Effect of Commuters' Income on the Ferry Operational costs in Lagos State, Nigeria

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ABSTRACT:

Commuters' mobility plays significant roles in urban economic due to its reliance on the cheapest means and available transportation system from one location to another. Commuters' income in Lagos State affects the amount of traffic generated along the waterways during travel behavior due to commuters' occupation and commuters' level of car ownership. This study aims to estimate the impact of ferry commuters' income on the waterways operations in Lagos state.

This survey was carried out in the four selected waterways terminals in Lagos State. The authors used primary data with the aid of snow balling sampling technique to administered 836 questionnaires at the selected inland waterways terminals in Lagos State. The study used multiple regressions to analyze the obtained data in the study area.

The result of the findings revealed that larger proportion of the respondents representing 63.9% (523) of the sample size had no car. Also, passenger's income that was measured using passengers' occupation and passengers' car ownership had a significant impact on ferry operational costs in Lagos State having R value of .699 (69.9%) and p-value of 0.000. This shows that ferry operational costs can be determined by passengers' daily or monthly income.

The study concluded that**ferry operating costs tend to be lower when the level of**

patronage is minimal due to commuters' income constraints.It was recommended that government should subsidize the freight price and come up with a policy that will enforce usage of ferry service.

KEY WORDS: Commuters' Income,Transportation System, Commuters' Level, Ferry

1. INTRODUCTION

Inland waterways play a crucial role in fostering economic development, particularly in remote regions. The potential opportunities in this sector are heavily influenced by specific regional factors, such as geographical conditions, the level of road infrastructure development, and socio-economic conditions. The historical significance of inland water transportation in moving goods and services dates back centuries (Sagan et al., 2020). This mode of transport has been favored due to its cost-effectiveness, energy efficiency, and environmentally friendly nature (Benamara, Hoffmann & Youssef, 2019).

However, recent years have witnessed growing congestion on urban roads, prompting a shift towards exploring more sustainable transportation alternatives. This shift has provided an opportunity for water transport to assume a more prominent role in urban mobility schemes worldwide (Canitez, 2019). Water transport has the potential to enhance urban transportation by offering faster, more efficient, and better-integrated services, alleviating issues related to congestion (Venter, Mahendra & Hidalgo, 2019).

The pricing dynamics in inland water transportation distinguish it from other industries. Prices are influenced by factors such as fuel costs, demand and supply forces, distance, time, and trip type. The competitive nature of the freight transport markets often dictates pricing, with variations based on direction, season, and service quality. To remain viable, overall prices must cover operational costs (Huarng& Yu, 2020). The interplay between transport demand and supply is complex, where transport supply can exist without an

immediate corresponding demand, but demand cannot occur without an adequate supply (Hörcher &Tirachini, 2022).

In underdeveloped countries, individuals tend to opt for the most affordable and readily available means of transport for mobility (Acheampong et al., 2020). Household income significantly influences modal choices in urban areas, with a positive relationship observed between income levels and traffic flow along waterways. Financial constraints inversely impact the modal choices of citizens, indicating the influence of pricing on travel behavior (Hörcher &Tirachini, 2021). Moreover, daily fare charges were found to have a significant influence on waterways transport operations (Ayantoyinbo& Afolayan, 2023). This research work would access an overview analysis of theferry passenger's income on waterways operations in Lagos state in relation to transport system efficiency and responsiveness. The needs to provide a lasting solution to the problem of travel demand and supply, availability of necessary facilities at the inland waterways terminal that will influence the rate utilization. Based on the aboveempirical study, the researchers tend to test for the relationship between ferry commuters' income and waterways operations.

2.METHODOLOGY

This study used survey design and having Lagos State as study area. This research relied on a well structured questionnaire survey with the helped of Cochran's sampling formula; the total number of 836 questionnaires from the 1360 passengers using ferry service daily between the hour of 7 am and 4: 30 pm was administered to ferry commuters. The authors used snow balling sampling technique to administered 836 questionnaires at the inland waterways terminals in Lagos State. However, the authors used both descriptive and inferential statistical (Regression) test to identify which variables have impact on analyze this study.

