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## AN APPRAISAL OF ROUTING AND SCHEDULING IN LINER SHIPPING (CASE STUDY: LAGOS PORT COMPLEX)

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### ABSTRACT

*This research reviews the nature, characteristics, trends, and problems associated with shipping line services as regards movement of cargos from one port of origin to other port of destination. Over the years, these critical services have never been encouraging due to some inherent problems associated with ship owners, shipping company, consignees, consignors and the freight forwarders as it relates to cost of freight, which is not in the interest of the importers. The research also analyses the critical challenges and opportunities of the shipping lines in terms of freight costs and movement. There is need therefore for the study to look also on the problems/ challenges and opportunities of shipping line services in Nigeria which came as a result of the slow rate of growth of the Maritime industry in Nigeria and the need to critically analyze the situation. The maritime industry being one of the world's most international industries is the bedrock of development. Primary data which include Interviews questionnaires were administered to the respondents. The questionnaires were distributed among the staffs of Apapa port complex, Tincan island port and staff of some Shipping companies. 200 out of the 250 distributed were returned. In analyzing the data, comparisons were made by the use of percentages and ratios. Analysis of variance was used to determine if there is any significant relationship between the activities Liner shipping and port operations and performance. It was then discovered that there is a significant relationship between vessel turn round time and port productivity and efficiency, between Liner shipping, container terminal and government revenue and that adequate cargo handling machines leads to faster turn-round time of vessels. It is however concluded that maximization of revenue within the port/ shipping sector, all depends on the inflow and outflow of vessels and cargoes.*

### KEYWORDS

linear shipping, Lagos Port.

### INTRODUCTION

#### BACKGROUND INFORMATION

Shipping routing is an idealistic consideration and practical subjection of vessels for navigation and mobility of same along certain designated routes in conformity to international regulations guiding ocean seaway trade. In some regions of the world, such as the far Eastern Asian waters and the Pacific, ships will usually deviate to avoid sections of these sea zones. Shipping is also tending to follow exact recommended routes of international agreements, as they pass through straights and channels and around headlands on which many vessels focus. Scheduling is concerned with the process of sequencing port calls and fixing the time of each port call for all ships involved.

Routing and scheduling is a large research area within communication and transportation. Within transportation there are four distinct modes which are truck, train, aircraft and ship. Shipping differs from trucking in that for example the draft of a ship is a function of how much weight is loaded on the ship whereby the ship-port compatibility is affected by the cargo loaded. Ships can also be diverted at sea and their voyages span days or weeks both of which are not true for trucks. Both planes and ships require large capital investment, they both pay port fees, and both operate internationally. However, airplanes come only in few varieties and do not operate around the clock whereas ships come in a large variety and do operate around the clock, making the two modes unlike as well. Because ships operate under different conditions than the other modes the ship routing and scheduling problems are also different (Christiansen et al., 2004). Within sea transportation there is a distinction between three separate modes of operation: industrial, tramp and liner (Lawrence, 1972). In industrial shipping the cargo owner also owns the ship. Tramp ships are like taxis as they follow the available cargo and liner ships are operated on published schedule that affect the demand for their services and where each cargo only constitutes a small part of the ship capacity (Ronen, 1983). Continuing growth in the world population, increasing globalization, and the extensive depletion of local resources have resulted in increased world trade. Since there is already a heavy pressure on the road and air networks (Christiansen et al., 2004) and only little possibility of extending them, transportation by ship has experienced a rapid growth over these years.

Today, more than 80% of international trade in goods is carried by sea (UNCTAD, 2010b). The majority of these goods is presently transported by ships deployed in the industrial and tramp segments. However, 70% of the seaborne trade, in terms of value, is transported by container ships (WTO, 2008). The container ship fleet, which is exclusively deployed in liner shipping, constituted 13.3% of the world fleet's total deadweight tonnage in 2010. Since 1980, the share of containerized tonnage has increased eightfold, which is a reflection of the increased containerization of the trade in consumer and manufactured goods (UNCTAD, 2010a,c). Despite the growth in the liner shipping segment of the industry, there has been very little research to support it (Sigurd et al., 2007). However this Research work will add to existing literatures in x-raying the problems and prospect of liner shipping in Nigeria.

