areas, modern rest rooms, cooling and weather control amenities and efficient telecommunication and hospitality services have transformed the overall experience of passengers using the inland water transport in metropolitan Lagos. This new modernization experience has been witnessed at Ikorodu, Liverpool, Bariga, Ijegun Egba, Badore, Ebute Ero and Falomo terminals.

Similarly, modern pontoon jetties and floating jetties with all-day round automatic height adjustment have enhanced passengers' boarding and alighting experiences and therefore prevents occurrence of passenger fall into the water beneath the jetties. Also, the modernization of ferry cars with I.T.S. enabled navigation route guidance system and emergency information dissemination during accident has given rise to boat crew and passenger rescue effectiveness as well as timely safety of lives and property along Lagos waterways. This has also improved travel time reliability and facilitates smoother and more enjoyable voyages for passengers' patronage.

Nonetheless, the study also discovered that water ambulance which is modernization strategy for safety of water transport passengers has assisted in the recent successful rescue operation carried out along the Lagos Lagoon. Passenger have also indicated their satisfaction with the newer boats equipped with advanced technologies, including GPS navigation systems, radar, and improved safety features, thereby promoting passengers' confidence in the reliability, efficiency, and safety of waterway travel in metropolitan Lagos. These innovations have instilled greater confidence in passengers and have led to an increased willingness and acceptability of the water-based transportation mode in the study area.

## 5. Conclusion

The study has shown that trend of infrastructure modernisation is statistically significant to predict inland water transport passengers' patronage, and it accounting for 40.1% of the variability in passenger patronage in Metropolitan Lagos. Also, it was found that there is 63% significant correlation between trends of infrastructure modernisation and passengers' patronage. Statistically, it can be concluded that infrastructure modernisation can significantly predicted passenger' patronage by 35%, while public-private partnership accounts for about 20% variations in passenger patronage of ferry services in Lagos State.

Importantly, infrastructural modernisation and public-private partnership adoption are crucial both individually and together to enhance passengers' patronage and continuous functioning of the ferry services in Lagos State. Boat/ferry service has a bright future in Lagos State, Nigeria, has it is evident by overwhelming demand for water mobility along the coastal communities in metropolitan Lagos. What is needed is to increase supply to match the demand for the commuter services. However, despite the inadequate infrastructure, water transport still played an important role by reducing the travel time between functional locations in Lagos metropolis when compared with road transport alternative.

The study therefore concludes that:

1. Navigational equipment upgrade and secured waterways have positive significant effect on passengers' patronage of inland water transport in metropolitan Lagos.
2. Trends of infrastructure modernization have positive and significant impact on passengers' patronage of inland water transport in metropolitan Lagos.
3. Public-Private Partnership has significant effect on passengers' patronage of inland water transport in metropolitan Lagos.

### *A. Recommendations*

Availability of large bodies of navigable inland waterways is a blessing to Lagos State as this could be harnessed by the state government and Private investors to sustain a virile water transport services in order to reduce dependency on road mode for intra-city commuting road traffic congestion. The study therefore recommends the following:

1. Lagos state office of PPP and NIWA should foster

continuous and rapid investments in water transport infrastructure modernization to increase competition and attract more patronages to the inland water sector.

2. There must be a rigorous and sustained dredging of the navigable waterways in Metropolitan Lagos through the PPP strategy for efficient, speedy and safe water transport services.
3. LASWA should continue to open up access to more functional water route in order to increase the proportion of water mode users and reduce pressure on road mode.

## References


[1] 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.

[2] Adejare, Q. A., Nwilo P. C., Olusina J. O. and Y. D. Opaluwa (2011) A study of ferry service route network in Lagos Lagoon Nigeria using graph theory. Journal of Geography and Regional Planning Vol. 4(6), pp. 326-337, June 2011.

[3] 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.

[4] 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.

[5] Aderemo, A.J. and Mogaji, S.A. (2010). Rural Transportation of public Facilities in Nigeria: a case study of Edu Local Government Area of Kwara State. Journal of Human Ecology, 29, 171-179.

[6] Afolabi Oluwaseyi, J. Ademiluyi, I. A and Fashola Olawunmi K., Analysis of Intra – City Water Transportation in Lagos State. International Journal of Innovative Research and Advanced Studies, Volume 3, Issue 8, 2016.