3LITERATURE REVIEW

3.1 Conceptual Review

Spatial interaction denotes a dynamic process of movement from one location to another, encompassing the transfer of individuals, goods, services, or information in response to localized supply and demand. This overarching concept includes various forms of movement, such as intra-urban commuting, intercontinental migration, traffic in goods, and the flow of intangibles like information. Spatial interaction is essentially a response to the differentiation in the utilization of inland spaces for activities such as work, school, shopping,

and recreation.In the realm of transport studies, three fundamental concepts—complementarity, intervening opportunity, and transferability—help explain the intricacies of spatial interaction, as proposed by Jin Yang, Li, Sha & Wang (2021).

The concept of complementarity focuses on spatial interaction arising from area differentiation. It considers two spatially separated areas or towns (y) and their interaction, which is influenced by natural and cultural differentiations. Regions with abundant resources may attract individuals seeking better opportunities in terms of work, housing, or education. In the context of Lagos, for instance, inland water transport enables people to move to more fertile and attractive places with greater opportunities due to high urbanization and industrialization.

Intervening opportunity introduces constraints on the possibility of interaction between two areas (x and y) due to alternative sources of supply from another area (z). In other words, when considering potential movement between areas (y) and (x), there might be an intervening origin or alternative destination in another area (z). Intervening opportunity signifies the presence of alternative supply or demand, affecting spatial interaction between two areas.

Additionally, transferability acts as a constraint on the movement of goods and individuals based on distance. If the monetary cost or time required for a trip between the origin and destination is prohibitively high, transferability becomes challenging. Even in the absence of intervening opportunities, interaction is hindered if the cost of overcoming the distance exceeds the travelers' willingness and ability to pay.

Ullman's spatial interaction concept provides a comprehensive understanding of spatial interaction across various transportation facets, offering valuable insights into the dynamics of movement and connectivity.

3.1.1. Empirical Review of Relevant Studies

Odekunle, Onabanjo, Agabi, Federal, and Adedini (2022) conducted an assessment of the socio-economic characteristics of ferry passengers and the operation of ferry services in

Ikorodu Waterways, Lagos State. They employed descriptive techniques to estimate the socio-economic characteristics of ferry patrons in Ikorodu waterways. Despite encountering challenges in ferry operations, passengers preferred waterway transportation due to its perceived speed, convenience, and reliability. The study recommended a focus on enhancing the efficient operation of ferry water transportation to encourage greater adoption.

Kamal (2011) investigated the socio-economic characteristics and users' perceptions of the intra-urban public transport system in Ayangburen Park, Ikorodu, Lagos State. Spearman's rank correlation coefficient was used to analyze the relationships between socio-economic characteristics and users' perceptions. The study found irregularity in overall perceptions of the public transport system and recommended the rehabilitation of adjoining roads by the government, along with appropriate subsidies from the local and state governments to ensure sustainability.

Oluwole, Akintayo, and Ojekunle (2018) estimated the Private Cost of Commuting in Metropolitan Lagos, focusing on socio-economic characteristics of commuting households. The study revealed a poor understanding and underestimation of immediate costs of private car use, such as travel time, stress, and maintenance. The researchers recommended coordination between housing and transport policies, emphasizing the construction of affordable houses near planned public transport hubs and improvements in areas with a high number of moderate-income workers.

Ademiiluyi, Afolabi, and Fashola (2016) analyzed intra-city water transportation in Lagos State, utilizing descriptive statistical tools and Spearman's Ranked Correlation Analysis. The study found an insignificant relationship between the frequency of travel, education, and income of respondents. Recommendations included Public Private Partnerships (PPP) initiatives and technological advancements to ensure the safe and efficient deployment of water transportation systems.

Madhani (2019) highlighted the importance of strategic cost management for attaining and sustaining a strategic competitive advantage. The focus is on anticipating and forming

cost structures, levels, and behavior patterns for products, processes, and resources. Strategic cost management views products, processes, and resources as creative elements for achieving a competitive advantage, emphasizing the need for information beyond traditional cost management practices.

4. RESULTS AND DISCUSSION

The findings presented in Table 1 indicate that 367 respondents (44.9%) fell within the age group of 31-40 years, with 193 respondents (23.6%) falling in the 41-50 age group. Additionally, 117 respondents (14.3%) were in the 21-30 age group, while 80 respondents (9.8%) were in the less than 20 age group. The remaining 61 respondents (7.5%) were above 50 years old. These results highlight that a majority of the respondents belong to active and productive age groups, actively engaging in various business activities and contributing to the generation of trips. This underscores that mobility through ferry services is primarily undertaken by individuals within these active age groups. Salisu (2022) supports this, noting that the active age group tends to make more trips due to their diverse socio-economic engagements. To effectively manage the increasing traffic for various socio-economic activities, a functionally effective and efficient inland waterways transport system that caters to all age groups is essential in the state.

