ISSN: 2756 – 4118 *African Journal of Science Policy and Innovation Management* Volume 1, Issue 2. December, 2020
ajspim.oauife.edu.ng

OPERATIONAL CHARACTERISTICS AND SUPPLY OF INLAND WATERWAY TRANSPORTATION SERVICE IN THE COASTAL AREA OF ANAMBRA STATE, NIGERIA

Akpudo C. Udechukwu* and Stephens S. Mobolaji

Department of Transport Management Technology, Federal University of Technology, Akure, Nigeria.
*Corresponding author email: cuakpudo@futa.edu.ng

ABSTRACT

The inland water transportation (IWT) system in Nigeria is one of the most significant modes of transportation for being easily accessible and inexpensive in terms of cost of operations and maintenance. IWT has been playing a significant role in the development of trade, commercial activities, and growth of societies since ancient time. An understanding of its operational characteristics and supply will aid its appreciation and potentials to fixing the intermodal connectivity of the Nation's transportation system and network, particularly in Anambra State. To this end, the study assessed the operations and supply of IWT by registered operators in Anambra State along existing routes. The assessment was done by on-the-spot surveys and administration of questionnaire for a two-week period. The data generated were analysed using descriptive statistics for the assessment of operational characteristics and multiple regression for the determination of the factors influencing the supply of IWT in Anambra. The study revealed that private ownership dominated supply and most of the vessels used were mid-sized wooden boats. Lucrative routes were those plied on market days. It was also discovered that demand was the single most significant factor that determines supply of IWT services. The study recommends that to make IWT more attractive, the operators must improve on the services offered and for the supply pattern to improve, the existing routes must generate more traffic outside market days. It was also recommended that boat operators should explore other uses of their boats outside market days.

Keywords: Transportation; Inland waterways; Operational characteristics; Boat operators.

1.0 INTRODUCTION

Water transportation involves short sea and deep ocean trips as well as those involving the use of inland waters such as creeks, rivers, canals and lakes. These means of movement are the cheapest per unit of cargo moved and carry more than 95 percent of international trade. This makes it the most important transportation mode especially for countries endowed with water bodies. Water transportation is also the oldest means of transporting persons and goods (Fellinda, 2006). It is a key component of the intermodal transportation network and is essential to Nigeria's economy, environment and quality of life (Adejare, Opaluwa, & Nwijo, 2011). Inland water transportation (IWT) as a component of water transport deals with the movement within national territories by the use of watercrafts such as pontoons, river ferries, and boats over a body of water, such as a lake, river or canal (Sriraman, 2002). IWT plays a vital role in urban growth and development as

well as serves as a link between urban centres and agricultural rural areas by offering cheap means of conveying passengers and bulk produce.

Specifically, the role and importance of IWT in Anambra State cannot be over emphasized. Apart from the fact that it is a sustainable and environmentally friendly mode in terms of energy consumption, noise and gas emission, it also connects rural agricultural areas that supply the state with food for domestic consumption and raw materials for industrial uses. IWT has also helped in overcoming traffic congestion challenges in Anambra State, particularly along the Asaba-Onitsha route that serves commuters and travelers passing through Delta and Anambra States. Water travel is a realistic and potentially effective option given that Anambra state is blessed with abundant water bodies that could be harnessed to offer fast, safe, comfortable and cheap water transportation services. It is therefore safe to say that for effective transportation in any given society, there must be an adequate blend of various modes of transportation where the gains of the different modes are used to complement each other for a sustainable transportation system. Ezenwaji (2010) found that the road mode of transportation carried 97% of commuters in the State. This implies that the strain and pressure being put on the road infrastructure which cannot be sustained. The promotion of IWT in Anambra State cannot therefore be over-emphasized.