[7] Akpudo C. Udechukwu and Stephens S. Mobolaji (2020), Operational characteristics and supply of inland waterway transportation service in the coastal area of Anambra State, Nigeria, African Journal of Science Policy and Innovation Management, Volume 1, Issue 2. December 2020.

[8] Anderson, E.E., Talley, W.K, (1995). The oil spill size of tanker and barge accidents: Determinants and policy implications. Land Economics, 71, 216-228.

[9] Asenime C.O (2008) A study of Inland Waterway Transportation in Metropolitan Lagos, Research thesis submitted to the school of Post Graduate Studies, University of Lagos.

[10] Badejo, Bamidele (2014). Maritime Transportation Industry in Nigeria: Structure, Analysis, Challenges and Prospects.

[11] Bardo, J. W. and Hartman, J. J. (1982). Urban Sociology: A Systematic Approach, Itasa, IL.: F.E. Peacock Publishers.

[12] Ferry Navigable Routes within Lagos Lagoon. Journal of Technological Development

[13] Flying Doctors Nigeria (FDN) (2017). Boat Ambulances for Remote Site Locations in Nigeria. https://www.flyingdoctorsnigeria.com/2017/04/19/boat-ambulances-remote-site-locations-nigeria/

[14] Geetha R; Adarsh H S; S Bharath; Bankim Mandal; Hariharan S; and RD Vidyarani. Enhanced Life Jacket with GPS and GSM. International Journal of Engineering Research in Electronics and Communication Engineering, Vol 4, Issue 5, May 2017.

[15] Global GPS tracking solutions (GPSWOX, 2020) (2020). GPS tracker for Boat/Yacht. https://www.gpswox.com/en/gpstrackersshop

[16] GPS Leader (2019). Life Vest GPS tracking devices from GPS Leaders. https://gpsleaders.com/lifevest-gps-tracking-benefits/

[17] Gray, L. (2004). An examination of the problem of water transportations in old Degama province, Nigeria. Journal of waterways, Africa. 20-26. https://www.scienceabc.com/humans/why-are-vehicles-exhaust-fumes-harmful-to-humans

[18] Ikuejawa Abiola Oladeji (May 16, 2019) An Evaluative Study of Inland Water Transport Development in Nigeria.

[19] International Fire and Security Exhibition and Conference (2021). Control Room. https://www.ifsecglobal.com/control-rooms/

[20] International Maritime Organisation (2019). E-navigation. https://www.imo.org/en/OurWork/Safety/Pages/eNavigation.aspx

[21] Kimba, G. (2008). Development of inland waterways in Freetown Sierra Leone. Journal of African integration. Vol. 3, 91-100.

[22] Lagos metropolitan Area Transport Authority (LAMATA) (2014): Description of Transportation Projects Currently Happening in Lagos. www.lamata.ng.com

[23] LASWA, (2015), Projects. http://web.laswa-ng.com/projects

[24] LASWA (2019), 100,000 Commuters Traveling on Lagos Waterways Daily. www.vanguardngr.com/2019/11/100000-commuters-travels-on-lagos-waterways-daily-%E2%80%95-laswa/amp/

[25] Lawal Bello Dogaraw, Marine Accidents in Northern Nigeria: Causes, Prevention and Management. International Journal of Academic Research in Business and Social Sciences. Vol. 2, No. 11, 2012.

[26] Toffoli, A. Lefevre, J.M. Bitner-Gregersen, E. and Monbaliu, J. (2005). Towards the identification of warning criteria: Analysis of a ship accident database, Applied Ocean Research, 27: 281–29.

[27] Tolley, R.S. and Turton, B.J. (1995), 'Transport Systems Policy and Planning: A Geographical Approach', Longman Scientific and Technical, Essex.

[28] Ukoji Vitus Nwankwo; Ukoji Vitalis Ukoji (2015). Boat Accidents in Nigeria: General Trends and Risk Factors, (June 2006 – May 2015).

[29] Ukonne, U. (2019). The Lagos traffic Situation; Implication on a thriving economy.

[30] United Nation (2015). Global sustainable transport conference. https://sustainabledevelopment.un.org/topics/sustainabletransport