

Assessment of operational performance and service quality in inland waterway transport: A case study of Warri Southwest, Nigeria

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Abstract: *Purpose:* This study aims to evaluate the operational performance and service quality of inland waterway transport in Warri Southwest, Nigeria, by examining the factors that influence them. *Methodology:* The study employs a quantitative research approach, using a structured questionnaire to collect data from 180 respondents. The data is analyzed using regression analysis and a structural equation model (SEM) with the help of PLS Software Version 13.0. *Results:* The findings indicate that cargo clearance, infrastructure quality, and storage facilities significantly influence the performance of agent operation in inland waterway transport ($p=0.000$). Staff performance also directly impacts the provision of logistical services, which affects customer service. However, jetty operations do not promote operational performance ($p=0.075$). Additionally, staff performance does not significantly influence the association between jetty operation and performance and the relationship between cargo clearance and infrastructure level ($p=0.136, 0.388$). *Theoretical contribution:* This study contributes to the literature on inland waterway transport by providing empirical evidence on the factors influencing operational performance and service quality. The findings can help inform the development of policies and strategies to improve the efficiency and effectiveness of inland waterway transport in Nigeria and other similar contexts. *Practical implications:* The study's recommendations include improving the quality of infrastructure, cargo clearance processes, and storage facilities to enhance operational performance. Additionally, investing in staff training and development can improve the provision of logistical services and, in turn, customer service. The study also suggests that the government and relevant stakeholders should prioritize the development of inland waterway transport to unlock its potential for socio-economic development, particularly in rural and hard-to-reach areas.

Keywords: inland waterway transport, operational performance, service quality, cargo clearance, sustainable development

1. Introduction

Maritime transport is the movement of people, goods, and other related services via the sea, lakes, coastal waterways, rivers, and canals (Oni, 2009). Inland water transportation is where this passenger movement occurs most frequently in marine transport. The primary mode of transportation for persons leaving rural regions is inland water transportation. Ocean, coastal, and inland waterways comprise the three main water transportation categories. Regarding expenses and carrying huge traffic, inland waterways are superior, especially when cost is more essential than speed. The states that makeup Nigeria's interior waterways are underdeveloped, underutilized, and do not receive the attention they deserve. The signing of the N34.8 billion contract for dredging in lower Niger, which includes roughly 572 kilometres of waterways spanning from Warri in Delta state to Baro in Niger state, is the federal government's attempt to change this (Obed, 2013).

The inland waterway transportation infrastructure makes it simpler for the underprivileged to access their fields fishing huts, and to transfer goods from one place to another. When there is no other method to access other modes of transportation, like land or road transit, this kind of transportation typically helps accessibility to distant areas or regions surrounded by water. The Warri Southwest has relied heavily on the inland transportation sector to transport people and cargo for many years. Particularly in the rural areas of the Niger Delta region, this industry provides naturally appropriate and comparably less expensive modes of transportation for conveying passengers and goods.

According to Aderemo and Morogaji (2010), navigable inland waterways include rivers, lakes, lagoon coastal streams, and canals. According to Ukoji (2015), the capacity of inland waterways to migrate to locations that are not motorable or accessible due to those locations being surrounded by water enables industrial, economic, and social development. In this situation, goods like fish and other locally produced items can travel to the outside world, while goods from outside can travel into these regions. This can result in a rise in demand for vessels for transportation, fishing, security, and leisure activities, opening up job prospects for those living there. People in the region would gain employment by actively participating youth in welding and fabrication operations.

According to Obed (2016), investors in inland water transport have access to potential prospects in facility management, jetty operations, and boat manufacturing. He concurred with an earlier statement that insufficient security deters potential investors from using the lucrative commercial opportunities offered by Nigeria's inland canal services. Development-related difficulties have also been, such as dredging and maintaining river channels, private sector participation in the water transportation industry, establishing and renovating river ports, purchasing passenger boats/ferries, security boats, building channel buoys, and other initiatives. However, the main focus of this study will be on the Escravos route's inland waterway transit operational performance and service quality. Inland waterway transportation in the Escravos would be relevant when consumer satisfaction is considered.

It is impossible to overstate the value of Nigeria's extensive network of inland waterways to the country's socio-economic, commercial, and industrial development. Inland waterways are the only method of transportation in some regions of Nigeria, particularly in the rural areas along the coast and in the Niger Delta. If these regions' inland waterways are in bad condition, it could hurt their socio-economic well-being. However, this study deals with a few problems of inland waterway transport's operational effectiveness and service quality. Although there has been much research in other service sectors, including telecommunications and education, little has been done to specifically examine the importance of quality of service in public transit.