In spite of the accruable great potential of IWT, it has been noted to be a mode of transport that has suffered so much neglect over time in terms of investment and drive by both the government and the private sector. Past developmental projects in previous National Plans has given little or no attention to the development of inland water transportation in the Country. Most water routes in Nigeria have not been able to meet up with the demand of the passengers. Anambra State has continued to witness problems of inadequate supply of passenger and cargo boats which occurred as a result of increase in population and commercial activities (Ezenwaji, 2010). NIWA (2017) reported that since 2016, the number of registered operators in Anambra state has declined to 38 operators against 65 operators in 2014. This has affected the few passengers/shippers who patronized them. Sometimes, the water transport users are often stranded at jetties due to poor/low supply and frequency of operations of the few available vessels. Even when there are available ferries, the transport fares are high; safety and comfort are compromised while services are invariably adjudged to be poor. A decline in the number of operators and consequently supply is evident. This study therefore sets out to answer questions such as whether the decline in number of operators has affected the overall supply of IWT. To these ends, this study will attempt to assess the operational characteristics of IWT, its supply and routes as well as factors that affect its supply. These will be the objectives of the study.

2.0. Literature Review

Many studies have been able to examine the various aspects of water transportation in developing countries in terms of operational characteristics and supply of service as well as the challenges. Literature reviewed on studies done outside Nigeria include; Sulaiman *et al* (2011), Gilberto (2016), Moacir de *et al*., (2016), Islam & Charles (2006), Svetlana & Elena (2018), Mohammad and Zobair & Subir(2014). This literature may not be applicable to the Nigerian context because of the differences in government policies and management. Studies conducted in Nigeria include;

Ezenwaji (2010), Obed (2013), Obeta (2014), Ademiluyi *et al* (2016), Bayode (2016), Ojile (2006), and Owoputi *et al*., (2018).

For instance, Ademiluyi *et al* (2016) analyzed intra-city water transportation in Lagos state. Some factors identified as being responsible for low water transport commuting in the State include; poor water transportation infrastructure, weak policy formulation, safety and security issues, exorbitant fares, inaccessibility and unavailability amongst others. Obeta (2014) worked on the characteristics of IWT in Nigeria. The author reported that IWT was more developed in the deltaic areas of Southern Nigeria compared to the hinterland areas. Obed (2013) studied the operations and management of the IWT in Nigeria and reported that delay in the implementation and enforcement of the Cabotage Act and inadequate infrastructure are the problems facing the operation of IWT. Solomon, Otoo, Boateng, & Desmond (2020) studied the Voolta Lake transport system in Ghana where they observed that IWT in the country is faced with administrative, market, logistic and technical constraints which impede smooth operations and growth of the industry. The study recommended the institutionalization and proper regulation of IWT; dredging and periodic maintenance of navigational channels; improvement of logistics and infrastructural development as well as promotion of integrated transport planning.

From all indications, none of the above studies examined or assessed the operational characteristic of IWT, its supply nor the factors that affect it in any part of Southeastern Nigeria. Most IWT studies in Nigeria were focused on Lagos. Therefore, it is against this backdrop that this study is designed to examine the operational characteristic and supply of inland water transport service in Anambra State, Nigeria.

3.0. Methodology

3.1. Study area

The study area is Anambra State, Nigeria, with particular focus on Anambra Lagoon. Anambra is one of the States situated in the South-East geo-political zone of Nigeria. Anambra State lies between Latitudes 6º 44' & 5º44' N & Longitudes 6º36' & 6º72' E. Business and farming are the major economic activities in the region. The area is richly blessed with water resources as the region is by-passed by the River Niger and also accommodates the Ezu river, which is a major tributary of the Oma-Mbala River; the largest left bank tributary of the River Niger. Anambra State consists of twenty-one (21) Local Government Areas. The State operates inland water transport mostly within Onitsha South and Oma-Mbala region which consists of three Local Government Areas namely; Anambra West, Anambra east and Ayamelum. Onitsha south is strategically positioned as a regional hub for trade and logistics in Eastern Nigeria. It also serves as hub and final destination for water transportation for the people of Oma- Mbala region.

