



## Evaluation of Compulsory Regulatory Port Services and Revenue Generation of Onne Port Nigeria

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### KEYWORDS

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### ABSTRACT

Compulsory regulatory services are those port services which are required by Port Authority to provide to port users and/or vessels that call to the port. These services are by port statutory requirement that the Port Authority provides such services and collect revenues from the port users who benefits from such services. Such revenues collected include pilotage fees, lease fees, berth rent, MOWCA, contingency deposit, ship dues etc. This study evaluated the impacts of these compulsory regulatory port services on revenue generation of Onne Port Nigeria. In carrying out the study, secondary data consisting of time series data on port revenue covering a period of six years (2016-2020) of Onne port obtained from NPA Onne annual reports. The data collated were analyzed using multivariate statistics of stepwise regression method with the help of computer aided software SPSS version 22. The results inform that the mix of the independent variables have significant impacts on revenue generation of Onne Port Nigeria. The findings further show that unit increase on pilotage and other services have positive significant impacts on revenue generation while, unit increase on lease and throughput fees have negative significant impacts on revenue generation due to discounts offered to port users for increase in unit patronage. The study recommends that the port authority should ensure adequate pilotage and maintenance of other services to satisfy potential port users to earn loyalty and increase patronage by port users in order to generate more revenues and adopt an optimization approach to manage discounts on unit increase on throughput and lease fees to minimize the effect on the overall revenue generation specially in a long run.

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## 1. INTRODUCTION

Onne port is one of the vibrant and a fast-growing shipping ports in the Eastern Nigeria that is well equipped with modern container handling facilities serving a gateway to nation's economy (Chang et al. 2014; Zhu, 2023). Onne Port Complex is situated on the Bonny River Estuary along Ogu Creek. Onne is the pioneer port to operate on the Landlord Port Model, devised to encourage private sector participation in the Port Industry (ThankGod, 2023). There are multiple operations and port services that are carried out in the port in addition to the Oil and Gas operations. Some of such multiple operations are General Cargoes, Bulk Cargoes (Dry & Wet)

and most especially the recent development on massive containerized Cargo handling as well as other Logistics Services provided to vessels and companies that are customers to the port industry. The Onne port can be described as a multi-purpose cargo port in the sense that it can handle various types of cargoes ranging from containerized cargoes to general cargoes including oil and gas. The Port is industrialized with modern facilities and equipment. Onne Port has one of the biggest harbour mobile cranes in Africa (Liebherr 600) with a lifting capacity of 208 metric tons and 220 Gmk, 5220 grove twin cranes that has capacity of lifting single heavy cargo of 300 tons owned by one of the Terminal Operators in the Port

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(NPA, 2023). Onne is a relatively major port in the region and has several quays with facilities for cargo ships up to 60,000gt. It is also the main base for the offshore activity in the region. Onne port is known as Oil and Gas Free Zone (OOGFZ) and contains several quays to cater to off shore supply vessels and a shipyard (WAS - West Atlantic Shipyard). The port comprises three areas which are the Federal Lighter Terminal, the Onne Port Complex, and the Federal Ocean Limited, which includes facilities for offshore oil and gas supply vessels.

Onne port attracts shipments and vessel patronage monthly which account for great number of ship traffic, cargo throughput; berth occupancy and revenue generation to the port industry (Abubakar, 2022). Ships with her cargoes entering the port call for compulsory assistance which the port authority by its regulations are mandated to provide to assist calling vessels to the port. These services include pilotage services, berthing/mooring, loading and discharges. Vessels coming to ports require good channels, security and other necessary services to facilitate ship entry, exit and efficient cargo delivery, which the port authority is obliged to provide (ThankGod, 2023). In order to provide these services, Port Authority ensure frequent channel maintenance, environmental protection, berth allocations, pilotage services and efficient cargo delivery equipment, etc. are made available. Port user are mandated by regulation to pay certain fees, charges or dues for the use of the port facilities and services rendered. Some of those fees include harbour dues, lease fees, pilotage charges, throughput fees, ship dues, contingency dues, berth rent, cargo due, Maritime Organization of West and Central Africa (MOWCA) environmental protection fees etc., these fess, dues or charge collected by the Port Authority account for the overall revenue generated by the Port Authority monthly and annually (NPA, 2021). The significance of these services is pertinent to the port users vis-à-vis the revenue generated to the Port Authority (Abubakar, 2022).

