# ANALYZING THE DETERMINANTS OF CHOICE OF MODE FOR FREIGHT TRANSPORT IN APAPA SEAPORT

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**Abstract**
*Over the years, global trade and intermodal freight transport continue to be significant. Freights are transported in Nigeria majorly by road transports which negatively affect the best practice of intermodal freight transportation. Mode choice is very paramount in freight transportation. The freight forwarders' preference on choice of mode has greater influence on accessibility as they make decision for freight haulage. This study therefore analyses the underlying factors that influences the choice of modes for cargo distribution at Apapa Port, Nigeria. The primary data was obtained through the administration of questionnaires designed to gather relevant information. 156 freight forwarding organizations were sampled on factors influencing choice of modes for freight haulage, and the operational challenges experienced during freight haulage by road and rail transport. The data were analyzed using frequency distribution, t-test and ANOVA statistics. The result revealed accessibility of mode (14.2%), safety and security of cargo (12.93%), reliability of mode (11.64%), frequency of mode (9.87%), and transit time (speed) (8.77%) respectively were the major factors influencing modal choice. Further findings using ANOVA test result revealed a statistically significant difference in the mean rating of the factors that influences choice of mode for haulage as the F-value showed $F_{cal} = 149.706 > F_{crit} = 1.84$; df = 10, 1606; $p < 0.05$ at 0.05 level of significance in favor of accessibility. The t-test conducted on comparison of the mean scores on the operational challenges facing road and rail freight haulage at Apapa port revealed no statistically significant difference between the mean scores on the operational challenges facing road freight haulage (87.08) and the mean scores facing rail freight haulage (47.50) as the t-value showed $t_{cal} = 1.676 < t_{crit} = 2.201$; df = 11; $p > 0.05$ at 0.05 level of significance. It is therefore, recommended that distance regulation should be encouraged to limit the distance or route over which a given mode could operate especially for road transportation to eliminate the dominant use of road transport for long haul. Also, modal choice in cargo haulage should be given more attention by policy makers for the better understanding of the various determinants that possibly influences choice of modes.*

**Keywords:** freight, intermodal, modal choice, rail, road.

## Introduction

The movement of goods globally are on the increase making critical contributions to a nation's economy (NCFRP, 2011), hence, the demand for transportation system to meet and support this emergence of freight transportation. According to Kite-Powell (2001), the maritime shipping industry carries 90% of the world's international trade that supports the supply chain of manufacturing organizations for making international sourcing economically promising. Nigeria as a country that engages in international trade should appreciate the role of shipping in the business world and therefore, put high priority on efficient transportation system. This is because efficient transport system is very vital in the development of any nation and in the world economic output. In the submission of Ubogu, Ariyo, and Mamman (2011), a reliable and effective transport system immensely contributes to the growth and affluence of a country. Consequently, no country would experience economic development without a good transportation system (Salim, 2003; Lingaitiene, 2006). For an effective transport system to

be viable, it entails the development of smooth operation of multimodal haulage (i.e modal interchange) for seamless movement of cargo that stimulates national development.

Modern transport for freight distribution system globally is tending towards adoption of the most excellent transportation system practices that are reliable, efficient, timely, and cost-effective (Ubogu, 2011). According to Bina *et al.* (2014), most commodities are transported by road and rail, hence, competing with one another. These modes in many cases are either complementary or competitive in their operations. The competition between road and rail transport system are thereby critically pertinent in improving the efficiency of freight transportation system (Forkenbrock, 2001). Modal choice is a critical aspect in freight transportation demand. Usually, the decisive factor for choice of mode carrier selection for cargo is the lowest total shipping/transport costs or the shortest transit time involved (Wong, 2007). The road network is the most dominated mode of transport for shipping cargoes from and to the seaports regardless of the shipping cost and transporting time. Due to the little attention on how goods are conveyed by road, some of the cargoes end up not reaching their destinations as a result of frequent road traffic crashes mostly involving heavy freight vehicles (Ubogu, 2001). According to the MITI, (2002), Ubogu, Ariyo and Mamman (2011), the trend in freight transport system in Nigeria shows fall of expectations as hinterland bound cargo are transported in a way not consistently efficient with excellent practices.

The revitalization of the rail-track is not to compete or form a modal shift but to complement the only existing road transport network for shipment in Apapa Port. The road-rail intermodal transport is steadily emerging as the greatest innovative in freight transportation system (Bontekoning, Macharis, & Tripp, 2004; Janic, 2007). Similarly, this innovation is gradually coming to see the light of the day as it is being experienced in the recent times in Apapa Port. Ubogu (2011), in his submission assert that the major reason for the trend of intermodal transportation is to reduce freight transport costs and transit time in transporting cargoes to destination points. According to Hassan Bello (2015), transportation of containers by rail costs about 20% less for distances greater than 500 kilometers, and as the distance increases the cost advantage continues to increase. A typical modern Wagon on two four-wheel trucks can hold up to 125 tons of freight. The rail freight transportation is therefore, crucial in improving the economy of a nation and plays a major role compared to road haulage over a long-distance voyage.