3.2. Data and analysis

In this study, survey design was chosen to enable the researchers gather informed opinion on the operation of IWT. The study employed the use of primary data by administering questionnaire to the forty-six (46) operators registered with the National Inland Waterways Authority (NIWA) and relevant to the supply of IWT routes in the study area within a 14-day period. However, of these registered operators, 33 boat operators returned copies of their questionnaire. This indicates a 72

percent return rate. This means that 462 copies of questionnaire were returned and found useful in total within the 14-day period (See Appendix I). Interviews and on-the-spot assessments were also conducted to appraise the operations of the IWT and routes plied by the different operators. The questionnaire elicited information on the socio-economic characteristics of the operators and operational characteristics such as fleet type, frequency of service, routes and distances covered. The data analyzed using descriptive statistics revealed fleet characteristics (age, type and capacity of vessel, engine type and capacity); frequency of service, distances and routes covered; maintenance; and type of cargo.

To understand operational characteristics, one would have expected to see service (time) hours but it can be difficult to handle and use appropriately because service hours ordinarily should include the times passengers and cargo spend in the terminal while waiting to board or be loaded onto to the departing vessel and the journey times. Journey times are complicated further by the variation in flow rate of the river and the direction of movement – be it against or along the river flow. To this end, frequency of service; that is, number of times a round trip is made in given time will be a better alternative as it will show the number of times a particular operator or vessel made a round trip over a given distance. In addition, headway can be used to show the interval between successive departures and arrivals for operators with multiple vessels or for departures and arrivals from particular terminals.

In addition, multiple regression was used to determine the factors influencing the supply of IWT services in the State.
The regression model was of the general form:

$$S_{iwt} = ß_i + ß_1 P_{is} + ß_2 F + ß_3 R + ß_4 D + ß_5 F_d + ß_6 T + ß_7 R_c + e$$

Where S_{IWT} = Supply of IWT; $ß_i$= coefficient of the intercept; $ß_3$, …. $ß_7$ are the coefficients of the independent variables; P_{is}= Price of inputs of supply; F = fare; R = revenue; D = demand; F = future demand; T= time; R_c= route competition. The factors were ranked on Likert scale of 1 to 5 with one being the least level of importance affecting the supply of IWT.

4.0. Results and Discussion

4.1. Socio economic characteristic of the respondents (operators)

Table 1 presents the socio-economic characteristics of the operators. Results reveal a male dominated (100%) work force in the study area. This can be attributed to the nature of the trade that requires physical strength in the discharge of duties. The marital status of the respondents shows that 33.33% of the boat operators were single and 66.67% were married. This result indicated that majority of boat operators were married, which could imply that the trade is not attractive to young men. Furthermore, the study revealed that 12.12% of the operators were between the ages of 18-25 years, 42.42% were within 26-34 years, 39.39% were within 35-45 years and 6.06% were above 46 years. The impact of the unattractiveness of the IWT to the younger generation is likely the slow adoption of recent technological innovations to the trade as literature shows that adoption of innovations is mostly driven by younger individuals.

The educational status of the boat operators revealed that 24.24% had no formal education, 12.12% acquired first school leaving certificate and 63.64% were secondary school certificate holders. The large percentage of operators with secondary education is not surprising because the certificate may not provide them jobs in other employment that will give them a living income.

The number of years of experience in the operation of IWT showed that 15.15% have less than 5 years of experience, while 30.30% have 5–10 years and 54.55% have more than 10 years of experience in the sector. This also points to the fact that the younger generation are not that attracted to this trade but the sector has ample experienced hands to guarantee safe IWT operations.

4.2. Operational characteristic of boat services in Anambra waterways

4.2.1 Vessel ownership

Results in Table 2 show that 93.94% of the vessels were privately operated. Of this proportion, 84.85% were privately owned by individuals and 9% were owned by individuals or private entities in partnerships or joint ventures. Approximately 6% of the boats were publicly owned by the community and churches. From the above analysis, the assessment showed that private individuals are more involved in providing means of water transport in Anambra State with no government ownership and operations of vessels. There was no public-private partnership too. This finding was alluded to by the Chairman of Wooden Boat and Speedboat Operators Association in the State during an interview conducted in the course of the study. The Chairman reported that Anambra State has no government owned boats for the movement of goods and passengers. This can be seen glaringly from the fact that the State has no department/unit for water transportation in the State Ministry of Transport and as such it is likely that no budget is being allocated to IWT development in the State. This implies that water transportation policy and regulations in Anambra State are generally handled by the National Inland Water Authority (NIWA). However, NIWA does not have a single operational vessel in the State. This negates one of NIWA's function - the operation of ferry services within the inland waterways system in the country.