Examining the educational background of the respondents in Table 1, a larger proportion of the sample size had diploma education, constituting 292 respondents (35.7%). Additionally, 247 respondents (30.2%) had higher education, and 103 respondents (12.6%) held M.Sc qualifications. Furthermore, 114 respondents (13.9%) had secondary school education, while 62 respondents (7.6%) had primary education. These results suggest that a majority of the respondents possess the educational background to make informed decisions regarding their choice of transportation. This aligns with the findings of Meena et al. (2019), indicating that the majority of respondents travel with a purpose daily, contributing to increased traffic flow along the waterways.

Table 1 also reports the years of work experience of the passengers. The table reveals that 319 respondents (39.0%) have 1-5 years of work experience, with 119 respondents (14.57%) having between 6-10 years of experience. Moreover, 120 respondents (14.7%) have between 11-15 years of work experience, and 122 respondents (14.9%) have between

16-20 years of experience. Additionally, 82 respondents (10%) have between 21-30 years of experience, while the remaining 56 respondents (6.8%) have more than 30 years of work experience. These results indicate that a significant portion of the respondents in the study area have substantial work experience, contributing to their daily mobility using transportation facilities and suggesting that they can offer valuable insights into different types of transport systems in the study area.

Table 1: Socio-Economic Characteristics of the Respondents

Variable	Frequency	Percentage
Age of Respondents		
Less than 20yrs	80	9.8
21-30yrs	117	14.3
31-40yrs	367	44.9
41-50yrs	193	23.6
Above 50yrs	61	7.5
Total	818	100
Academic Status		
Primary	62	7.6
Secondary	114	13.9
Diploma	292	35.7
Degree/HND	247	30.2
M.Sc	103	12.6
Total	818	100
Work Experience		
1-5yrs	319	39.0
6-10yrs	119	14.5
11-15yrs	120	14.7

16-20yrs	122	14.9
21-30yrs	82	10
Above 30yrs	56	6.8
Total	818	100

Source: Field Survey, 2023.

4.1: Distribution by Respondents' Career

Report from Table 2 presents data on the respondent's career. It showed that larger proportion of the respondents are traders which constitutes 327 (40%) of the sample size, followed by 251 (30.7%) of the respondents that are into other businesses. Also, 150 (18.3%) of the respondents are civil servants, 59 (7.2%) of the respondents are students while the remaining 31 (3.8%) are military and paramilitary personnel. This indicates that when talking about timely daily delivery, trader's finds waterways transport to reliable during transport demand and supply in the study area.

Table 2: Distribution by Respondents' Career

Variables	Freq	Per
Students	59	7.2
Civil Servants	150	18.3
Military and para-military	31	3.8
Traders	327	40
Others	251	30.7
Total	818	100

Source: Field Survey, 2023.