Over the years, precisely (1993-2013), there had been decrease drastically in the rail transport performance in freight transportation compare to road in Nigeria, this is because the rail system ceased to function resulting to rail transportation losing its share of the freight market to road transportation steadily thereby allowing road transportation to grow without effective implementation of road transport quality system (NRC, 2017). The performance of road transport operation is marked by a highly competitive and unregulated sector while the railway system has remained regulated. The rail system has therefore unsuccessfully challenged the domination of road in freight transportation. An efficient intermodal freight transportation system is thus, required to meet customers' needs for sustainable, highly reliable, and rapid transport services at low cost. The shippers are the principal decisive-makers affecting the demand of intermodal services (Patterson, Ewing, & Haider, 2008). Freights hauled to hinterlands are important components of the space economy. The volume, size, characteristics of goods, and mode of transportation are essential parameters of freight traffic analysis (Ubogu, 2011).

Freight transportation is susceptible to delays, accidents, damages, pilfering, and other forms of logistical problems. These constraints however, results to inefficient physical distribution of freight transportation system. The Nigerian Ports operations are characterized by the problem

of over dependence on road transportation for the movement of cargoes from the seaports to different locations in the country. Studies have revealed that freight transportation by multimodal transportation could safe as high as 44.2% freight cost compared to unimodal transportation (Ubogu, 2011). In Apapa seaport, freights are being transported and distributed from the ports in a manner that is not consistent with best practices. With the collapsed of the railway system for several decades, the road transportation has been the dominant mode for haulage in Nigeria. This reinforces the unimodal pattern of freight distribution. Olagunju (2011) avers that 80% of freight is hauled by road network system in Nigeria leading to steady growth in the number of heavy goods vehicles plying the road network. Consequently, causing traffic congestion and reduction in the life span of road infrastructure in the port and its corridor. The freight share of rail according to Ubogu (2011), from 1970-2006 accounted for 4.74% against road that was 86.56% and 8.70% for water.

According to Oni, and Okanlawon (2012), the railway system no longer exerts a strong influence nor plays a competitive role in modern Nigeria. Unfortunately, this has led to continuous decline in rail freight haulage performance over the years not until recently it resumes operations for haulage especially in Apapa Port. The rail transport system linking the Apapa Port has been revitalized and commenced operation for freight haulage. This is with a view to integrate rail and road for greater efficiency in freight transportation for greater impact on national economy. Despite efforts by the Federal Government of Nigeria to revitalizing the rail system for freight transportation, its usage is low, the Port-hinterland interactions determined by road and rail connections provide several variables influencing the choice of modal selection for freight transport that support intermodal competition. These benefits influence the perceptions of freight forwarding agents and or consignees to choose a particular mode for freight haulage. The present intermodal transport system in Apapa Port is not effective because freight forwarders tend to choose road transport instead of rail transport for freight haulage, which affect the implementation of integrated transport system in the Drafted National Transport policy of Nigeria 2010. This study analyzes the major determinants of choice of modes for freight haulage in the Apapa seaport with specific objectives to determine the factors influencing the choice of mode for freight transport and to assess the operational challenges of freight haulage experienced by road and rail transportation in Apapa Port.

## Test of Hypotheses

**$H_{01}$:** There is no significant difference in the factors influencing choice of modes for road and rail freight transport.

**$H_{02}$:** There is no significant difference in the operational challenges facing road and rail freight haulage at Apapa Port.

## Literature Review

Jiang, Johnson, and Calzada (1999) carried out a study on Freight demand characteristics and mode choice. The intention was to examine the freight demand characteristics that determine modal choice by shippers in France. Using a nested logit to analyze a large-scale disaggregated preference for shippers to test mode choice of transportation. The outcome revealed travel distance, shipper's accessibility to transport infrastructure, the shipper's own transportation facilities, and the shipment packaging were the crucial determinants of the demand for rail and combined transportation. Similarly, Cullinane and Toy (2000) also carried out an investigation on identifying influential attributes in freight route/mode choice decisions. The rationale was to identify and justify attributes for freight route/mode choice. Using content analysis to analyzed freight route/mode choice literatures. Findings revealed Cost (Price/Rate), Speed, Transit-time reliability, Characteristics of the goods, and Service were the top five ranked attributes of route/mode choice. In the same vein, Samimi, Kawamura, and Mohammadian (2011) carried out an investigation on behavioural analysis of freight mode

choice decisions. The focus was to examine how truck (road) and rail transport system compete for movement of commodity in US. Using binary logit and probit models to analyze data collected from a nationwide establishment survey, result showed that some specific-shipment variables (e.g. distance, weight and value) and specific-mode variables (e.g. haul time and cost) were observed to be the determinants of mode choice. Furthermore, the shipping cost was found to be a central factor for rail shipments, while haul time was observed to be more sensitive for road shipments. Sensitivity of mode choice decisions under different scenarios of fuel price fluctuation was further analyzed. A low level of sensitivity was found with respect to fuel price, such that 50% increase in fuel price does not cause a significant modal shift between truck (road) and rail.