### STATEMENT OF PROBLEM

The majority of international trade is transported by ships as the maritime shipping industry is the major provider of transportation of large volumes over great distances. The overwhelming relevance of Liner Shipping and the Shipping industry to the functionalities of the maritime industry at large to the overall growth and development of the world economy cannot be fully established without dwelling into some of its peculiar problems. Over the years, the operations and services rendered to users within the confines of the operating environment have not been satisfactory due largely to lack of shipping policy and some government policy inconsistencies. Shipping operations and services have over the years been dominated by foreign shipping companies and vessels of which Maersk-line is inclusive. Therefore, a critical analysis of the challenges and opportunities facing these shipping lines and services in Nigeria is very important. Also many factors like the management of bunker, activities of pirates, application of information and communication technology, safety practices and ship turnaround time affect the growth and survival of a shipping line. Some shipping lines know this fact. While some have taken the lead in innovating trends that would help them overcome these challenges, others sit with no attempt to innovate; still waiting for the changes to blow them away. Thus, because the concept

of liner shipping is growing rapidly, there is need to develop an exclusive appraisal of liner shipping. Therefore, Liner shipping operations have, on several occasions found several operational and managerial policies with regards to routing and scheduling operation within the confines of the system is very confusing. This is because the demand experienced in liner shipping is characterized by an origin and destination pair. However, the type of operation varies. An example of a route can be when a company involved in liner shipping creates routes; the company will often associate a ship type with each route in order to ensure adequate cargo capacity and compatibility between the ships and the ports that they visit. While the routing problem is concerned with sequencing port calls, the scheduling problem is concerned with sequencing port calls and fixing the time of each port call for all ships involved. The two problem types are thus mutually exclusive. Should the sequence of the ports be given, then fixing the time of the port calls is known as a timetabling problem (French, 1982) which is a sub problem of a scheduling problem as the result is a schedule. Routing and Scheduling problems are largely tactical and/or operational in nature. It also includes Fleet Management and composition problems, containerization problems, operational problems, Demand functions problem, transshipment and planning problems.

## OBJECTIVES

The main aim of this study is to x-ray the operational functionality of Routing and Scheduling in liner shipping in Nigeria maritime Industry. Base on the above stated factor, the research objective will take into consideration the following element which will guide the study.

1. To critical examine the relationship between Liner Shipping Operations and Port Productivity.
2. To examine the operational relationship between vessel turnaround time and Port efficiency and Productivity.
3. To examine the operational challenges of Routing and Scheduling in liner shipping and government revenue.

## RESEARCH QUESTIONS

1. How the operations of Liner Shipping can affects port operational performance?
2. How can vessel turnaround time be a measure of port efficiency and productivity?
3. How routing and scheduling in liner shipping can affect port revenue?

## RESEARCH HYPOTHESIS

The following hypothesis shall support this study.

- H<sub>01</sub>: There is no significant relationship between Liner shipping and port operational performance.  
 H<sub>A1</sub>: There is a significant relationship between Liner shipping and port operational performance.  
 H<sub>02</sub>: There is no significant relationship between vessel turnaround time and port productivity and efficiency.  
 H<sub>A2</sub>: There is a significant relationship between vessel turn round time and port productivity and efficiency.  
 H<sub>03</sub>: There is no significant relationship between Routing and Scheduling in liner shipping and government revenue.  
 H<sub>A3</sub>: There is a significant relationship between Routing and Scheduling in liner shipping and government revenue.

## JUSTIFICATION OF STUDY

Every research study must aim at either solving a specific Human problem or contribute to existing literature on the impact of Liner shipping thereby forming a reference material for students and researchers. Prospects and findings from this research work would assist investors, stakeholders and experts in the maritime sectors to focus their seemingly volatile debates on the impacts of Liner shipping and how it has affect the shipping operation within the confines of a maritime country like Nigeria.

Lastly, the findings of this study are envisaged to help in developing strategies that would enhance capacity utilization of liner shipping, reduction of the volume of passenger/container traffic, delay caused by the berth as well as increase vessel turnaround time and berth occupancy ratio.

## METHODOLOGY

**Research Method:** This research employs a pre-study and case study method, to ensure sufficient collection of relevant material, taking into account the lack of research in this subject. We used the material obtained from the interviews and the primary source, to structure our purpose, research questions, and to define the case of our study and an occasional primary data through the use of questionnaire. The questionnaires were distributed to the staff of the Nigerian Ports Authority and some identified regular customers, operators of the port services. The essence of choosing the staff is because of their long years of experience service delivery in the ports, administrative know-how of the ports, the normal arrival rates of the vessels in the port and other Ports logistics.