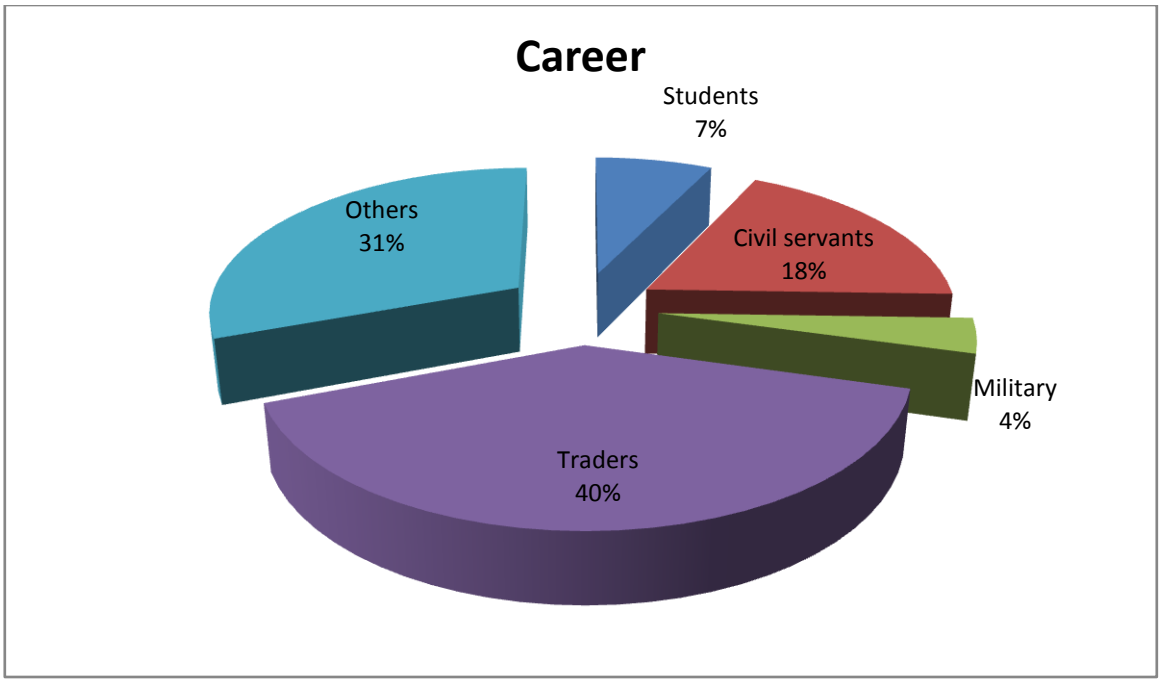

Fig 1: Chart representing Respondents Career.

3.3. Passenger's/ commuters' Level of Car ownership

Table 3 showed that out of 863 respondents from the study area, 295 respondents that represent 36.1% of the sample size owns a car, while the remaining 523 (63.9%) of the respondents have no car. This implied that majority of the respondents rely absolutely on public means of transport for their daily activities.

Table 3: Respondents' Car Ownership

Variable	Frequency	Percentage
Vehicle Ownership		
Yes	295	36.1
No	523	63.9

Source: Field Survey, 2023.

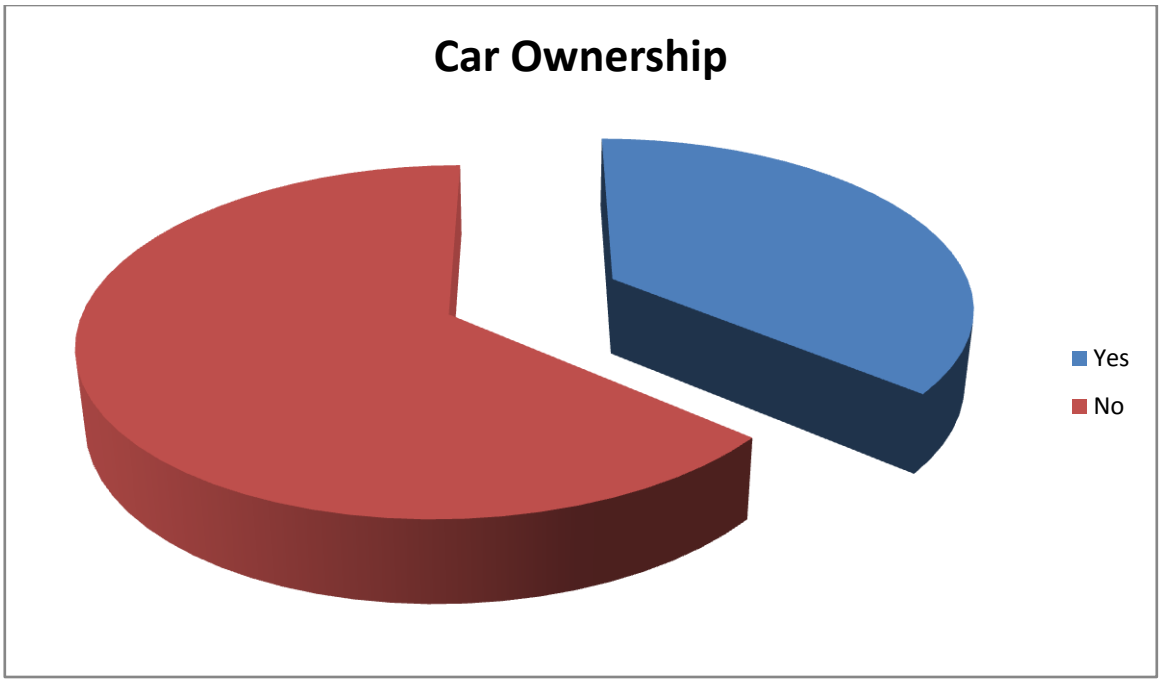

Fig 2: Level of car ownership

Hypotheses Testing

Ho_1: There is no significance relationship between socio-economic characteristic of commuters and ferry operating cost.