Yaowu, Chuan, Chao, and Binglei, (2013), in another study carried out on an analysis of interstate freight mode choice between truck and rail. The goal was to investigate unobserved factors that influence freight mode choice between truck (road) and rail for shipments in Maryland. Using binary probit and logit models to analyze data obtained from freight analysis framework database. Result revealed transportation mileage ratio, the value of time for commodity, trade type, origin, and fuel cost played key roles in modal split choice for all shipments. Similarly, Ravibabu (2013) in another study carried out on mode choice for inland movement of export shipments. The rationale was to examine the mode choice behaviour between rail container and road truck in India. Data obtained from 124 export firms through structured questionnaire was analyzed using a nested logit model. Results revealed total cost and transit time to significantly influence the mode choice among the transport attributes.

Ubogu, Ariyo, and Mamman (2011) carried out a study on port-hinterland trucking constraints. The rationale was to evaluate the rank-order and the magnitude of the operational constraints associated with cargo haulage from Nigeria seaports to the hinterland. Using Kruskal-Wallis non-parametric test to analyze data obtained from 302 sampled truck drivers at seaport terminals. The result revealed harassment from law enforcement agencies, poor roads, mechanical vehicle breakdown, accidents, traffic congestion, and armed robbery on the highways constitutes major operational constraints with cargo haulage from the seaport to the hinterland by road. Similarly, Obasanjo, Francis and Williams (2014) in another study carried out on road haulage constraints in the transportation of petroleum products. The idea was to examine the constraints of the distribution of petroleum products by road in Northern Nigeria. Using the Kruskal-Wallis non-parametric test to analyze the data obtained from truck drivers through questionnaire. The result revealed delays at (police and military) check points, mechanical problems, bad roads, traffic congestion, accidents, high cost of fueling vehicle in transit, theft, and delays in off-loading are the major challenges of road freight haulage.

**Road-Rail Competition**

Rail transport that is supposed to enjoy unchallenged dominance of freight traffic haulage in Nigeria is being suppressed by the road transport. Unfortunately, for the railway, there has been a continuous decline in its performance over the years not until recently it resumes operations for haulage especially in Apapa Port. The Nigerian railway system remains static in structure and is highly unresponsive to the emerging socioeconomic and political challenges. It therefore, no longer exerts a strong influence nor plays a competitive impact in modern transportation (Oni, & Okanlawon, 2012). In other word, the Nigeria rail transport system has hardly developed at all when compared to developed countries. As at 2021, Nigeria's rail network consisted of 3505 km of narrow-gauge lines and 669 km of standard gauge lines. The total length of Nigeria road network is estimated at 200,000km representing the principal means for freight movement across the country (Road Sector Development). The road network is the most utilized mode for freight movement and assumed a significant role since the collapse of the rail system in the 1970s/80s. The road transport accounts for about 80%

movements of goods in Nigeria (Olagunju, 2012). This placed the road in a favourable position to compete with long haul railway services for high-value commodities and subjects the roads to severe pressure due to the absence of rail transport to convey heavy goods over long haul. There has been a downward trend in the performance of Nigeria rail freight transport. The decline is as a result of the operational policy constraints of rail service provider resulting from the decisions of the Government as a major shareholder.

**Road to Rail Strategy**

The Road-to-Rail Strategy is to rebalance road to rail freight split to create a more appropriate market share to ease heavy trucks from the road network. The implication is to reduce overall transport and logistics costs, and other externality costs (such as road damage, road accidents, road congestion, noise pollution, carbon emissions, etc.). Several strategies can be employed to and integrate various modes for haulage. In many cases, more than one of these strategies may be combined in any given attempt at transport coordination. Ikporukpo and Filani (2000) have well reviewed these strategies and identified the following:

(i) Rate regulation: It involves fixing of rates by public agency to make certain operators in particular mode not to have competitive advantage over certain operators in other modes through unjustifiable fixing of rates. To realize this, two distinct approaches are adopted. First, the rigid tariff system that involves a fixed and inflexible freight rate for the movement of a given product over a specified distance on a particular route. Secondly, the forked system which denotes the fixing of maximum and minimum rates by the regulatory body.

(ii) Quantity control: This implies the regulation of the number of operators or number of trucks each operator could own. Usually, this strategy is effected through restrictive licensing. The logic behind this approach is to disallow a mode from out-competing another mode by having a large stock of infrastructure.

(iii) Distance regulation: This is initiated to limit the distance a particular mode could operate or as succinctly put by Ikporukpo and Filani (2000) "A determination of the routes to be operated or both". Strictly speaking, this entails restricting, for instance, road vehicles to operate beyond predetermined distance from their base. It could also mean prohibiting them from operating in some routes in other not to compete with rail and pipeline. For this reason, the protected mode may be in a position to carry out transportation tasks it is best suited to do.