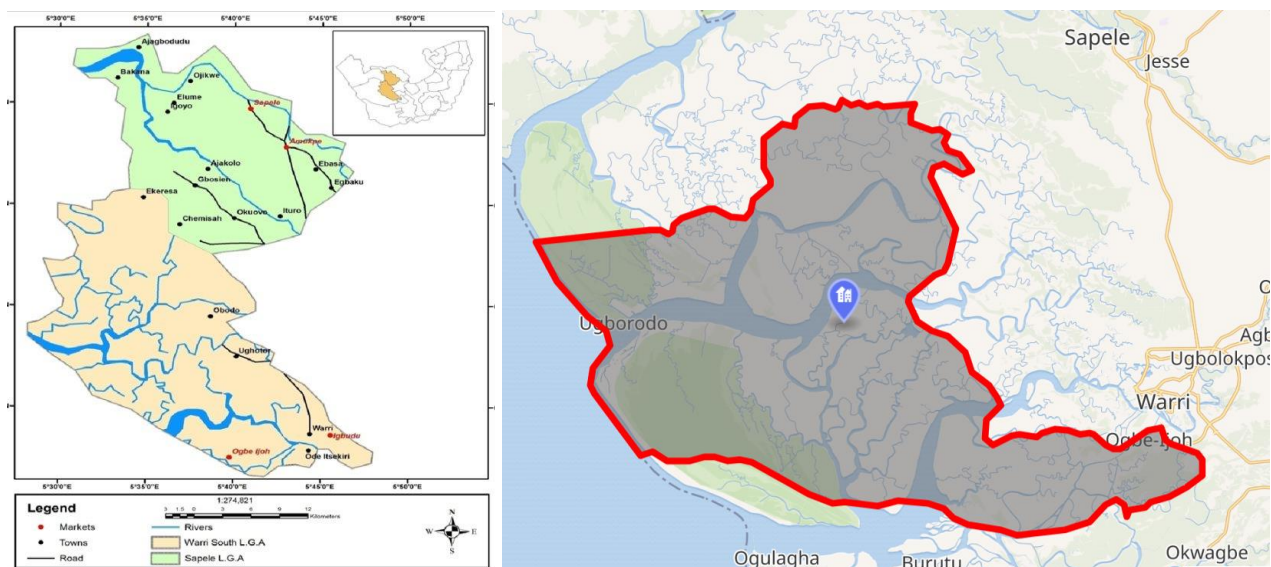
Poor management of the jetties, subpar infrastructure, uncomfotability of services, and excessive transportation costs are some elements that impact operational performance and service quality in the Warri Southwest. Lack of organizational policy leads to poor management of jetties since it determines the services that are provided and how they are delivered, how much money is made, and how the organization's operational performance and quality of service are affected.

Another significant problem is inadequate infrastructure, including poorly built jetties and a lack of well-equipped waiting areas where customers can wait before boarding a boat after making a reservation, significantly impacting the level of service. Because of inadequate planning and administration, most of the jetties in the study are built improperly; they are made of wood rather than concrete. Poor management of jetties leads to overloading, uncomfotability, and safety concerns, all impacting customer pleasure. This study aims to assess the operational performance and quality of service rendered in the inland waterways of the Warri South jetty. The objectives include examining the operational performance of inland waterway transport in the study area, examining jetty agents in the study area, examining the quality of service of inland waterway transport in the study area, and exploring the operational challenges of jetty agents in the study area.

1.1. Study areas

The study focuses on assessing inland waterway transport operational performance and quality of service. It will be restricted to the Delta State's Warri southwest local government area. This is due to the presence of jetties in this location; the time frame for this study is 2017 to 2021. This time is relevant because it constitutes the period in which the Nigeria Maritime University was established. This study will, therefore, show the operational performance and the quality of service rendered by jetties in the Warri Southwest zone.

Figure 1: Map of Warri Southwest zone



2. Literature review

Abdulkadir and Halimat (2020) stated that Lagos City has many navigable interior waterways that, if fully utilized, would reduce road traffic congestion and pollution and provide inexpensive ways to travel vast distances within the city. Their study focused on the Ikorodu-Ebutte Ero route and studied inland water transport services on the Lagos lagoon. With the aid of standardized questionnaires, primary data were collected. Secondary data were obtained from pertinent public and private organizations. Descriptive approaches, such as frequency counts, tables, and graphs, were used to analyze the data. The findings showed insufficient port buildings and ships in the vicinity. The majority (67.3%) of the excursions made by water were mainly for business.