**Instrumentation:** The measuring instrument (questionnaire) was first administered to two different ports within Lagos (Apapa and Tinican Port) for responses. The summary of their responses were collected and analyzed using ANOVA method to test the hypothesis as well as the result gotten from the questionnaires and a coefficient of 0.05 degree of significance was obtained, indicating a strong relationship in the likelihood of future responses. This shows that the measuring instrument is reliable. The validity adopted is the content validity. The information is assessed, edited to eliminate the errors, the data is then coded and grouped according to the study to ease analysis. It is then analyzed using ANOVA method, the Analysis was done with the aid of Statistical Package for Social Sciences (SPSS) and result presented tables respectively.

The ANOVA formula presented thus;

$$TSS = \sum_{i=1}^n$$

$$TRSS = \sum_{i=1}^n nj (x_j - \bar{x})$$

$$F = \frac{TRMS}{EMS}, d = 5\%$$

Where;

TSS = Sum of Squares total

TRSS = Sum of Squares treatment

ESS = Sum of square due to error

TRMS = Treatment mean Square

EMS = Error mean Square

**Data analysis and discussions:** This aspect contains the analysis of the data obtain through questionnaire. A total of two hundred and thirty six (236) questionnaires (base on the Yarayamen formula) were administered in the specified case study Lagos port complex in Lagos state to the port workers but only two hundred copies (200) were recovered. The reason is that some were not submitted at all and some were not completely filled. The data analysis started with presentation of the data, result presentation and discussion of each data with the use of different tables for each items with discussion of each data with the use of different tables for each items with discussion on respondents perception through percentage analysis. In the same vein, respondents on each variable in the questionnaire were discussed. Also, the hypothesis of this research would be verified with the aid of analysis of variance (ANOVA) techniques using the F distribution method so as to determine the hypothesis that should be rejected and the one to be accepted. More so, the findings of this research shall be discussed based on the result on acceptance of the hypothesis and conclusion shall be drawn based on the commensuration of the research with the existing models/theories in the research, which determine the validity and reliability of the research to the existing body of knowledge on the research.



## DATA PRESENTATION, RESULT AND DISCUSSION

TABLE 1: THE SEX DISTRIBUTION OF THE RESPONDENT

SEX	NUMBER OF RESPONDENT	PERCENTAGE
MALE	148	74%
FEMALE	52	26%
TOTAL	200	100%

SOURCE: BUHARI S.O (2014) FIELD SURVEY

DISCUSSION: As presented above, 74% of the respondents were male, while 26% were female. This implies that a percentage of port workers are male.

TABLE 2: THE AGE DISTRIBUTION OF THE RESPONDENT

AGE	NUMBER OF RESPONDENT	PERCENTAGE
18-25	30	15%
26-35	55	27.5%
36-45	70	35%
45 ABOVE	45	22.5%
TOTAL	200	100%

SOURCE: BUHARI S.O (2014) FIELD SURVEY

DISCUSSION: As presented above, 15% of the respondents were between ages 18-25, 27.5% were between ages 26-35, 35% were between ages 36-45 while 22.5% were between the ages 45 and above. This implies that all port workers are adult because they are all above 18 years of age.

TABLE 3: MARITAL STATUS OF THE RESPONDENT

MARITAL STATUS	NUMBER OF RESPONDENT	PERCENTAGE
SINGLE	60	30%
MARRIED	140	70%
TOTAL	200	100%

SOURCE: BUHARI S.O (2014) FIELD SURVEY

DISCUSSION: As presented in the above, 30% of the respondents were single, while 70% were married. This implies that higher percentages of port workers are married.

TABLE 4: EDUCATIONAL BACKGROUND OF THE RESPONDENT

EDUCATIONAL BACKGROUND	NUMBER OF RESPONDENT	PERCENTAGE
SSCE	35	17.5%
OND/NCE	45	22.5%
HND/B.Sc	65	32.5%
M.Sc/ MBA	35	17.5%
PhD	5	2.5%
OTHERS	15	7.5%
TOTAL	200	100%

SOURCE: BUHARI S.O (2014) FIELD SURVEY

DISCUSSION: As presented in the table 4 above, 17.5% of the respondents were SSCE holders, 22.5% were OND/NCE holders, 32.5% HND/B.Sc holders, 17.6% were M.Sc/MBA Holders, 2.5% were PhD holders while 7.5% were those who possess other certificate not specified between the ages 45 and above. This implies that majority of port workers are educated.