In an effort to analyze the influence of commuters' socio-economic characteristics on ferry operating costs in Lagos State, multiple regression analysis was conducted and presented in tables 4, 5, and 6. The results revealed that 69.9% of the variation in the impact of commuters' socio-economic characteristics on ferry operating costs in Lagos State could be explained by the multiple regression models. Consequently, the model was unable to account for only 30.1% of the variation. The statistical significance was confirmed by an F-value of 388.545, with a significance level of P=.05, as indicated in table 4. Furthermore, all examined variables were found to be statistically significant. The correlation coefficient R had a value of .699 (69.9%), while R^2 had a value of .488 (48.8%), and the adjusted R-square was .487. This indicates both the combined impact of independent variables on the dependent variable and the suitability of the data for the model.

The impact of commuters' socio-economic characteristics on ferry operating costs in Lagos State is detailed in Table 4, with these characteristics measured through independent variables such as commuters' car ownership and commuters' occupation. Among these variables, commuters' occupation exhibited the highest significant contribution to the dependent variable at 0.582 (58.2%), followed by commuters' car ownership, making a substantial contribution of .136 (13.6%) but less than the former variable.Passengers' occupation has a positive and significant impact on the ferry operation having highest t-value of 12.995 and a coefficient of 0.582, while passengers' car ownership has a t value of 3.044 and a weak coefficient of 0.136. This indicates ferry passengers' occupation is a major factor that influence waterways operations in Lagos State.

This suggests that socio-economic characteristics, particularly the level of commuters' vehicle ownership and commuters' occupation, have a statistically significant impact on ferry fuel costs. This finding aligns with the perspective presented by Oluwole et al. (2018), asserting that improved fuel costs for ferry services correlate with a higher quality of service provided by waterways operators in the state.

Furthermore, this is in agreement with the findings of Ademiluyi, Afolabi, and Fashola, (2016) which states that commuters' socio-economic characteristic influences frequency of travel, mobility means and travel time. Thus, enhancing huge increase in traffic and the revenue generated along the waterways in Lagos State.

Table 4: Model Summary of socio-economic characteristic of commuters and ferry operating cost.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.699[a]	.488	.487	.53560

a. Predictors: (Constant), Passengers' Occupation, Passengers' Vehicle Ownership

Source: Authors Field Survey, 2023.

Table 5: ANOVA of socio-economic characteristic of commuters and ferry operating cost.

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	222.925	2	111.462	388.545	.000[b]
	Residual	233.800	815	.287		
	Total	456.725	817			

a. Dependent Variable: Cost of Fuel

b. Predictors: (Constant), Passengers' Occupation, Vehicle Ownership

Source: Authors Field Survey, 2023.

Table 6: Coefficients of socio-economic characteristic of commuters and ferry operating cost.

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	1.416	.067		21.241	.000
	Vehicle Ownership	.212	.070	.136	3.044	.002
	Passengers' Occupation	.341	.026	.582	12.995	.000

Dependent Variable: Cost of Fuel (Per Liter)

Source: Authors Field Survey, 2023.

4. Conclusion

Utilizing multiple regression analysis to comprehensively assess the impact of commuters' income on ferry operating costs; this study employed a snowballing technique to explore the correlation between ferry operating costs and commuters' income in the waterways of

Lagos. The empirical findings indicated a significant influence of ferry commuters' income on operating costs. Notably, affordable transport fares, indicative of lower costs, were associated with a substantial increase in patronage, leading to higher running costs for the ferry.

Additionally, the research established that ferry operating costs tend to be lower when the level of patronage is minimal due to commuters' income constraints. This suggests that an increase in transport fare results in a reduction in waterway traffic. In essence, a higher level of utilization corresponds to increased operating costs during efficient and responsive mobility along waterway transport networks in Lagos State. It is noteworthy that the empirical relationship between ferry operating costs and commuters' income in Lagos, Nigeria, as determined in this study, differs from those observed in developed countries such as the UK and US, where various promotional strategies are implemented to balance transport demand and supply. This conclusion did not only contribute to waterways operations but to all transport systems operations to promote mobility efficiency.

The study suggests that the government should consider subsidizing freight prices and implementing policies that encourage the use of ferry services. Such measures aim to boost traffic along inland waterways in the study area, ultimately enhancing the overall efficiency and sustainability of waterway transportation.

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