Poor ridership was noted; it was later determined that this was primarily because of the comparably high fare costs and concerns about passenger safety, as stated by 67.4% and 58.7% of the respondents, respectively. Additionally, it was discovered that high-income earners used this style more frequently than low-income workers. The respondents' high use of water transportation (71.3%) suggests that this mode has tremendous potential to be extensively embraced if more focus is placed on its development by both the public and commercial sectors.

Pidlisnyi (2016) examined the historical eras of inland water transport development in Ukraine. The author examines the issues that have made river transportation less competitive than other kinds of transportation. In recent years, this problem has resulted in several freight switches from river transit to rail and road. It is essential to take action to prevent river traffic from stalling and to ensure further expansion of river traffic to revitalize Ukrainian inland waterways navigation and increase the capacity of river transport (an economical and ecological method of transportation). The following are the key directions for river transportation development: hastening the passage of the Ukrainian Law "On Inland Waterway Transport" as the legislative foundation for restoring navigation on Ukraine's waterways. According to studies that call for more research on its computation, adopting a single river gathering is the only progressive norm that the draft law is said to possess. Innovative methods for fleet development and infrastructure rehabilitation in public-private partnerships are provided. The author highlights that one strategy for improving river transportation is fostering an environment that encourages competition. It is essential to approve the Ukrainian Law on the International Shipping Register of Ukraine". Due to the implementation of international norms for fleet registration, including foreign vessels, the Ukrainian Navy can return. Streamlining the procedures for allowing foreign-flagged ships to pass through Ukraine's inland waterways will also encourage competitiveness. As a result, it will boost multimodal transport of commodities in containers and export-import traffic. The state members of the Danube Commission are recommended in this article to ensure the Danube's depths. The author suggests boosting Ukraine's involvement in rehabilitating canal E-40 under the European Initiative. It permits the Dnipro River's transit capability, will aid in the resumption of freight traffic between the Black Sea and the Baltic Sea, and will aid in the resurgence of freight between Belarus and Ukraine. The author suggests boosting Ukraine's involvement in rehabilitating canal E-40 under the European Initiative. It will allow for the exploitation of the Dnieper River's transit potential, connect the Black Sea and the Baltic Sea, and support the resurgence of freight between Ukraine and Belarus.

Owoputi (2019) studied the difficulties and effects of inland waterway transportation in the Nigerian coastal region of Ogun State. Both primary and secondary sources were used to gather the data. In this study, two different kinds of questionnaires were used. We employed both descriptive and inferential statistical techniques. Descriptive techniques were used for tabulation and data summary. The effect of water transportation on socio-economic development was investigated using multiple regression analysis after data reduction using an orthogonal factor analytical approach. Significant variances were established using post hoc analysis. The study's inferential analysis used multiple regression techniques and an analytical process. According to the study, inland rivers in the coastal region of Ogun state have great potential. The area's riverine nature is confirmed by the fundamental morphometric. Reports of ridership indicate that water transportation is still underdeveloped and underutilized and that inland waterways are not used very often because of a lack of amenities. The causes of the problems at the jetties are different at each jetty. Five variables accounted for 78.9% of the variance in the water jetties in the Ogun State. Four significant issues hampered the development of inland waterways. These include lack of funding, inadequate jetty resources, political sway, and government regulations prohibiting private ownership of jetties or undressed waters. In the Nigerian coastal region of Ogun State, the study advocated stricter regulations and the requirement to promote private and public participation in canal development.

Golebiowski (2016) researched inland water transport in Poland and concluded that it is the most energy-efficient mode of transportation. Inland canal transportation uses fewer diesels per 100 tonne-kilometers than rail or road transportation. It can be predicted that cross-docking in seaports with Polish supporting infrastructure (especially in Western European ports) will be the key factor driving demand for container transport on inland waterways in Poland. The degree of cross-docking at inland waterway transportable maritime container terminals in the Gdansk and Szczecin-Winoujcie port complex is predicted to increase to 2.57 million TEU annually by 2027 based on the study's current predictions. Inland waterways might move these commodities to commercial support facilities (competing with road and rail transportation).