Table 2: Socio- Economic Characteristics of the Respondents

Variable	Case	Frequency	Percentage
Gender	Male	33	100
	Female	0	0
Marital Status	Single	11	33.33
	Married	22	66.67
	Divorce	0	0
	Windowed	0	0
Age Status	Age below 18 years	0	0
	18-25 years	4	12.12
	26-34 years	14	42.42
	35-45 years	13	39.39
	Above 46 years	2	6.06
Educational Level	No Formal Education	5	15.15
	Primary	4	12.12
	Secondary	21	63.64
	Tertiary	3	9.09
Y	Less than 5 years	5	15.15
ears of Experience	5-10 years	10	30.3
	Above 10 years	18	54.55

Source: Authors' Field Work, 2019

ISSN: 2756 – 4118 *African Journal of Science Policy and Innovation Management* Volume 1, Issue 2. December, 2020
ajspim.oauife.edu.ng

Table 2: Vessel Ownership

Types of Ownership		Frequency	Percentage
Privately owned	Individuals	28	84.85
	joint venture between individuals and units within the society	3	9.09
Publicly owned		2	6.06
Public -Private Partnership		0	0.00
Government owned		0	0.00
Total		33	100

Source: Authors' Field Work, 2019

4.2.2. Fleet characteristics and supply in the study area

Table 3 revealed that the total numbers of functional boats in use by the thirty-three (33) respondents was forty-three (43) boats comprising 31 passenger and 12 cargo boats. The study revealed that out of the 31-passenger boats, 12 are speedboats with capacity of less than 15 passengers, 2 are metallic ferries with capacity for 50 passengers, and 16 are wooden ferries with capacities for 31-50 passengers and above 50 passengers. The study revealed only one non-motorized boat with capacity for 15 passengers. The cargo vessels were of three types. These made a total of 12 boats in the study area. A break down showed that three of them were non-motorized boats with less than one-ton capacity, 7 were wooden boats with capacities of between 1- 5 tons and two barges with capacities of between 5 - 10 tons.

Table 3: Fleet type and capacity

Boat Type	Passenger (PAX) Capacity					Cargo Capacity in tons				Total
Type of boat	Less than 15 pax	16-30 pax	31-50 pax	> 50 pax	Total	Less than 1 ton	1- 5 tons	5- 10 tons	Total	
Non-Motorized	1	0	0	0	1	3	0	0	3	4
Wooden Ferry	0	6	10	0	16	0	7	0	7	23
Metallic ferry	0	0	0	2	2	0	0	0	0	2
Speedboat	12	0	0	0	12	0	0	0	0	12
Roofed boat	0	0	0	0	0	0	0	0	0	0
Barge	0	0	0	0	0	0	0	2	2	2
Total	13	6	10	2	31	3	7	2	12	43
					975 seats				58 tons	

Source: Authors' Field Work, 2019

Notes: Load factor (degree of use of supplied capacity – payloads) is usually unitary in passenger and cargo services in IWT. This implied that capacity utilization is optimal.

Using the upper limits, the total passenger carrying capacity will be 975 seats [(13 x 15) + (6 x 30) + (10 x 50) + (2 x 50)]. Whereas the total carrying cargo capacity can be summed to be 58 tons [(1 x 3) + (7 x 5) + (2 x 10)] if the upper limits of their capacities are utilized for computation. Nine hundred and seventy-five seats and 58 tons are the available carrying capacities and payloads supplied on these routes.