**Criteria for selection of the best transportation mode**

In selecting a mode for freight transport, a shipper considers not only the transit cost. Several variables influence modal choice for freight haulage. McKinnon (1989), avers that the selection of freight transport modes also known as modal split in the field of transport logistics is one of the most controversial topics. Traditionally modal choice is assumed to be dependent on three main factors namely; price, speed, and reliability. Although, freight modal split is also influenced by other factors, such as the physical geography, the spatial distribution of industries, density of transport network system, structure of its economy, governments policies on transport regulation, investment, and taxation. The modal choice of transport has a direct impact on the efficiency of a logistic channel. Each transport mode therefore, have various characteristics, and different strengths and weaknesses. Keith (2012) asserted that the factors considered in making modal decision include the cost, service, product characteristics, relationships, and capacity. These factors simultaneously play a part in the decision of selecting a mode. Hyun-chan and Alan (2013), avers that modal choice is dependent on the demand, infrastructure and the quality-of-service characteristics. They

further established the factors that strongly influence modal choice as delivery time, reliability, frequency of service, cost, accessibility, restitution, customer service, damage and suitability, attribute of the shippers, the commodities needed to be conveyed and the spatial attributes of shipments. Similarly, Samwel (2014) in his submission opined that the cost of service, quality of product delivered, environmental factors, safety and security, as well as the turnaround time are the major determinants of choice of modes for freight transport. In the same vein, Juan, Ivan, and Jorge (2014), in a study, established costs, and service frequency was the most influencing variables in the choice of transport mode.

## Methodology

The research adopted descriptive research design. The use of structured questionnaire was employed for the collection of primary data administered to the targeted respondents. Functional freight forwarding organization sample population was 156 and a census of the whole population was sampled to administered questionnaire for the reliability and validity of the data collected due to the population significantly small. Of the 156 respondents sampled, 9 respondents which represent 6% non-response rate did not return the questionnaires within the time-frame given and all follow-up action yield no positive response. The results are thereby based on 94% response rate of 147 respondents. The data collected from the field was analyzed using the ranking-order system and frequency distribution. Furthermore, ANOVA and t-test were used in testing the hypotheses.

## Results

**Table 1: Preferred shipping mode by freight forwarding organizations**

| Preferred Ship Mode | Number of occurrence | Percentage |
|---|---|---|
| Road | 103 | 70.1 |
| Rail | 31 | 21.1 |
| Inland waterways | 13 | 8.8 |
| TOTAL | 147 | 100.0 |

**Source:** Author's field survey, 2021

Table 1 above showed 70.1% of the 147 freight forwarding organizations preferred road transport system for shipment of freight, 21.1% preferred rail transport for the same purpose while 8.8% prefer to ship freight by inland waterways transport.

**Table 2: Mode of shipment easily accessible by the organization**

| Mode of Shipment | Ease of accessibility | Percentage |
|---|---|---|
| Road | 121 | 82.3 |
| Rail | 16 | 10.9 |
| Inland Waterways | 10 | 6.8 |
| TOTAL | 147 | 100.0 |

**Source:** Author's field survey, 2021

Table 2 revealed a large proportion of the freight forwarding organizations constituting 82.3% opined to road transport mode to be easily accessible to the organization for freight transportation, 10.9% easily accessible to rail transport while 6.8% revealed inland waterways to be easily accessible.

**Table 3: Mode of vehicle use for haulage**

| Mode of haulage | Number of occurrence | Percentage |
|---|---|---|
| Company owned Vehicle. | 57 | 38.8 |

| | | |
|---|---|---|
| Contracted from transport company | 72 | 49.0 |
| Others (both options above) | 18 | 12.2 |
| TOTAL | 147 | 100.0 |

**Source:** Author's field survey, 2021.

Table 3 revealed 49% of the freight forwarding organizations hauled freight through vehicle contracted to transport company, 38.8% through company (own account) vehicle while 12.2% attested to utilize both means to haul freights. The result showed most of the freight forwarding organizations opt to freight cargoes through contracting of vehicle from Transport Company.

**Table 4: Factors of mode choice for freight transportation**

| Factors of mode choice | Number of response | Percentage | Ranking-order |
|---|---|---|---|
| Flexibility of mode | 990 | 8.73 | 6th |
| Accessibility of mode | 1611 | 14.2 | 1st |
| Frequency of mode | 1120 | 9.87 | 4th |
| Cost | 920 | 8.11 | 7th |
| Transit time (speed) | 995 | 8.77 | 5th |
| High service delivery | 890 | 7.84 | 8th |
| Safety and security of cargo | 1467 | 12.93 | 2nd |
| Capacity of mode | 762 | 6.72 | 10th |
| Less traffic congestion | 410 | 3.61 | 11th |
| Reliability | 1320 | 11.64 | 3rd |
| Cargo characteristics | 860 | 7.58 | 9th |
| TOTAL | 1134 | 100 | |

**Source:** Author's field survey, 2021

Table 4 presents the findings on factors influencing of mode choice. After scoring the whole factors based on the ranking of the 147 freight forwarding organizations, six major factors were identified to influence choice mode selection for freight transportation. Factors such as accessibility of mode, safety and security of cargo, reliability of mode, transit time (speed), high service delivery and cost respectively were the major factors of modal selection in freight transportation. The sequence arrangement revealed the ranking-order of the factors influencing modal selection.

**Testing of Hypothesis One**

**$H_{01}$:** There is no significant difference in the factors that influence choice of modes for road and rail freight transport.