Solomon, Boateng & Koomson (2021) Waterbodies have been an incredible means of travel for transferring people and/or products inside and beyond regional, national, and continental borders, according to a study on inland water transport in Ghana. Many nations continue to rely on inland water transportation to move bulk and general freight over great distances across lakes and rivers. The Volta Lake Transport Company (VLTC) manages Ghana's Inland Water Transport (IWT) system, which has

been operating for many years. Despite the many years of operational activity, the IWT system in Ghana is still hampered by a number of obstacles, such as administrative, commercial, logistical, and technological barriers, that prevent efficient operations and the expansion of the sector. Through interviews and questionnaires, open-ended verbal questions were utilized to elicit respondents' opinions on these significant difficulties. Some recommendations were made to help the IWT system in Ghana and other nations facing comparable challenges, including institutionalizing and properly regulating IWT, dredging or routine maintenance of navigational channels, bettering logistics and infrastructural development, and promoting integrated transport planning. Some of the advantages of better IWT, as enjoyed by many nations with competitive IWT, were also explored compared to Ghana and other nations with low IWT competition as a motivating strategy. They concluded from their analysis that inland water transport needs to be improved and encouraged to compete more effectively with other modes of transportation and advance the transportation infrastructure.

Furthermore, several studies have been carried out on the Inland waterway. Nur, Marufuzzaman, Burch, and Puryear's (2018) study of inland waterway ports reveals their importance to the nation's economy. This port type provides exceptional assistance and boosts a country's transportation industry and import-export trade. However, there haven't been many attempts to characterize these inland waterway ports. The stochastic Analytical Hierarchy Process (AHP), which we propose as a systematic multi-criteria, multi-personnel decision-making approach in this paper, can be used to characterize inland waterway ports and pinpoint the most pervasive elements that might significantly affect a port's performance and overall utilization. This reliable approach may successfully deal with biases, inconsistent judgments, and inconsistent data while lowering the uncertainty related to decision-making processes. To visualize and validate the modelling results, they use the inland waterways system of the state of Mississippi in their study. Based on the criteria established in this study, the results of this case study show that inland ports along the Mississippi River exhibit less capability than ports along the Tennessee-Tombigbee waterway. However, this approach may be applied to a single set of ports with varied situations to get various valuable managerial insights.

Hossain et al. (2019) noted that because ports are considered the centre of the maritime transportation system, evaluating port performance is essential for a country's growth and economic success. In order to assess the overall effectiveness and usage of inland waterway ports, this study suggests a novel metric, the port performance index (PPI), which is based on six factors: port facility, port availability, port economics, port service, port connection, and port environment. This study employs a Bayesian network (BN) model that focuses on quantitative and qualitative aspects to evaluate a port, in contrast to literature that primarily rates ports based on quantitative factors. Further examination of the assessment of inland waterway port performance is conducted using a variety of cutting-edge methodologies, including sensitivity analysis and belief propagation. Their research demonstrates that the six criteria are required to forecast PPI. The study also revealed that of the six criteria for PPI for inland waterway ports, port services have the most impact, while port economics have the least.

3. Methodology

Data on the Escravos route were obtained from different jetties in Warri South operating on the route. Questionnaires of approximately 180 were distributed to the passengers and operators of the inland water transport in the study area. The questionnaires were drawn based on a Likert comfortability and passenger satisfaction scale. Additionally, personal interviews were carried out with the operators/management of the jetties about safety, time maintenance, employers' attitude, and reliability in delivering according to passengers' satisfaction.

Structural equation modelling was used for the study analysis. It is a statistical method increasingly used in scientific studies in the field of social sciences in recent days. The most important reason for the spread of this statistical technique is that the direct and indirect relationship among causal variables can be measured with a single model (Meydan & Sen, 2011). Structural equation modelling is a statistical method used to test the relationship between observed and latent variables. Observed variables are the measured variables in the data collection process, and latent variables are the variables measured by connecting to the observed variables because they cannot be directly measured. Structural equation modelling consists of two primary components: structural and

measurement models. The widespread adoption of the structural equation model is due to its minimization of measurement error and its ability to account for the relationship between errors in the observed variables. Another difference from the regression models of the structural equality models is that they are based on the covariance matrix.

For this reason, in some sources, it is named covariance structure modelling or analysis or covariance structure (Bayram, 2013). However, structural equation modelling confirms the correspondence of the data relations with the theoretical model. For this reason, structural equation modelling is more suitable for testing hypotheses than other methods (Karagoz, 2016). Structural equation modelling consists of a system of linear equations. The key in the regression analysis is to determine how much of the change in the dependent variable is explained by the independent variable or variables. Although multiple regression analysis can only be applied to observed variables, the basic principles can be applied to structural equation modelling (Kline, 2011). The equation is stated as follows:

$$Z = \beta_1.X + \beta_2.Y + 1.Res_1 \quad (1)$$

$$W = \beta_3.X + 1.Res_2 \quad (2)$$

$$T = \beta_4.Z + \beta_5.Y + \beta_6.W + 1.Res_3 \quad (3)$$

Structural equation modelling is addressed in two groups: endogenous and exogenous variables. In structural equation modelling, the endogenous distinction is used as a more accurate distinction because a variable can assume the role of both the dependent and independent variables simultaneously. Endogenous variables are dependent variables explained by other variables, and Z, W and T are endogenous variables. Exogenous variables are independent variables not explained by any variables, and X and Y are external variables. If there is more than one exogenous variable, covariance between these variables is needed. The terms Res1, Res2 and Res3, which appear in the equations, represent the residuals of each endogenous variable. These residuals are also called error terms of the structural model. Unlike regression models, structural equality models are based on the covariance matrix. However, it mainly consists of a system of linear equations.