Table 4 shows that 81.82% of the boats used outboard engines while 18.18% operate with inboard engines. In terms of capacity, 70.37% of the outboard engines are 225 horse power (Hp) single engines and 29.63% use less than 200 horse power enginse (Hp). This implies that the use of outboard engines with 225 Horse power single engine is predominant in the study area.

Table 4: Types of Engine used and their Capacity

Type of Engine			Capacity supplied				
			Less than 200 Hp		225 Hp		
Type of engine	Frequency	Percentage	Frequency	percentage	Frequency	percentage	Total
Outboard	27	81.82%	8	29.63%	19	70.37%	100
Inboard	6	18.18%	4	66.67%	2	33.33%	100
Stern Drive	0		0		0		
Jet Drive	0		0		0		
Total	33	100%	12		21		

Source: Authors' Field Work, 2019

Table 5 revealed the age of the boat supplied for service along the study routes. It was indicated that 18.18% had been in service in the routes for less than 5 years, 12.12% for between 6-10 years, 18.18% for between 11-15 years and 51.52% have been plying the routes for above 15 years. From these findings, it can be inferred that majority of the boats have been in use for upwards of 15 years. This implies that the fleet is relatively old.

Table 5: Age of the Boat supplied

Age of the Boat	Frequency	Percentage
Less than 5years	6	18.18%
6-10years	4	12.12%
11-15years	6	18.18%
Above 15years	17	51.52%
Total	33	100%

Source: Author's Field Work, 2019

Table 6 reveals the number of boat trips per day in the study area. It shows that 6.60% of the boats make only one round trip per day, 42.42% make two trips per day, 39.39% operate 2 - 4 round trips per day, while 12.12% make more than 4 round trips daily. Generally from the findings, it shows that all boats are fully engaged in day-to-day operations where majority of the boats are

employed for a least two round trips per day. Total daily distance covered by all the operators is estimated to be 330 kilometers. Recall, that the total passenger seats supplied and used is 975 seats and total cargo space supplied and used is 58 tons. This will give a combined passenger seat-kilometre:

$$Passenger\ Seat - km = \frac{passenger\ seat}{Kilometre} = \frac{975}{330} = 2.954\ passenger - km$$

That is, 3 passengers carried per kilometer per day is the movement in the study area.
For the cargo movement, the cargo-kilometre is

$$cargo - km = \frac{cargo\ tons}{Kilometre} = \frac{58}{330} = 0.175\ tons - km$$

That is 0.175 tons is carried per kilometer on daily basis.

Table 6: Boat Trips

Daily number of round trips	Frequency	Percentage	Distance (km)	Round trip	Total distance per day
Once per day	2	6.60%	5	10	20
Twice per day	14	42.42%	5	10	140
2-4 times per day	13	39.39%	5	10	130
More than 4 times	4	12.12%	5	10	40
Total	33	100.00%			330

Source: Author's Field Work, 2019

Table 7 revealed the type of cargo carried along the study route. Investigations revealed that the nature of the goods transported by IWT operators in Nigeria is largely influenced by the aspects of the pattern of settlement and agricultural practices along the navigable channels of the rivers. Agricultural products were found to be the main cargo transported along the study area.

4.3.1 Factors affecting supply of inland waterway transportation in Anambra State

The regression analysis for factors affecting supply in the study area is presented in Table 4.5. The variables (independent) are prices of input of supply (PIS), fare, revenue, demand, future demand, time and route competition. While the dependent variable is capacity supplied. From the analysis, the result revealed that demand had the most significant impact on the supply for inland waterway transport with p-value of .0016.

Cargo type	Frequency	Percentage
Bulky cargoes	7	21.21%
Crude oil	0	0.00%
Agricultural product	23	69.70%
Other	3	9.09%
Total	33	100.00%

Source: Author's Field Work, 2019

The result shows that price, fare revenue, future demand, time and route competition were of no significance at all as factors affecting supply for water transportation in the route under consideration. The results of the regression were acceptable because the R-square showed that 78.8 percent of the 462 observations (as the supplied capacity of each of the 33 operators were examined for 14 days (13 x 14 = 462) fits well into the model that the regression generated given a standard error margin of 31.369 for the seven independent variables and other variables not captured.