TABLE 5: THE OCCUPATIONS OF THE RESPONDENT

OCCUPATIONS	NUMBER OF RESPONDENT	PERCENTAGE
NPA	50	25%
FREIGHT FORWARDERS	25	12.5%
CONCESSIONAIRES	44	22%
CUSTOM OFFICERS	20	10%
SHIPPING COMPANY STAFF	10	5%
CONTAINER TERMINAL STAFF	20	10%
STEVEDORES	25	12.5%
OTHERS	6	3%
TOTAL	200	100%

SOURCE: BUHARI S.O (2014) FIELD SURVEY

DISCUSSION: As presented in the table 5 above, 25% of the respondents were NPA staff, 12.5% were FREIGHT FORWARDERS, 22% CONCESSIONAIRES, 10% were CUSTOM OFFICERS, 10% were CONTAINER TERMINAL STAFF, 5% were SHIPPING COMPANY STAFF, 12.5% were STEVEDORES while 3% were not specify in the questionnaires.

Question 1: Inadequate funding hinder Liner shipping Operation in Nigeria

TABLE 6: HOW DOES INADEQUATE FUNDING HINDER LINER SHIPPING OPERATIONS?

ALTERNATIVE OPTION	NUMBER OF RESPONDENT	PERCENTAGE
STRONGLY DISAGREE	30	15%
DISAGREE	20	10%
NEUTRAL	10	5%
AGREE	60	30%
STRONGLY AGREE	80	40%
TOTAL	200	100%

SOURCE: BUHARI S.O (2014) FIELD SURVEY

DISCUSSION: As presented in the table 6 above, 15% of the respondents strongly disagree that inadequate funding hinder liner shipping operations, 10% disagree, 5% neutral, 30% agreed, 40% strongly agreed, This implies that majority of the respondent are of the opinion that inadequate funding affects the liner shipping operations.

Question 2: liner Shipping has increase cargo Throughput in container Terminals

**TABLE 7: HOW LINER SHIPPING HAS BEEN ABLE TO INCREASED THE CARGO THROUGHPUT AT CONTAINER TERMINAL**

ALTERNATIVE OPTION	NUMBER OF RESPONDENT	PERCENTAGE
STRONGLYDISAGREE	20	10%
DISAGREE	15	7.5%
NEUTRAL	5	2.5%
AGREE	60	30%
STRONGLY AGREE	100	50%
TOTAL	200	100%

SOURCE: BUHARI S.O (2014) FIELD SURVEY

DISCUSSION: As presented in the table 7 above, 17.5 % (that 10%,7.5% of the respondents) disagree with the above question, 2.5% neutral, while 80% (that 30%, 50% of the sample population) agreed, This implies that majority of the respondent are of the opinion that liner shipping operations has been able to increase cargo throughput.

Question 3: Inadequate manpower affects Liner shipping Operations

**TABLE 8: HOW INADEQUATE SKILL MANPOWER AFFECTED THE OPERATION OF LINER SHIPPING**

ALTERNATIVE OPTION	NUMBER OF RESPONDENT	PERCENTAGE
STRONGLYDISAGREE	40	20%
DISAGREE	34	17%
NEUTRAL	8	4%
AGREE	88	44%
STRONGLY AGREE	30	15%
TOTAL	200	100%

SOURCE: BUHARI S.O (2014) FIELD SURVEY

DISCUSSION: As presented in the table 8 above, 59 % (that 44%,15% of the respondents) agreed with the above question, 4% neutral, while 37% (that 20%, 17% of the sample population) disagree, This implies that majority of the respondent are of the opinion that lack of skilled manpower affect the operations of Liner shipping.

Question 4: Government policy inconsistency affects liner shipping Services

**TABLE 9: HOW POLICY INCONSISTENCY OF GOVERNMENT AFFECTS LINER SHIPPING IN NIGERIA**

ALTERNATIVE OPTION	NUMBER OF RESPONDENT	PERCENTAGE
STRONGLYDISAGREE	20	10%
DISAGREE	15	7.5%
NEUTRAL	10	5%
AGREE	60	30%
STRONGLY AGREE	95	47%
TOTAL	200	100%

SOURCE: BUHARI S.O (2014) FIELD SURVEY

DISCUSSION: As presented in the table 9 above, 17.5 % (that 10%,7.5% of the respondents) disagree with the above question, 5% neutral, while 77.5% (that 30%, 47.5% of the sample population) agreed, This implies that majority of the respondent are of the opinion that policy inconsistency of government leads to cargo diversion to neighboring port.