Therefore:

Z, W and T = Overall quality of service as an output (Dependent)

Against the following input index: X (Independent variables)

4. Results and discussion

4.1. Results

4.1.1. Analysis of jetty agent operational performance in Warri Jetty

Table 4.1: Mean and standard deviation of the variables

Variables	N	Min	Max	Mean	Std. Dev.
Freight clearance	150	1	5	3.91	.550
Infrastructure level	150	1	5	3.65	.567
Storage facility	150	1	5	3.51	.479
Customer service	150	1	5	3.44	.485
Quality of logistics services	150	1	5	3.51	.482
Staff performance	150	1	5	2.91	.522
Jetty Operation	150	1	5	3.35	.339

Source: Authors Analysis, 2022

The descriptive statistics analysis for the mean score and standard deviations of the dependent and independent variables is displayed in Table 4.1 above. The mean staff performance and cargo freight clearance values varied from 2.91 to 3.91 for the dependent and independent variables. The average for the infrastructure level was 3.65, while the average for the storage facility level was 3.51. The average

for customer service was 3.44. The standard deviation demonstrated the low variability of all the factors. The least variable was found in staff performance (2.91), while the greatest was in freight clearance.

Table 4.2 displays the normality test utilizing skewness and kurtosis for the relevant variables. The findings demonstrated that each variable's distribution was favourably significantly skewed (as the values were more significant than 1). The same was valid for freight clearance, with a skewness value of 3.91 compared to 3.56 for port operation. Staff performance (2.91), customer service (3.44), and infrastructure level (3.65) all had skewness more than 1.

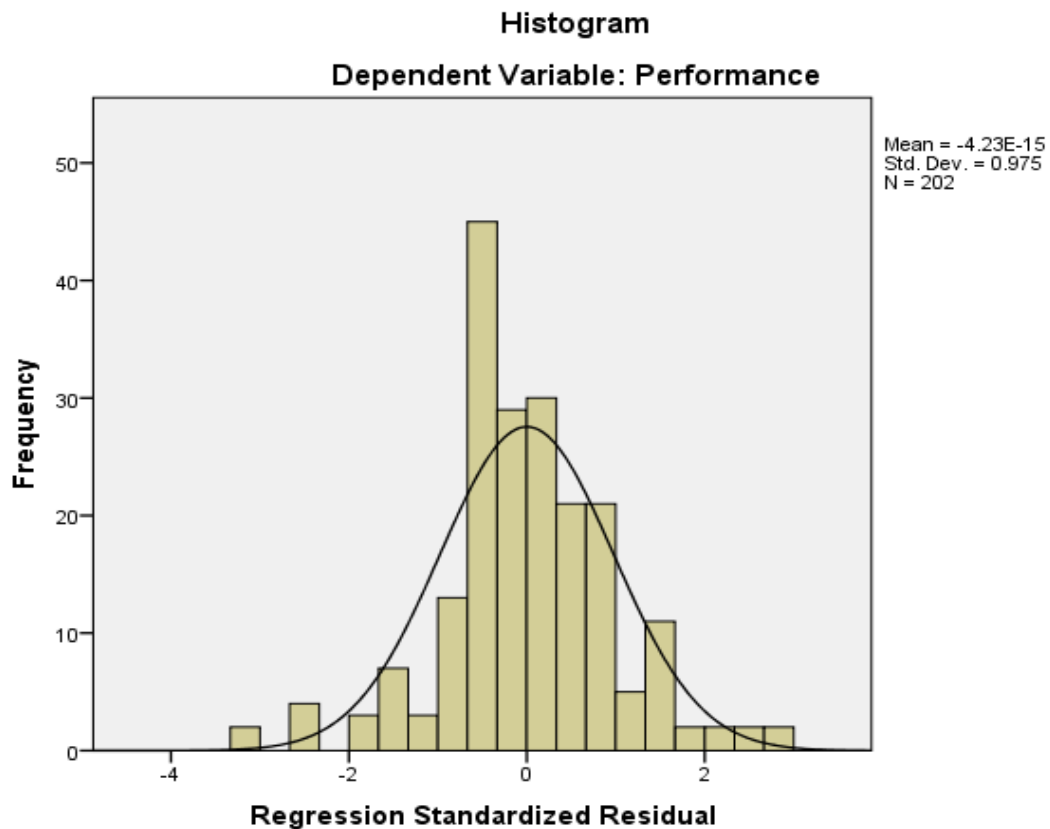
Table 4.2: Normality test (Skewness and Kurtosis)