Therefore, the study aims to examine these services and determine their significant impact on the revenue generation of Onne port. The elaborate objectives of this study were to determine the impacts of compulsory pilotage service fee, throughput fee, lease fee, and other service fees on revenue generation of Onne port.

## 2. LITERATURE REVIEW

The underlying principles for this study are founded on two theories which include customer service theory and revenue maximization theory. The customer service theory is formulated by Adam Smith, in his book titled "The Wealth of Nations" in 1776 (Nicole, 2018). The theory emphasises that customer satisfaction is the basis for competition in industry, therefore, a healthy port is a port that can meet customer satisfaction and compete favourably in the global shipping industry. This theory is relevant to Port Authority in service provision to potential port users to maintain loyalty and patronage. Customer service theory is all about attracting customers and keeping them patronizing the organization's products and services. The key thing to aim at is to earn loyalty from the potential port user (Nicole, 2018).

Revenue maximization theory states that revenue is generated from sales of company products or services and the

maximization of sales of a company's products (Beniamino, 2018). The theories can be adopted in the port industry to explain efficiency in port services that would attract more patronage in terms of increasing vessel traffic and cargo throughput. This can be achieved through marketing strategies using measures such as advertisement, sales promotion, demos, test samples, campaign, references, etc., to increase revenue and capture higher market share in the port industry (Okorie, 2019; Hlali and Hammami, 2017).

Onne port has witness drastic improvement in vessel traffic, tonnages and cargo throughputs since concession which also has reflected on revenue generation of the port in the recent time (Bunmi, 2022; Abubakar, 2022) and this has also contributed to growth and economic development of the global maritime trade (Hlali et al. 2023; Khaslavskaya et al. 2021). Onne Seaport generated over N242 billion revenue in the 2022 (Port & Ship, 2023) and set a target of N336 billion for revenue generation for the year, 2023 and has achieved over over N54 billion revenue of which translate to 16.3 percent of the target before the second quarter 2023 (This Day, 2023) and when compared to the same period last year (2022), the revenue had increased over N1billion.

This study reviewed many related literatures such as, Edih, et al., (2023) whose work centred on Port operation's efficiency and revenue generation in global maritime trade: implications for national growth and development in Nigeria. Abubakar, et al., (2022), Appraisal of conservative service impacts on revenue generation in Nigerian ports industry. Osadume, et al., (2020), Port Revenue Performance and Economic Growth: The Nigerian Ports Authority Experience, 2010-2019 and so many others, however, there was no work available in the literatures that studied on evaluation of Compulsory Regulatory Port Services and Revenue Generation of Onne Port Nigeria using stepwise multiple regression analysis to study the impacts of pilotage fees, lease fees, berth rent, MOWCA, contingency deposit, and ship dues on revenue generation of Onne port, Nigeria, hence, this was the identified gap in the literature which this study addressed.

## 3. METHODOLOGY

In order to evaluate the impacts of compulsory regulatory service fees on revenue generation of Onne port, secondary data were collected to achieve the objectives of the study. The secondary data were time series data on compulsory regulatory fees of Nigerian Ports Authority (NPA) Onne for the periods of six years, because this duration as there were no studies which evaluated the impacts of compulsory regulatory service fees on revenue generation of Onne port. These services fee include pilotage service charges, lease dues, throughput dues, harbour dues, ship dues, contingency dues, berth rent, cargo due and MOWCA Environmental Protection levy. The data collected were on annually revenues.

To analyze the data collected on this study, statistical technique of multiple regression was deployed to determine the impacts of compulsory levies on revenue generation of Onne port.

According to Andrew (2006) multiple regression is a statistical technique that can be used to analyze the relationship between a single dependent variable and several independent variables. The objective of multiple regression is

to use the independent variables whose values are known to predict the value of the single dependent variable.