**Table 5a: Rating of the factors that influence choice of modes for haulage**

| Factors | No. of Samples | Mean | Standard Dev. |
|---|---|---|---|
| Flexibility of mode | 147 | 6.735 | 2.920 |
| Accessibility of mode | 147 | 10.959 | 1.271 |
| Frequency of mode | 147 | 7.619 | 2.101 |
| Cost | 147 | 6.259 | 2.980 |
| Transit time | 147 | 6.769 | 2.196 |
| High service delivery | 147 | 6.054 | 2.902 |

| | | | |
|---|---|---|---|
| Safety and security of cargo | 147 | 9.980 | 1.718 |
| Capacity of mode | 147 | 5.184 | 2.480 |
| Less traffic congestion | 147 | 2.789 | 1.223 |
| Reliability | 147 | 8.980 | 1.661 |
| Cargo characteristics | 147 | 5.850 | 2.639 |

**Source:** Author's field survey, 2021

Table 5a illustrates the descriptive statistics rating of the factors influencing choice of mode for freight haulage. The result showed a significant difference in the mean rating of the factors influencing choice of mode for freight haulage.

**Table 5b: ANOVA comparison of the mean rating by respondents on the factors that influence choice of modes for haulage**

| Source of variation | Sum of Squares | df | Mean Square | $F_{cal}$ | $F_{crit}$ | Sign level (p) |
|---|---|---|---|---|---|---|
| Between Groups | 7757.541 | 10 | 775.754 | 149.706* | 1.84 | 0.000* |
| Within Groups | 8322.041 | 1606 | 5.182 | | | |
| Total | 16079.582 | 1616 | | | | |

***-**Significant at 0.05 level of significance **Source:** Author's field survey, 2021.

Tables 5b showed the ANOVA comparison of mean rating by freight forwarding organizations on the factors that influence choice of modes for haulage. The table revealed a statistically significant difference in the mean rating of the factors that influences choice of mode for haulage at 0.05 level of significance since ($F_{cal}$ = 149.706> $F_{crit}$ = 1.84; df = 10, 1606; p < 0.05). Hence, the $H_O$ is rejected. Since, the ANOVA statistics indicated there was significant difference in the mean rating by the respondents on the factors that influence choice of mode for haulage, there is need to identify where the difference are, hence Duncan Post Hoc tests was carried out.

**Table 5c: Duncan post hoc tests on mean rating of factors that influence choice of mode for road and rail freight transport**

| | | Significant level = 0.05 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Factors of mode choice | No. of sample | A | B | C | D | E | F | G | H |
| Less traffic congestion | 147 | 2.7891 | | | | | | | |
| Capacity of mode | 147 | | 5.1837 | | | | | | |
| Cargo characteristics | 147 | | | 5.8503 | | | | | |
| High service delivery | 147 | | | 6.0544 | | | | | |
| Cost | 147 | | | 6.2585 | 6.2585 | | | | |
| Flexibility of mode | 147 | | | | 6.7347 | | | | |
| Transit time | 147 | | | | 6.7687 | | | | |
| Frequency of mode | 147 | | | | | 7.6190 | | | |
| Reliability | 147 | | | | | | 8.9796 | | |
| Safety and security of cargo | 147 | | | | | | | 9.9796 | |
| Accessibility of mode | 147 | | | | | | | | 10.9592 |
| Sign. Level | | 1.000 | 1.000 | 0.148 | 0.069 | 1.000 | 1.000 | 1.000 | 1.000 |

**Source:** Author's field survey, 2021.

From table 5c above, it is apparently clear that there is statistically significant difference between the mean rating of accessibility of mode (10.9592) and other factors of mode choice for freight transportation at 0.05 level of significance in favour of accessibility of mode. Similarly, there is statistically significant difference in the mean rating between safety and security of cargo mode (9.9796) and reliability (8.9796), Frequency of mode (7.6190), Transit time (6.7687), Flexibility of mode (6.7347), Cost (6.2585), High service delivery (6.0544), Cargo characteristics (5.8503), Capacity of mode (5.1837) and Less traffic congestion (2.7891) in favour of Safety and security of cargo. Also, there is statistically significant difference

between the mean rating of Reliability (8.9796) and Frequency of mode (7.6190), Transit time (6.7687), Flexibility of mode (6.7347), Cost (6.2585), High service delivery (6.0544), Cargo characteristics (5.8503), Capacity of mode (5.1837) and Less traffic congestion (2.7891) in favour of Reliability. Also, Frequency of mode (7.6190) and Transit time (6.7687), Flexibility of mode (6.7347), Cost (6.2585), High service delivery (6.0544), Cargo characteristics (5.8503), Capacity of mode (5.1837) and Less traffic congestion (2.7891) in favour of Frequency of mode. However, the post hoc tests also indicate no statistically significant difference between the mean rating of Transit time (6.7687), Flexibility of mode (6.7347), and Cost (6.2585). However, there is significant difference between Flexibility of mode (6.7347) and High service delivery (6.0544) and Cargo characteristics in favour of Flexibility of mode. Similarly, there is significant difference between Cargo characteristics (5.8503) and Capacity of mode (5.1837) in favour of Cargo characteristics. Furthermore, there is statistically significant difference between the mean rating of Capacity of mode (5.1837) and Less traffic congestion (2.7891) in favour of Capacity of mode. Hence, accessibility of mode has the highest mean rating (10.9592), while Less traffic congestion has the lowest mean rating (2.7891).