Variables	Items	Skewness	Kurtosis
Freight clearance	18	3.91	.550
Infrastructure level	10	3.65	.567
Storage facility	8	3.51	.479
Customer service	7	3.44	.485
Quality of logistics services	7	3.51	.482
Staff performance	7	2.91	.522
Jetty Operation	29	3.56	.339

Source: Authors 2022

Figure 4.1 shows a continuous variable's probability distribution estimated in the histogram below. Given that the graph was bell-shaped and symmetrical, the outcome indicates that the variable distribution was almost normal. The standard P-P plot is displayed below. It displays the degree to which the observed and anticipated values of the dependent variable (performance) correspond with each other. The plot's outcome revealed that the data set was quite close to the normal distribution because it roughly forms a straight line, except for a protruding region that is slightly off the origin and may be an outlier.

Figure 4.1: Histogram of Dependent Variable performances



4.1.2. Analysis of multicollinearity test for independent variables performances

Table 4.3: Multicollinearity test (VIF and tolerance)

Variables	Items	VIF	Tolerance
Freight Clearance	10	2.16	0.463
Infrastructure level	8	3.51	0.218
Storage facility	7	4.58	0.354
Customer services	7	2.82	0.418
Quality of logistics services	7	2.39	0.655
Staff performance	29	3.35	0.339
Jetty Operation	7	3.66	0.519

Sources: Authors, 2022

The multicollinearity test for the independent variables (predicators), as presented in Table 4.3, indicated that all the predicators had VIFs less than 5. The highest was 4.58 in the storage facility. Meanwhile, the tolerance in all the predicators was greater than 0.1. This, therefore, indicated that there was no threat of multicollinearity.

4.1.3. Correlation analysis of inland water operational performance at the jetty

Table 4.4: Correlation analysis

Constructs		Perform.	CC	IL	SF	CP	QLS	SP	PO
Performance	Pearson	1							
	Sig.								
Freight clearance	Pearson	.075	1						
	Sig.	.286							
Infrastructure level	Pearson	.534**	.469**	1					
	Sig.	.000	.000						
Storage facility	Pearson	.217**	.516**	.721**	1				
	Sig.	.002	.000	.000					
Customer service	Pearson	.489**	.069	.541**	.324**	1			
	Sig.	.000	.329	.000	.000				
Quality of logistics services	Pearson	.315**	.093	-.035	.029	.162*	1		
	Sig.	.000	.187	.624	.678	.021			
Staff Performance	Pearson	.276**	.172*	-.226**	.196**	.126	.264**	1	
	Sig.	.000	.015	.001	.005	.074	.000		
Jetty operation	Pearson	-.016	-.072	-.140*	-.299**	.289**	.059	.815**	1
	Sig.	.826	.310	.047	.000	.000	.406	.000	

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

The correlation coefficients between freight clearance, infrastructure quality, storage facility, customer service, logistics service quality, employee performance, and jetty operation are shown in Table 4.4. Although weakly positive, the association between inland waterway transport operating performance was significant ($p = 0.00$). The findings revealed that every variable had a significant ($p < 0.05$) and positive correlation with the efficiency of inland waterway transportation. Furthermore, the correlation between the various cargo clearances was only somewhat strong. Positive connections between infrastructure quality, storage capacity, and employee performance were statistically significant ($p < 0.05$). However, only a minor negative correlation (-0.016) between jetty operation and the calibre of logistical services was found, which was not statistically ($p\text{-value} = 0.826$) significant. The performance of inland waterway transport was significant ($p = 0.00$) and moderately positively correlated (0.391) with freight operation. The relationship between freight operation and operational performance is substantial and favourable, demonstrating that the more efficiently a jetty is operated, the more cargo/freight is cleared (Nwaogbe et al., 2020).