Generally, the regression model is expressed mathematically as:

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3 + \dots + b_n x_n + e \quad (1)$$

Where

Y is dependent variable (revenue generation)

a= intercept of the regression graph

b<sub>1</sub>, b<sub>2</sub>, ..., b<sub>n</sub> the slope of the graph

x<sub>1</sub>, x<sub>2</sub>, ..., x<sub>n</sub> the independent variables (x<sub>1</sub>= pilotage, x<sub>2</sub>= others fees, x<sub>3</sub>= throughput, and x<sub>4</sub>= leases fees)

Therefore, for this study the following models were formulated:

$$Y = a + b_1x_1 \quad (2)$$

$$Y = a + b_1x_1 + b_2x_2 \quad (3)$$

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3 \quad (4)$$

$$Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 \quad (5)$$

However, the type of multivariate regression analysis employed for this study is the stepwise regression analysis. Adam, et al., (2022) defined Stepwise regression as the step-by-step iterative construction of a regression model that involves the selection of independent variables to be used in a final model. The goal of stepwise regression is, through a series of tests to find a set of independent variables that significantly influence the dependent variable. This is done with computers aided software SPSS version 22 through iteration, which is the process of arriving at results or decisions by going through repeated rounds or cycles of analysis. The objectives of the study include to determine:

- The significant impact of pilotage service fees on revenue generation of Onne port.
- The significant impact of pilotage service fees and other fees on revenue generation of Onne port.
- The significant impact of pilotage service fees, other fees and throughput fees on revenue generation of Onne port.
- The significant impact of pilotage service fees, other fees, throughput fees and lease dues on revenue generation of Onne port.

### 3.1 Research hypotheses

H1= Pilotage service fees have no significant impact on revenue generation of Onne port.

H2= Throughput fees have no significant impact on revenue generation of Onne port

H3= Lease fees have no significant impact on revenue generation of Onne port

H4= Other service fees have no significant impact on revenue generation of Onne port

Figure 1 represent a conceptual design of the different factor of Compulsory Regulatory Port Services like pilotage service fees and others, throughput fees and lease dues, that can impact on Onne port's revenue generation.

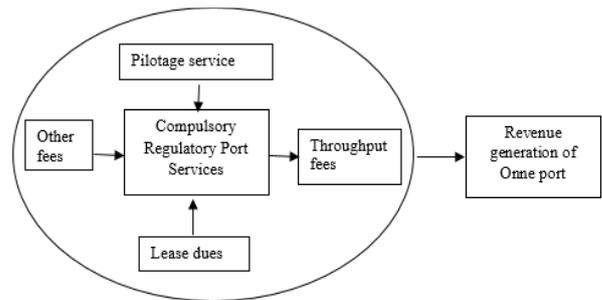


Fig 1. Conceptual design

## 4. RESULTS AND DISCUSSION

The table 1 below provides data on the port services and revenue generation of Onne Port. the service which include lease of equipment, throughput on cargo handling, pilotage services and Others which include the summation of harbour dues, ship dues, contingency due, berth rent, cargo due, Maritime organization of west and central Africa (MOWCA) environmental protection.

Table 1. Onne port services and revenue generation from 2016-2020 (USD).

S/ N	Lease fee	Throughput fee	Compulsory pilotage	Others	Revenue
1	6441664.1 6	2648355.14	61062619.52	109292887.2 2	17944552 6.04
2	6786997.4 3	2498819.46	97807230.32	148470074.5 6	25556312 1.77
3	7427262.7 2	2570524.14	96492401.06	139350528.4 7	24584071 6.39
4	7957131.5 0	2741203.66	103534876.8 7	137194719.6 3	25142793 1.66
5	8289381.4 3	3447161.65	120894211.4 1	134952649.0 3	26758340 3.52
6	8962337.6 2	2938794.54	113038292.5 3	23456653.34	22860696 0.97

Source: Compiled from NPA Onne annual reports

Table 2 demonstrates the input variables on stepwise regression model on probability of additions and removals of the variables to determine the impacts independent variables on the dependent variable at 0.05 significant level.