**Table 6: Rating of operational challenges being experienced in road freight transportation**

| Operational challenges | Number of response per challenge | Percentage | Ranking |
|---|---|---|---|
| Poor condition of transport infrastructure | 135 | 12.9 | 2nd |
| Pilferage (theft) | 88 | 8.4 | 8th |
| Accident | 132 | 12.6 | 3rd |
| Delivery reliability | 49 | 4.7 | 10th |
| Congestion | 128 | 12.2 | 4th |
| Poor transport service provider | 90 | 8.6 | 7th |
| Geographical coverage | 12 | 1.1 | 11th |
| High charge rates | 60 | 5.7 | 9th |
| Vehicle mechanical problem (incidents) | 115 | 11.0 | 5th |
| Harassment by law enforcement agents | 141 | 13.5 | 1st |
| Frequency in cargo damage | 95 | 9.1 | 6th |
| TOTAL | 1045 | 100.0 | |

**Source:** Author's field survey, 2021.

Table 6 revealed the major operational constraints experienced in road freight transportation. Of the 147 freight forwarding organizations, 13.5% affirmed harassment by law enforcement agents to be the most major operational challenges in road freight transportation, followed by 12.9% affirming poor condition of transport infrastructure, 12.6% and 12.2% opined to accidents and congestion respectively. The least challenges experienced are delivery reliability with 4.7% and geographical coverage with 1.1%.

**Table 7: Rating of operational challenges being experienced in rail freight transportation**

| Operational challenges | Number of response per challenge | Percentage | Ranking |
|---|---|---|---|
| Poor condition of transport infrastructure | 122 | 21.4 | 2nd |

| | | | |
|---|---|---|---|
| Pilferage (theft) | 44 | 7.7 | 5th |
| Accident | 8 | 1.4 | 8th |
| Delivery reliability | 108 | 18.9 | 3rd |
| Poor transport service provider | 94 | 16.5 | 4th |
| Geographical coverage | 141 | 24.7 | 1st |
| High charge rates | 35 | 6.1 | 6th |
| Harassment by law enforcement agents | 12 | 2.1 | 7th |
| Frequency in cargo damage | 6 | 1.1 | 9th |
| TOTAL | 570 | 100.0 | |

**Source:** Author's field survey, 2021.

Table 7 presents the operational challenges experienced in rail freight transportation. 24.7% of the freight forwarding organizations attested to geographical coverage being the major challenges in rail freight transportation, 21.4% opined to poor condition of transport infrastructure, followed by 18.9% to be delivery reliability, 16.5% poor transport service provider, 7.7% pilferage while the least challenge experienced is the frequency in cargo damage with 1.1% response.

**Testing of Hypothesis Two**

**$H_{02}$:** There is no significant difference in the challenges facing road and rail freight haulage at Apapa port.

**Table 8: t-test comparison of the mean scores on the challenges facing road and Rail Freight Haulage at Apapa Port**

| Variable | No of Samples | df | Mean | StD | $t_{cal}$ | $t_{crit}$ | Sign level (p) |
|---|---|---|---|---|---|---|---|
| Road Challenges | 12 | 11 | 87.08 | 47.82 | $1.676^{ns}$ | 2.201 | 0.122 |
| Rail Challenges | 12 | | 47.50 | 53.59 | | | |

***-** Not significant at 0.05 level of significance

**Source:** Author's field survey, 2021.

Table 8 below presents the t-test comparison of the mean scores on the Challenges facing road and rail freight haulage at Apapa port. From the result, there is no significant difference between the mean scores on the operational challenges facing road freight haulage (87.08) and the mean scores facing rail freight haulage (47.50) from Apapa port at 0.05 level of significance. Since the ($t_{cal}$ = 1.676< $t_{crit}$ = 2.201; df = 11; p >0.05), the $H_O$ is accepted.

**Discussion**

Factors that influence choice of modes have a greater impact in freight transportation. The result from table 1 revealed 70.1% of the freight forwarding organizations preferred road transport for freight haulage. The indication is due to the road transport system which receives high attention in infrastructure development in terms of the geographical coverage compared to other modes thereby reinforcing unimodal freight transportation. Findings from table 4 revealed major factors influencing choice of modes for road and rail freight transport to be; accessibility of mode (14.2%), safety and security of cargo (12.93%), reliability of mode (11.64%), frequency of mode 9.87%), and transit time (speed) (8.77%), with accessibility of mode being the most in decisive factor. The sequence in arrangement revealed the ranking order of the factors respectively. The outcome of the result is similar to the study of (Cullinane & Toy 2000; Samimi, Kawamura & Mohammadian 2011; and Ravibabu 2013) irrespective of the ranking revealed the homogeneity of relevant factors considered in the related literatures

reviewed. The F-test result of ANOVA in table 5 showed descriptive statistics and the ANOVA comparison of mean rating of the factors that influences choice of mode for haulage. The result revealed a statistically significant difference in the mean rating of the factors that influences choice of mode for haulage at 0.05 level of significance as the F-value showed ($F_{cal}$= 149.706>$F_{crit}$ = 1.84; df = 10, 1606; p < 0.05). The Duncan Post Hoc tests result further revealed the significant difference between the mean rating of accessibility of mode (10.9592) and other determinants of mode choice for freight transportation at 0.05 level of significance in favour of accessibility of mode. In general, the accessibility of road transport to the hinterland has a greater influence in the selection of mode for freight transport.