4.1.4. Analysis of Jetty agent operation performance

Table 4.5: Regression analysis of jetty agent operation performance

Model	B	Std. Error	Beta	T	Sig.
(Constant)	2.565	.291		8.825	.000
Cargo Clearance	.615	.098	.525	6.284	.000
Staff performance	-.312	.087	-.264	-3.592	.000
Quality of logistics services	.393	.070	.346	5.603	.000
jetty operation	-.381	.057	-.345	-6.665	.000

Sources: Author 2022

Table 4.5 displays the regression coefficient for jetty agent operation and operational performance. According to the findings, cargo clearance significantly improved operational performance, with a p-value of 0.000 and a coefficient of 0.615. Similar to the quality of logistics services, the operational performance of inland waterways likewise demonstrated a positive significant relationship with a coefficient of regression of 0.393 and a p-value of 0.000. However, the operational performance of the inland waterways was significantly negatively impacted by both personnel performance and jetty operation, with the former's coefficient of regression and p-value being -0.312 and 0.000, respectively, and the latter being -0.318 and 0.00.

Table 4.6: Regression analysis of the role of agents

Model	B	Std. Error	Beta	t	Sig.
(Constant)	4.659	.340		13.715	.000
Role of jetty agent in port call in arranging pilotage and stevedores	-.672	.122	-.605	-5.493	.000
Role of solicits of cargo on behalf of the owner	.638	.117	.590	5.433	.000
To arrange surface transport	-.388	.097	-.308	-4.011	.000
To arrange agreement	.222	.075	.188	2.945	.004

Source: Authors Analysis, 2022

Roles of jetty agents

The regression analysis for the jetty agent's impact on inland waterway transport is shown in Table 4.6. The findings demonstrated that all the studied agent variable roles significantly impacted inland waterway transport. The coefficient of regression for the jetty agents' and stevedores', as well as the function of cargo solicitors acting on behalf of the owner's behalf, suggested a negative influence on the agents' role, which was also significant ($p = 0.00$). However, with positive regression coefficients of 0.638 and 0.222 and p values of 0.000 and 0.004, respectively, organizing surface transport and agreements between vessel owners and contracted transport showed a robust beneficial impact on the role of agents in inland waterway transport.

Analysis of operational challenges

Table 4.7: Regression analysis for main variables

Model	B	Std. Error	Beta	T	Sig.
(Constant)	1.772	.514		3.448	.001
Policies inconsistency	-.081	.065	-.084	-1.248	.213
High jetty dues	.463	.118	.276	3.917	.000
Loss of man-hour	-.350	.092	-.236	-3.799	.000
Lack of sophisticated modern equipment	.529	.098	.355	5.397	.000
High numbers of different inspection	.443	.117	.266	3.887	.000

Sources: Author 2022

Table 4.7 presents the regression analysis results, including the p-value and regression coefficients. The findings indicated that policy inconsistencies by jetty agency regulators and high jetty dues and charges significantly improved operational issues. The models obtained p-values of 0.000 and coefficients of 0.463 and 0.529. The operational difficulties faced by jetty agents were negatively impacted by the loss of man-hours resulting from jetty congestion and a lack of sophisticated modern equipment in the jetty. However, the large number of various inspection agencies present at the jetty did not seem to be significant ($p = 0.213$).

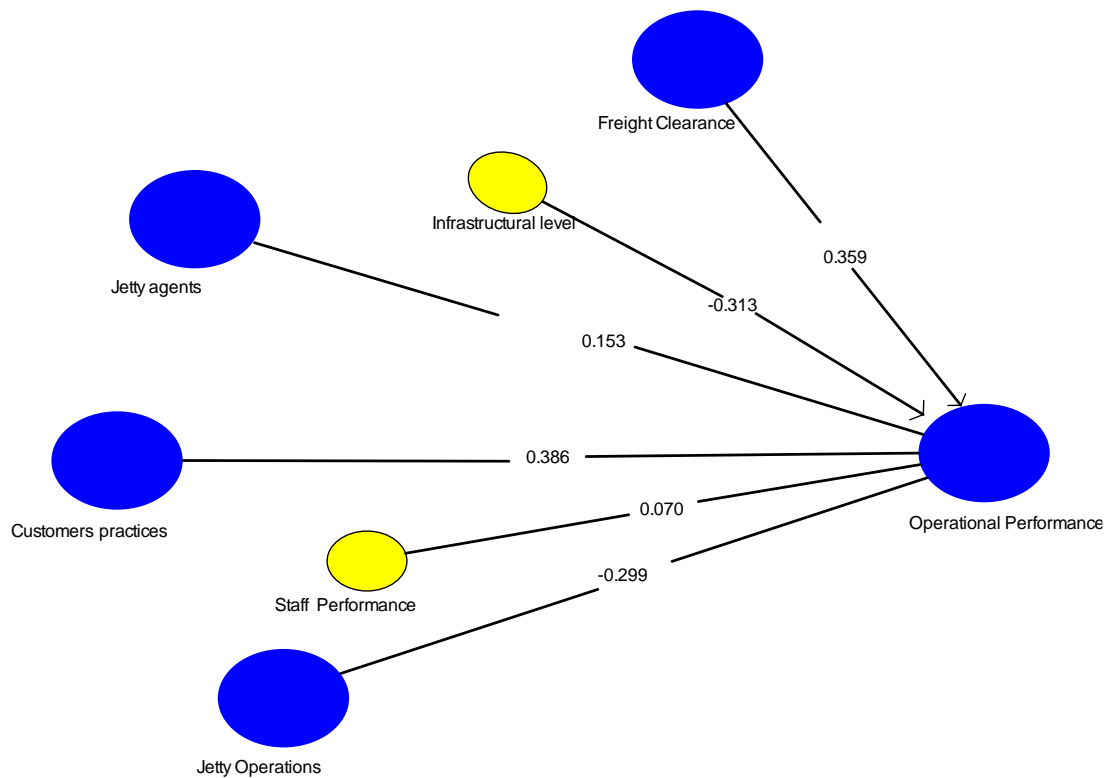
Analysis of the structural equation model for performance