Table 2. Variables Entered/Removed<sup>a</sup>

Model	Variables Entered	Variables Removed	Method
1	Compulsory_pilotage	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
2	Others	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
3	Throughput_fee	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).
4	Lease_due	.	Stepwise (Criteria: Probability-of-F-to-enter <= .050, Probability-of-F-to-remove >= .100).

a. Dependent Variable: Revenue\_generated

The model summary table3 shows that the SPSS built models in four steps each of which adds a predictor to the equation. While more predictors were added, adjusted r-square

levels off: adding a second predictor to the first raises it with 0.303, but adding the fourth predictor to the previous three only results in a 0.007-point increase. However, the final adjusted r-square is 1.000, which means that the total predictors' variables account for 100% of the variance in overall which is normal in social science research. The table also informs on the correlation of the predictor variables as additional variables were inputted the result shows a perfect positive correction of +1. Hence, there is a positive relationship between the dependent and independent variables. This informs that the mix of predictor variables results to increase in the revenue generation of Onne port Nigeria. This also informs that there is strong positive relation between the dependent and independent variables of the study, whereby, compulsory pilotage fees strongly correlate at 84.7%; compulsory pilotage and Others fees correlate at 98.5%; compulsory pilotage, Others, and Throughput fee at 99.9%; compulsory pilotage, Others, Throughput fee, and Lease due at 100%.

**Table 3. Model Summary**

Model	R	R Square	Adjusted Square	R Std. Error of the Estimate
1	.847a	.718	.647	18674335.79438
2	.985b	.970	.950	7046060.87654
3	.999c	.997	.993	2556297.51875
4	1.000d	1.000	1.000	145809.35074
a. Predictors: (Constant), compulsory_pilotage				
b. Predictors: (Constant), compulsory_pilotage, Others				
c. Predictors: (Constant), compulsory_pilotage, Others, Throughput_fee				
d. Predictors: (Constant), compulsory_pilotage, Others, Throughput_fee, Lease_due				

The ANOVA Table 4 shows the significance of the predictor variables at 0.05 significant levels. The table informs that the mix of variables added are significant at 95% significance level given that (Pvalues = < 0.05); compulsory\_pilotage (.033); compulsory\_pilotage and others (.005); compulsory\_pilotage, Others and Throughput\_fee (.004); compulsory\_pilotage, Others, Throughput\_fee and Lease\_due (.003). This implies that each of the services has a significant impact on revenue generation of the port industry. Hence, H1, H2, H3 and H4 are accepted to significantly impact on the revenue generation of Onne port.

**Table 4. ANOVA<sup>a</sup>**

Model	Sum of Squares	Df	Mean Square	F	Sig.
1 Regression	3547323074	1	3547323074	10.17	.033 <sup>b</sup>
Residual	781492.000	4	781492.000	2	
Total	1394923269	5	3487308173		
	445145.000		61286.300		
2 Regression	4793305422	2	2396652711	48.27	.005 <sup>c</sup>
Residual	598738.000	3	299369.000	4	
Total	1489409216	5	4964697387		
	27899.500		5966.500		
3 Regression	4929177030	3	1643059010	251.4	.004 <sup>d</sup>
Residual	217887.000	2	072629.000	38	
Total	1306931400	5	6534657004		
	8751.190		375.595		
Total	4942246344	5	226638.000		

4 Regression	4942225083	4	1235556270	5811	.003 <sup>e</sup>
Residual	859875.000	1	964968.000	5.473	
Total	2126036676	5	2126036676		
	2.963		2.963		
Total	4942246344	5	226638.000		
a. Dependent Variable: Revenue_generated					
b. Predictors: (Constant), compulsory_pilotage					
c. Predictors: (Constant), compulsory_pilotage, Others					
d. Predictors: (Constant), compulsory_pilotage, Others, Throughput_fee					
e. Predictors: (Constant), compulsory_pilotage, Others, Throughput_fee, Lease_due					

The coefficient Table5 provides the models and impacts of the independent variables on dependent variable revenue generation of Onne port at points when each of the variables are iterated. Pilotage services has significance value of 0.033 which emphasises that Pilotage services significantly impacts the revenue generation of Onne port Nigeria. The model equation is given as

$$Y_{\text{revenue generation}} = 110978182 + 1.286_{\text{Pilotage services}}; \quad (6)$$

which proves that a unit increase in Pilotage services will increase the revenue generation by 1.28units when other variables are kept constant. The impact of pilotage service is rated at 84.7% represented by Beta value on the regression coefficient table5.