The analysis of variance showed that the variables were highly correlated as the p-value for the ANOVA showed a value of zero and well below the 95% significance level adopted. Therefore, the regression model for Anambra State waterways for the factors that affects supply for inland waterway transportation is given by

$$S_{iwt} = 10.8658 + 3.4672P_{is} + 0.7669F + 0.2385R + 0.8909D + 1.7586F_d + 1.3191T - 0.6717R_c + 31.369$$

5.0 Conclusion and Recommendations

This study explored the operational characteristics and factors affecting supply of inland waterway transport in the coastal areas of Anambra State, Nigeria with a view to finding a visible remedy to those challenges. The development of any nation, or town's economy depends extensively on its transportation system and inland waterways transportation is part of the transportation system. This means that without an effective transportation system, the entire economy will suffer stagnation as transportation helps to bridge the gap between producers, suppliers and industrialists as well as individual commuters. Based on the finding, despite the crucial roles of inland water transportation, this sector has had limited government presence in the area of operations at all the tiers of government in the study area. It is therefore very expedient that the followings recommendations are taken into consideration. Government intervention in water transport would have positive impact on the economy and lives of the people in the study area. Such intervention could be in form of providing convenient, fast, affordable, safe and regular ferry services in the area to further aid the economic activities there and the surrounding areas. It was also concluded that public and private sector partnership should be encouraged so as to make the funding and management of water transport facilities sustainable.

ISSN: 2756 – 4118 *African Journal of Science Policy and Innovation Management* Volume 1, Issue 2. December, 2020
ajspim.oauife.edu.ng

Table 4.5 Regression Analysis for factors affecting supply as given by the Operators

R^2	0.788		
Adjusted R^2	0.785	n	462
R	0.888	k	7
Std. Error	31.369	Dep. Var.	**Capacity supplied**

ANOVA table

Source	*SS*	*df*	*MS*	*F*	*p-value*
Regression	1,665,673.48	6	277,612.25	282.12	1.90E-47
Residual	447,735.25	455	984.0335		
Total	2,113,408.73	461			

Regression output

					confidence interval			
Variables	*coefficients*	*std. error*	*t (df=455)*	*p-value*	*95% lower*	*95% upper*	*std. coeff.*	*VIF*
Intercept	-10.8658	3.5345	-3.074	7.70E-150	-17.8102	-3.9214	0	
PIS	3.4672	2.9395	1.18	0.2388	-2.3094	9.2438	0.026	1.026
Fare	0.7669	1.8285	0.419	0.6751	-2.8264	4.3602	0.01	1.02
Revenue	0.2385	0.151	-0.512	0.6092	-0.0585	0.5355	-0.029	10.199
Demand	0.8909	0.0581	15.346	0.0016	0.7768	1.005	0.899	10.212
Future demand	1.7586	2.9494	0.596	0.5513	-4.0376	7.5549	0.013	1.008
Time	1.3191	1.0512	1.255	0.2102	-0.7467	3.3849	0.028	1.003
Route Competition	-0.6717	1.2119	-0.848	0.8235	-3.0102	2.0601	-0.02	1.05
								4.078
								mean VIF

Source: Author's Field Work, 2019

REFERENCES

Ademiluyi, I. A., Fashola, O. K., & Afolabi , O. J. (2016). Analysis of Intra – City Water Transportation in Lagos State. *International Journal of Innovative Research and Advanced Studies (IJIRAS)*, Volume 3 Issue 8.

Adejare , Q. A., Opaluwa, Y. D., & Nwilo, P. C. (2011). Dredging of the inland waters and sustainable management of the waterways for national development. *Nigeria Journal of Technological Research*, 6 (1) 23-31.Bart , W., Patrick , W., & Tejo , S. (2015). Inland port performance: a statistical analysis of Dutch inland ports. ELSEVIER; Transportation Research Procedia , 8 (2015) 145 – 154 .