Table 4.8 presents a summary of the assessment of the structural model for performance with the decisions as it relates to the research hypothesis.

Table 4.8: Assessment of the Structural Model for Performance					
Hypotheses	Beta	SE	T value	P Values	Decision
Freight clearance -> Performance	0.386	0.088	4.409	0.000***	Supported
Infrastructure level *Customer service -> Performance	0.100	0.067	1.494	0.136*	Not Supported
Freight clearance -> Performance	-0.288	0.058	4.996	0.000***	Supported
Customer service *Quality of logistics services -> Performance	0.070	0.081	0.864	0.388*	Not Supported
Staff performance -> Performance	0.359	0.098	3.643	0.000***	Supported
Jetty operation *Infrastructure level-> Performance	-0.313	0.081	3.880	0.000***	Supported
Staff performance -> Performance	0.153	0.086	1.785	0.075	Supported

Sources: Authors, 2022

Figure 4.2: Summary of the measurement model (algorithm)



5. Discussion

The structural equation model results revealed that the performance of jetty agent operation in inland waterway transport was considerably ($p = 0.000$) impacted by cargo clearance, infrastructure quality, and storage facility. Similar to how it has an impact on customer service, staff performance has a direct impact on how well logistical services are provided. Jetty operation, however, did not support operational performance ($p = 0.075$). The association between port operation and performance or the relationship between cargo clearance and infrastructural level was not significantly influenced (supported) by staff performance ($p = 0.136, 0.388$). The coefficient of regression for the roles of jetty agents in jetty calls for setting up pilotage and stevedores, as well as the function of soliciting cargo on behalf of the owner, was -0.672 and -0.388 , respectively, which indicated a detrimental influence on the role of agents, which was also significant ($p = 0.00$).

Although it was only moderately positive, the association between inland waterway transport operating performance was significant ($p = 0.00$). The findings revealed that every variable had a significant ($p=0.05$) and positive correlation with the efficiency of inland waterway transportation. Cargo clearance and performance do, however, moderately correlate. The association between the various cargo clearances was moderately strong. Positive connections between infrastructure quality, storage capacity, and employee performance were statistically significant ($p 0.05$). However, only a minor negative correlation (-0.016) between jetty operation and the calibre of logistical services was found, which was not statistically ($p\text{-value} = 0.826$) significant. Inland waterway transport performance and freight operation had a significant ($p = 0.00$) and somewhat positive association (0.391) with the performance of inland waterway transport (Nwaogbe et al., 2020).

6. Conclusion

The importance of inland waterway transportation's operational effectiveness and level of service cannot be overstated. The study found that the variables impact operational effectiveness and service quality. This highlights the significance of efficient inland canal transportation, particularly in rural areas where it is the only available means of transit. The development of jetty infrastructure and ferries to improve the movement of people and goods along the route should be the government's top priority in the Warri South, where all modes of transit are through inland waterways. Finally, policy recommendations are provided on how to enhance how jetty operators manage consumers while the jetty is in operation and how operators stow cargo.

From a practical point of view, the study's findings can help inform the development of policies and strategies to improve the operational performance and quality of service of inland waterway transport in Nigeria and other similar contexts. From a scientific point of view, the study contributes to the literature on inland waterway transport by providing empirical evidence on the factors that influence operational performance and service quality, which can guide future research in this area.

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Ethics approval and consent to participate

Not applicable.

Availability of data and material

The data are available on request.

Competing interests

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