Question 5: Port Reforms Strategies Improve Liner Shipping Operations

**TABLE 10: HOW PORT REFORM STRATEGY IMPROVE THE OPERATIONS OF LINER SHIPPING**

ALTERNATIVE OPTION	NUMBER OF RESPONDENT	PERCENTAGE
STRONGLYDISAGREE	10	5%
DISAGREE	20	10%
NEUTRAL	-	-
AGREE	70	35%
STRONGLY AGREE	100	50%
TOTAL	200	100%

SOURCE: BUHARI S.O (2014) FIELD SURVEY

DISCUSSION: As presented in the table 10 above, 15 % (that 5%,10% of the respondents) disagree with the above question, zero neutral, while 85% (that 35%, 50% of the sample population) agreed, This implies that majority of the respondent are of the opinion that port reform strategy improve and also reshape to a large extent the operations of liner shipping.

Question 6: Environment policies on the water ways improve Liner shipping Standard

**TABLE 11: HOW ENVIRONMENTAL POLICY ON THE WATER WAYS HAVE IMPROVE STANDARDS IN LINER SHIPPING**

ALTERNATIVE OPTION	NUMBER OF RESPONDENT	PERCENTAGE
STRONGLYDISAGREE	30	15%
DISAGREE	10	5%
NEUTRAL	25	12.5%
AGREE	72	36%
STRONGLY AGREE	63	31.5%
TOTAL	200	100%

SOURCE: BUHARI S.O (2014) FIELD SURVEY

DISCUSSION: As presented in the table 11 above, 20% of the respondents disagree with the above question, 12.5% neutral, while 67.5% of the sample population agreed, This implies that environmental policy improve shipping activities on the water ways.

Question 7: Poor maintenance culture on port Infrastructure affects Liner Shipping

**TABLE 12: THE IMPACT OF MAINTENANCE CULTURE OF THE INFRASTRUCTURE AND SUPER STRUCTURE OF THE PORT AND SHIPPING FACILITIES**

ALTERNATIVE OPTION	NUMBER OF RESPONDENT	PERCENTAGE
STRONGLYDISAGREE	22	11%
DISAGREE	21	10.5%
NEUTRAL	8	4%
AGREE	55	27.5%
STRONGLY AGREE	94	47%
TOTAL	200	100%

SOURCE: BUHARI S.O (2014) FIELD SURVEY

DISCUSSION: As presented in the table 12 above, 21.5% of the respondents disagree with the above question, 4% neutral, while 74.5% of the sample population agreed; This implies that lack of maintenance culture affect the operational performance of liner shipping. Thus, it should be discouraged.

Question 8: Adequate provision of infrastructure and capacity building will affect Liner shipping

**TABLE 13: ADEQUATE SUPPORTING INFRASTRUCTURE AND CAPACITY BUILDING**

ALTERNATIVE OPTION	NUMBER OF RESPONDENT	PERCENTAGE
STRONGLYDISAGREE	-	-
DISAGREE	20	10%
NEUTRAL	-	-
AGREE	50	25%
STRONGLY AGREE	130	65%
TOTAL	200	100%

SOURCE: BUHARI S.O (2014) FIELD SURVEY

DISCUSSION: As presented in the table 13 above, 10% of the respondents disagree with the above question, while 90% of the sample populations agree. This implies that adequate support infrastructure and capacity building will enhance liner shipping operation.

Question 9: Maritime Security and safety affects Liner shipping Operation

**TABLE 14: LACK OF APPROPRIATE MARITIME SECURITY AND SAFETY STANDARD**

ALTERNATIVE OPTION	NUMBER OF RESPONDENT	PERCENTAGE
STRONGLYDISAGREE	25	12.5%
DISAGREE	15	7.5%
NEUTRAL	10	5%
AGREE	70	35%
STRONGLY AGREE	80	40%
TOTAL	200	100%

SOURCE: BUHARI S.O (2014) FIELD SURVEY

DISCUSSION: As presented in the table 14 above, 20% of the respondents disagree with the above question, 5% neutral, while 75% of the sample population agreed; this implies that lack of appropriate security and safety standard affect operations of liner shipping.