The iteration of pilotage services and others services of the port industry are significant at 0.003 and 0.015 respectively, which implies that pilotage services and others services positively affect revenue generation of the Onne port at 91.3% and 50.6% respectively.

The model equation is given as

$$Y_{\text{revenue generation}} = 61943092 + 1.386_{\text{pilotage service}} + 0.339_{\text{Others}} \quad (7)$$

which proves that additional unit increase in Pilotage services and other services will increase the revenue generation by 1.39 and 0.34 units respectively, when other variables are kept constant.

The iteration of pilotage services, other services and throughput fees are significant at 0.002, 0.006 and 0.045 respectively, which implies that pilotage services, others services and throughput fees have positive impacts on revenue generation of Onne port. The impact of pilotage service, other and throughput is rated at 104%, 48.2% and -21.5% respectively.

The model is given as:

$$Y_{\text{revenue generation}} = 98576584 + 1.585_{\text{pilotage service}} + 0.323_{\text{Others}} - 19.361_{\text{throughput fees}}; \quad (8)$$

which proves that additional units increase in Pilotage services, and other services will increase the revenue generation by 1.59 and 0.32 units respectively, while throughput affects the revenue generation by -1.936units for

every unit increase due to discounts given for every increase on throughput handled by the concessionaires at the private terminals.

The iteration of pilotage services, others services, throughput fees and lease fees are significant at 0.003, 0.006, 0.010 and 0.026 respectively, which implies that pilotage services, others services, throughput fees and lease fees impacts on revenue generation of Onne port. The impact of pilotage service, other and throughput is rated at 116%, 39.8%, -19.1% and -18.2% respectively.

The model is given as:

$$Y_{\text{revenue generation}} = 126518168 + 1.775_{\text{pilotage service}} + 0.266_{\text{Others}} - 17.209_{\text{throughput fees}} - 6.053_{\text{lease fees}} \quad (9)$$

which proves that unit increase in Pilotage services, and other services will increase the revenue generation by 1.78 and 0.266 units respectively, while throughput and lease fees affect the revenue generation negatively by -17.2 and -6.05 units respectively for every unit increase due to discounts given for every increase on throughput handled and lease of equipment by the concessionaires at the terminals.

Finally, each of the predictor variables shows significance; pilotage (0.033), Others (0.015), throughput (0.045) and Lease (0.026), which implies that all the variables are significant above 95% significance level and therefore have impacts on revenue generation of Onne port industry, however, as every other variable has positive effects on revenue generation, throughput and lease fees have a reverse effects on revenue generations as unit increase on throughput and lease fees reduces the revenue generation as results of considerable discounts given to port users on increase patronage on those services.

**Table 5. Coefficients<sup>a</sup>**

Model	Unstandardized Coefficients	Std. Error	Standardized Coefficients		95.0% Confidence Interval for B			
			Beta	T	Sig.	Lower Bound	Upper Bound	
1	(Constant)	110978181	40573713		2.73	.052	-1672506	223628870
	compulsory_pilotage	1.286	.403	.847	3.18	.033	.167	2.406
2	(Constant)	61943091	18170609		3.40	.042	4116102	119770080
	compulsory_pilotage	1.386	.153	.913	9.03	.003	.898	1.875
3	Others	.339	.068	.506	5.01	.015	.124	.555
	(Constant)	98576583	10392360		9.48	.011	53861864	143291303
4	compulsory_pilotage	1.585	.071	1.044	22.4	.002	1.281	1.889
	Others	.323	.025	.482	12.9	.006	.216	.429
4	Throughput_fee	-19.361	4.246	-.215	-4.56	.045	-37.630	-1.092
	(Constant)	126518168.4	1274165		99.2	.006	110328366	142707970
4	compulsory_pilotage	1.775	.009	1.169	204.	.003	1.665	1.885
	Others	.266	.003	.398	99.4	.006	.232	.300
4	Throughput_fee	-17.209	.257	-.191	-66.8	.010	-20.479	-13.940