From the findings on the major operational constraints experienced in road freight transportation, the result revealed the major operational challenges in road freight transportation experienced include; harassment by law enforcement agents (13.5%), poor condition of transport infrastructure (12.9%), accidents (12.6%), congestion (12.2%) and vehicle mechanical problem (5.7%) with delivery reliability (4.7%) and geographical coverage (1.1%) to be least experienced. This is akin to the studies of (Ubogu, Ariyo, & Mamman 2011; and Obasanjo, Francis & Williams 2014) which revealed harassment from law enforcement agencies, poor roads, mechanical vehicle breakdown, accidents, traffic congestion and theft/armed robbery constituting major challenges of road freight haulage. The operational challenges experienced in rail freight transportation include geographical coverage (24.7%), poor condition of transport infrastructure (21.4%), delivery reliability (18.9%), poor transport service provider (16.5%), pilferage (7.7%) being the major challenges in rail freight transportation while the least operational challenge experienced is the frequency in cargo damage with (1.1%) response. The geographical coverage of rail transport system being the most operational challenge experienced in rail freight shipment is due to limited fixed route of the narrow gauge-single track that runs in the country since before independence which is not as extensive as road transport. The decline in rail transport system has contributed to the over utilization of the road transport system for freight distribution to the hinterland hence goods not transported in the best practice of transportation system. Furthermore, the t-test result showed a comparison of the mean operational challenges facing road and rail freight haulage at Apapa port. The result in table 8 revealed the difference between the mean scores of the operational challenges facing road freight haulage (87.08) and the mean scores facing rail freight haulage (47.50) from Apapa port at 0.05 level of significance as t-value revealed ($t_{cal}$= 1.676<$t_{crit}$ = 2.201; df = 11; p >0.05) is not statistically significant. This is to say that the operational challenges are commonly encountered through both road and rail freight transport.

## Conclusion

Factors influencing choice of mode for freight transportation were identified in the study with accessibility of mode constituting a key component that plays significant impact in modal selection. The inability of the rail network operation to be extensive and inconsistent in service as that of the road restrict the accessibility of its usage to the freight forwarding organizations. The ease accessibility of road to freight forwarding organizations for onward delivery results to its overutilization hampering the implementation of integrated transport system. There is the need to fully maximize the accessibility of rail network for freight haulage to increase the intermodal freight transport competition. Furthermore, several constraints affect the operation of freight transportation by road and rail transport. The major operational challenge experienced by road include harassment by law enforcement agents, poor condition of transport infrastructure, accidents, congestion and vehicle mechanical problem while that of the rail include the geographical coverage, poor conditions of transport infrastructure and delivery reliability. Apparently, if these constraints can be tackled, effective and seamless

operation of freight transportation to the hinterland would be feasible and efficient hence, the reduction in the logistical cost of transporting freight.

**Recommendations**

It has become necessary to enhance the seamless movement of freight in the best manners of practice through efficient and effective intermodal transport system. The dominant use of road transport for freight movement is not an all-time feasible solution. The underlying factors in choice of mode plays significant role influencing the selection of mode for freight transport. In view of this, the following recommendations are suggested:

(i) Accessibility to mode for freight transport is a significant factor in mode choice. Hence, there should be a shift in the design and construction of standard rail service network across the country to increase the coverage of rail transport network for freight transportation as well as ensuring it full utilization.

(ii) Regulation of weight per axle should be encouraged and monitored so as to limit the total tonnage over which a given mode could haul especially road transportation for long haul.

(iii) The phenomenon of modal choice in cargo haulage should be paramount and be given more attention by policy makers aimed at improving and increasing the attractiveness of rail transport.

(iv) There is the need for regular sanitization and proper monitoring of the law enforcement agencies especially along the highway so as to avoid harassment, and maximum security mechanism on highways to checkmate theft.

**References**

Bina, L., Binova, H., Brezina, E., Kumpost, P., & Padelek, T. (2014). Comparative model of unit costs of road and rail freight transport for selected European Countries. *European Journal of Business and Social Sciences, 4*(3), 127-136.

Bontekoning, Y. M., Macharis, C., & Tripp, J. (2004). Is a new applied transportation research field emerging? -A review of intermodal rail-truck freight transport literature. *Transportation Research Part A: Policy and Practice,* 38(1), 1-34.

Cullinane, K., & Toy, N. (2000). Identifying influential attributes in freight route/mode choice decisions: A content analysis. *Transportation Research Part, E* 36, 41-53.

Forkenbrock, D. J. (2001). Comparison of external costs of rail and truck freight transportation. *Transportation Research Part A*, 35, 321-337.