Question 10: Cargo diversion led to loss of revenue

**TABLE 15: PERCEPTION TOWARDS CARGO DIVERSION AND REVENUE LOSS TO NEIGHBORING PORT**

ALTERNATIVE OPTION	NUMBER OF RESPONDENT	PERCENTAGE
STRONGLYDISAGREE	20	10%
DISAGREE	10	5%
NEUTRAL	-	-
AGREE	80	40%
STRONGLY AGREE	90	45%
TOTAL	200	100%

SOURCE: BUHARI S.O (2014) FIELD SURVEY

DISCUSSION: As presented in the table 15 above, 15% of the respondents disagree with the above question, while 85% of the sample populations agree. This implies that cargo diversion is synonymous to revenue loss to other neighboring port.

Question 11: Lack of Training and Re-training of Personnel affects Liner shipping Operations

**TABLE 16: PERCEPTION TOWARDS LACK OF TRAINING AND RETRAINING OF PERSONNEL**

ALTERNATIVE OPTION	NUMBER OF RESPONDENT	PERCENTAGE
STRONGLYDISAGREE	5	2.5%
DISAGREE	3	1.5%
NEUTRAL	2	1%
AGREE	86	43%
STRONGLY AGREE	104	52%
TOTAL	200	100%

SOURCE: BUHARI S.O (2014) FIELD SURVEY

DISCUSSION: As presented in the table 16 above, 99% of the respondents agree with the above question, 1% were neutral, while 4% of the sample populations disagree. This implies that lack of training and retraining of personnel will reduce efficiency and lead to redundancy of service.

Question 12: Inadequate Funding and under investment affects the maritime Industry

**TABLE 17: PERCEPTION TOWARDS INADEQUATE FUNDING AND UNDER INVESTMENT IN THE MARITIME SECTOR**

ALTERNATIVE OPTION	NUMBER OF RESPONDENT	PERCENTAGE
STRONGLYDISAGREE	30	15%
DISAGREE	16	5%
NEUTRAL	25	12.5%
AGREE	63	31.5%
STRONGLY AGREE	72	36%
TOTAL	200	100%

SOURCE: BUHARI S.O (2014) FIELD SURVEY

DISCUSSION: As presented in the table 17 above, 20% of the respondents disagree with the above question, 12.5% were neutral, while 67.5% of the sample populations agree. This implies that inadequate funding and under investment in the maritime sector affects operational efficiency of liner shipping.

Question 13: Liner shipping in Nigeria has attained optimal performance

**TABLE 18: PERCEPTION TOWARDS OPTIMAL PERFORMANCE OF LINER SHIPPING TO THE MARITIME INDUSTRY GROWTH**

ALTERNATIVE OPTION	NUMBER OF RESPONDENT	PERCENTAGE
STRONGLYDISAGREE	105	52.5%
DISAGREE	70	35%
NEUTRAL	20	10%
AGREE	5	2.5%
STRONGLY AGREE	-	-
TOTAL	200	100%

SOURCE: BUHARI S.O (2014) FIELD SURVEY

DISCUSSION: As presented in the table 18 above, 87.5% of the respondents disagree with the above question, 10% were neutral, while 2.5% of the sample populations agree. This implies that liner shipping have not been able to reach its target. Hence, the need for proper funding into the sector cannot be overruled.

Question 14: There is significant relationship between vessel turnaround time and port productivity and efficiency

**TABLE 19: PERCEPTION TOWARDS VESSEL TURNAROUND TIME AND PORT PRODUCTIVITY AND EFFICIENCY**

ALTERNATIVE OPTION	NUMBER OF RESPONDENT	PERCENTAGE
STRONGLYDISAGREE	10	5%
DISAGREE	7	3.5%
NEUTRAL	8	4%
AGREE	50	25%
STRONGLY AGREE	125	62%
TOTAL	200	100%

SOURCE: BUHARI S.O (2014) FIELD SURVEY

DISCUSSION: As presented in the table 19 above, 8.5% of the respondents disagree with the above question, 4% were neutral, while 87.5% of the sample populations agree. This implies that there are imbalances in liner shipping as it affect container throughput"