Lease_due							
	-6.053	.244	-.182	24.77	.026	-9.158	-2.949
				4			

These findings agree with the work of Abubakar, et al., (2022) on appraisal of conservative service impacts on revenue generation of Nigerian ports industry, which considered three basic conservative services including pilotage, towage and berthing/mooring operations and the study concludes that the conservative services have significant impacts on port revenue generation in Nigerian ports. Also, the work of Edih, et al., (2023) on port operation's efficiency and revenue generation in global maritime trade: implications for national growth and development in Nigeria revealed that efficient port operations affect revenue generation in global maritime trade. Similarly, the study of Samuel and Tyokoso (2014) on Taxation and Revenue Generation: An Empirical Investigation of Selected States in Nigeria discovered that, taxation has a significant contribution on revenue generation and tax evasion and tax avoidance have a significant effect on revenue generation in Nigeria.

## 5. CONCLUSION

The study on the evaluation of compulsory regulatory port services and revenue generation at Onne Port, Nigeria, provides valuable insights into the factors influencing revenue generation within the port industry. The key findings highlighted a strong positive relationship between various compulsory regulatory services and the revenue generated at Onne Port. Specifically, pilotage services emerge as a significant contributor to revenue, emphasizing the importance of investing in and ensuring the prompt attendance of vessels by NPA-trained pilots. The results of hypotheses testing of the stepwise multiple regression analysis informs that the study hypotheses were rejected and alternatives accepted, inferring that the pilotage service fees have significant impact on revenue generation; the iteration of pilotage service fees and other fees have significant impact on revenue generation; the iteration of pilotage service fees, other fees and throughput fees have significant impact on revenue generation; the iteration of pilotage service fees, other fees, throughput fees and lease dues have no significant impact on revenue generation of Onne port.

The study's recommendation to invest more in pilotage services aligns with the observed impact of these services on revenue generation. Additionally, the emphasis on providing efficient services for vessels, including berth allocation, security, and maintenance, underscores the need for comprehensive measures to attract more vessels to the port. The study suggests that increased vessel calls can lead to higher revenue through various channels such as berth rent, ship dues, cargo dues, and other related fees.

Furthermore, the study identifies throughput and lease fees as contributors to revenue, but notes drop in revenue with increased patronage due to associated discounts. This finding emphasizes the need for strategic pricing and discount management to optimize revenue while accommodating increased throughput.

Overall, the study contributes valuable insights for port management, highlighting the significance of specific regulatory services and efficient operational practices in

enhancing revenue generation. The recommendations provide practical guidance for port authorities to focus on key areas that can positively impact revenue streams, ensuring sustained financial growth for Onne Port, Nigeria.

Based on the findings of the study, several recommendations are proposed to enhance the efficiency and revenue generation of the Onne port industry. First, it is recommended that the port invest more in pilotage services and ensure prompt attendance of vessels by NPA trained pilots in adherence to regulations. This will enhance safety and efficiency in vessel operations. Additionally, the port should focus on providing efficient services for calling vessels, including berth allocation, adequate security, maintenance, and dredging of port channels. By attracting more vessels to the port, it can significantly increase income through various sources such as berth rent, ship dues, cargo dues, and MOWCA charges. Furthermore, the study's contribution to knowledge lies in its use of stepwise regression analysis to predict the impacts of various variables, highlighting the significant role of pilotage services and other port services in revenue generation. Moreover, the study underscores the importance of understanding how revenues from throughput and lease may fluctuate with changes in patronage, suggesting potential adjustments in pricing strategies to optimize revenue generation.

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