Hassan, B. (2015). *Importance of efficient rail system in solving the country's cargo transportation and economic problems – A regulator's perspective.* Paper Presented at the National Conference on Rail Transportation System. Transcorp Hilton Hotel, Abuja, 20th - 21st January, 2015.

Hyun-chan, K., & Alan, N. (2013). *Determinants of freight transport mode choice in New Zealand.* Findings of a revealed preference survey. 13th World Conference on transport research, July 15-18, 2013.

Ikporukpo, C., & Filani, M. (2000). Transport coordination in Nigeria: Trends and issues, *The Nigerian Geographical Journal New Series, 3*(4), 29-42

Janic, M. (2007). Modelling the full costs of an intermodal and road freight transport network. *Transportation Research Part D: Transport and Environment,* 12**,** 33-44.

Jiang, F., Johnson, P., & Calzada C. (1999). Freight demand characteristics and mode choice: An analysis of the results of modeling with disaggregate revealed preference data. *Journal of Transportation and Statistics*, 2(2), 149-158.

Juan, D. P. J., Ivan, S. O., & Jorge E. C. M. (2014). *Railway and highway choice model for foreign trade freight.* Paper Presented at Conference on Traffic and Transportation Engineering. Santander, Espana.

Keith, R. (2012). Key factors and trends in transportation mode and carrier selection. *Pursuit – Journal of Undergraduate Research at the University of Tennessee, 4*(1), articles 5.

Kite-Powell, H. L. (2001). Marine policy: Shipping and ports. *In* J. Steele, S. Thorpe, & K. Turekian (eds*)., Encyclopedia of Ocean Sciences,* Academic Press, London, U.K.

Lingaitiene, O. (2006). Application of a general model of a multimodal transportation in logistics. *Transport and Telecommunication. 7*(1), 92-96.

Mckinnon, A. (1989). *Physical distribution systems*. London: Routledge,

Ministry of International Trade and Industry (MITI). (2002). *Annual report on masterplan for an integrated transportation infrastructure,* Federal Ministry of Transport, Abuja. 133-137.

National Cooperative Freight Research Program (NCFRP) (2011). *Performance measures for freight transportation.* Report 10. Washington, D.C.: Transportation Research Board.

Nigeria Railway Corporation (NRC). (2017). *Facts and figures. managing director's office.* NRC headquarters, Ebutte-Metta, Lagos.

Obasanjo, T. O., Francis, M., & Williams, J. J. (2014). Road haulage constraints in the transportation of petroleum products in Northern Nigeria. *IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT), 8*(3), 1-8.

Okanlawon, K. R. (2011). *A study of rail mass transit in Lagos and its environs.* Germany: Lambert Academic Publishing, 2011, P.64

Olagunju, K. (2011). *Articulated lorries management in Nigeria: Road safety perspective.* A Paper Presented at the Road Safety Forum, organized by the International Road Safety Organisation; at Ladi Kwali Hall, Sheraton Hotel & towers, Abuja, 6th May, 2011.

Oni, S. I., & Okanlawon, K. R. (2012). An assessment of the usage of the Lagos mass transit trains. *International Journal of Railway,* 5(1), 29-37.

Patterson, Z., Ewing, G., & Haider, M. (2008). Shipper preferences suggest strong mistrust

of rail: Result from stated preference carrier choice survey for Quebec City-Windsor corridor in Canada. *Transportation Research Record: Journal of the TRB,* 67-74

Ravibadu, M. (2013). A nested logit model of mode choice for inland movement of export shipments: A case study of containerized export cargo from India. *Research in Transportation Economics*, 38, 91-100.

Salim, I. (2003). *Security aspect of multimodal transport*. Proceedings of the Expert Meeting on the Development of Multimodal Transport and Logistics Services, 24 – 26.

Samimi, A., Kawamura, K., & Mohammadian, A. (2011). *A disaggregate analysis of rail-truck mode choice behaviors for freight shipments.* The 90th Transportation Research Board Annual Meeting, CD-ROM. Washington D.C.

Samwel, O. M. O (2014). Determinants of choice of transportation mode for white petroleum by oil marketing companies in Kenya. *Journal of Business and management, 16*(2), 135-148.

Ubogu, A. (2001). *Multimodalism in Nigerian's maritime industry: The need for Institutionalization.* Unpublished M.Sc Dissertation, Department of Geography, University of Lagos. 52-27.

Ubogu, A. E. (2011). The potentials of rail-road integration for port-hinterland freight transport in Nigeria. *International Journal for Traffic And Transport Engineering, 1*(2), 89-107.

Ubogu, A. E., Ariyo, J. A., & Mamman M. (2011). Port-hinterland trucking constraints in Nigeria, *Journal of Transport Geography 19*. Elsevier Ltd, 106-114.

Wong, P., & Chi, C. (2007). *An evaluation of the factors that determine carrier selection*. Doctoral thesis, University of Huddersfield.

Yaowu, W., Chuan, D., Chao, L., & Binglei, X. (2013). An analysis of interstate freight mode choice between truck and rail. *Procedia- Social and Behavioral Sciences, 9*6, 1239-1249.