**TABLE 20: TEST OF HYPOTHESIS (Using Analysis of variance, ANOVA)**

QUESTION	SD	D	N	A	SA	TSD	TSA
Q1	30	20	10	60	80	50	140
Q2	20	15	5	60	100	35	160
Q3	40	34	8	88	30	74	118
Q4	20	15	10	60	95	35	155
Q5	10	20	-	70	100	30	170
Q6	30	10	25	72	63	40	135
Q7	22	21	8	55	94	43	149
Q8	-	20	-	50	130	20	180
Q9	25	15	10	70	80	40	150
Q10	20	10	-	80	90	30	170
Q11	5	3	2	86	104	8	190
Q12	30	16	25	63	72	46	135
Q13	105	70	20	5	-	46	135
Q14	10	7	8	50	125	17	175
MEAN	26.2	19.7	9.6	62.1	83.1	45.9	132.6

SOURCE: BUHARI S.O (2014)

**TABLE 21: MODEL SUMMARY**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.989 <sup>a</sup>	.978	.976	6.21304

a. Predictors: (Constant), TSA

**TABLE 22: ANOVA<sup>a</sup>**

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	20773.706	1	20773.706	538.153	.0002 <sup>b</sup>
1 Residual	463.223	12	38.602		
Total	21236.929	13			

a. Dependent Variable: TSD

b. Predictors: (Constant), TSA

**TABLE 23: COEFFICIENTS<sup>a</sup>**

Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.
	B	Std. Error	Beta	
1 (Constant)	174.876	5.801		30.145
TSA	-.888	.038	-.989	.001

a. Dependent Variable: TSD

From the ANOVA Table, it can be seen that the significance value in the ANOVA table is 0.0002 which is less than the significance level of 0.05. This shows that there is a significant relationship between the variables. Therefore, we accept the alternative hypothesis one, two and three and reject the null hypothesis that;

- There is significant relationship between Liner shipping and Port operational performance.
- There is significant relationship between vessel turnaround time and Port productivity and efficiency.
- There is a significant relationship between Routing and Scheduling and Port revenue.

## CONCLUSION

In this research a classification scheme for scheduling and routing problems in liner shipping has been developed. The scheme is based on existing schemes for vehicle routing problems and literature concerning liner shipping. Articles on the subject are classified according to the developed scheme and subsequently grouped according to three of the characteristics in the scheme. The grouping resulted in four groups of articles all involving routing hence, none of the articles were classified as both a scheduling problem or a fleet management and scheduling problem. The classification scheme is expected to help elucidate the characteristics of the predominantly practical problems currently in the literature and thereby create some uniformity in the literature in the long run. The scheme can then form the basis from which a general model or group of models can be developed.

## RECOMMENDATIONS

After a thorough and exhaustive research on “**Appraisal of Routing and Scheduling in Liner Shipping (Case Study: Lagos port complex)**”. It is very obvious that some of the recommendations have with and adopted will definitely enhance productivity and management efficiency in the ports. There is need for government to rise up to the challenges of these current trends within the confines of the port environment by creating a congenial business environment that will lift the operational standards of the port system.

1. Shipping Company should as a matter of fact and urgency be proactive in the choice of viable route so as to met up the expected target delivery to the customer.
2. To ensure and promote continues dredging of waterways to support continue free flow of vessel operation.
3. Government policies “if any” should be design to favour routing and scheduling operation of liner industry so as to improve vessel calls at our ports.
4. The operations of fleet management, fleet allocations and deployment decision should be thoroughly organized and manage so as to improve industry management and efficiency.
5. There is need to revisit the existing Liner Operation structures within the confines of the maritime sector.
6. There is need for effective Liner routing and scheduling structure so as to ensure even distribution of activities in the ports and enhance port assets utilization.
7. There is need for shipping companies and terminal concessionaires’ to invest in the expansion of port infrastructure and super structure such as port spaces, transit sheds, stacking areas and parking areas for better accommodation of containers and cargos within the confines of the port environment.
8. There is need for better construction and building of new and feeder ports aimed at reducing the pressure of vessel inflow and outflow on the congested ports within the confines of the port environment.
9. It is also recommended that procurement of sound and facilities modern equipment and other infrastructure so as to facilitate cargo handling of both imports and exports and goods delivery to the respective consignee.
10. There is need for a reconstruction and rehabilitation of all seaports facilities and ports infrastructure and super structures through due diligence and at a cost that is meaningful and profitable.
11. This research also tends to recommend that for proper operational modalities of our port systems, there is need for the provision of ICD (inland container depot) in the geopolitical zone of Nigeria.

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