Bayode, & Ipingbemi. (2016). Safety and operational characteristics of water based transportation in Lagos state. *Journal of Traffic and Transportation Engineering*, 1(1); 131-141.

Ezenwaji, E. E. (2010). Constraints on Effective Water Transportation in Some Riverine Communities of Old Anambra L.G.A., Anambra State. *A Paper Delivered at the 2010 Rural Development Seminar, Rural Transportation in Nigeria.* Owerri, Imo State.

Gilberto M.R ,Moacir de , F. J., Rodrigo , C. T., M. R., & Oduvaldo, V. (2016). Waterways Cargo Transportation: A Comparison between Brazil and the United States. *A paper presented at the 6th International Conference at the Information System Logistic and Supply Chain (ILS2016).*

Islam, E.-N., & Charles, R. (2006). Challenges to Inland Waterways Logistics Development: The Case of Egypt. *ResearchGate journal* , 1-24.

Fellinda. (2006). World's Water Transport needs further Development. *Journal for Transport Development*, 4(6); 68-75.

Moacir de , F. J., Rodrigo , C. T., João Gilberto , M. R., & Oduvaldo, V. (2016). Waterways Cargo Transportation: A Comparison between Brazil and the United States. *A paper presented at the 6th International Conference at the Information System Logistic and Supply Chain (ILS) between 23th - 26th July 2016.*, (pp. 51-60). Brazil.

Mohammad , T. H., Zobair , I. A., & Subir, D. (2014). A Study on the Accidents of Inland Water Transport in Bangladesh: The Transportation System and Contact Type Accidents . *Journal of Transport System Engineering*, 1 (1) 23-32.

NIWA. (2017). *National Inland Waterways Authority (NIWA). Annual Reports.*

Obedi, B. C. (2013). A Critical Assessment of the Inland Waterways Operations and Management of the Development of Nigerian Maritime Industry. *Greener Journal of Environmental Management and Public Safety*, 99-117.

Owoputi , A. E., Paul I. , I. I., & Akpudo , C. U. (2018). Opportunities and challenges of inland waterways transport in the southwest coastal belt of Nigeria . *Bhúmi, The Planning Research Journal* , 6 (1) 10-17.

Obeta, M. C. (2014). The Characteristics of Inland Water Transport in Nigeria. *IOSR Journal Of Humanities And Social Science (IOSR-JHSS)*, 19(3): 119-126.

Ojile, M. O. (2006). *Draft Report of the Socio-Economic Characteristics for the Idealization of the Port Harcourt Warri Roads.* Abuja: Submitted to Messer allots Nigeria. Limited on behalf of the Federal Ministry of Works, Abuja.

Solomon, B., Otoo, E., Boateng, A., & Desmond , A. K. (2020). Inland Waterway Transportation (IWT) in Ghana: A case study of Volta Lake Transport. *International Journal of Transportation Science and Technology*, https://doi.org/10.1016/j.ijtst.2020.05.002.

Suleiman, O. O., Saharuddin, A. H., Kader , A. S., & Laily, A. (2011). Safety and Environmental Risk and Reliability Model for Inland Waterway Collision Accident Frequency. *International journal of energy and environment*, 5(4); 167-177.

Sriraman, S. (2002).A long –term perpecttive on Inland Water Transport in India. *RITES Journal.*

Svetlana , M., & Elena , P. (2018). Current Situation and Optimization of Inland Waterway Infrastruture Financing. *Scientific Journals Maritime University of Szczecin*, 13 (3) 51-63.

Appendix I: Distribution of the questionnaire

Sampled Routes	No. of registered operators as at August 2019	Copies of questionnaire sampled for 14 working days	No. of Operator's completely returned questionnaire	Copies of questionnaire received
Onitsha Marina – Otuocha Onitsha – Asaba	46	644	33	462

Source: Author's field work (2019)

Note: Two routes sampled are operated by the same operators as indicated in the table.