BERTH OCCUPANCY RATE PERFORMANCE OF NIGERIAN EASTERN PORTS

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Abstract

The study analyzed the differences in berth occupancy rate among Nigerian Eastern Ports that includes Onne, Rivers, Calabar and Warri ports. Due to the under/over utilization of berthing spaces available at the Eastern Nigerian Ports over time, secondary data were obtained from the Nigerian Ports Authority (NPA) to help elicit information on the berth occupancy rates performance among the Nigeria Eastern Ports from 2018 to 2022. Descriptive analysis used in the study revealed that the berth occupancy rate differs among Nigerian Eastern ports, recording 10.5% for Delta port; 38.2% for Rivers port, 26% and 25.3% for Onne and Calabar ports respectively. A one-way Analysis of Variances (ANOVA) was used to test the differences in berth occupancy rates performance. Findings revealed that the berths are all under-utilized among the ports and also there is a statistically significant difference in berth occupancy rate among Nigeria Eastern seaports, with F value of 9.797 and P value at 0.001. The study concluded that Rivers recorded best berth utilization rate among the Nigerian Eastern Ports with 55.8% while Onne with 37.8%, Calabar 37% and Delta with 15.4% were under-utilized. It is recommended among others that West Africa Container Terminal (WACT) at Onne port should be provided with more berthing space to reduce congestion at the terminal by port management and also should provide the necessary means to dredge the ports channels, especially for Delta and Calabar ports, so that bigger vessels can navigate to the port so as to engage the berth.

Introduction

The efficiency of port operations is critical for the economic development of any nation, particularly for countries like Nigeria, where maritime trade plays a significant role in the economy. Berth occupancy rates in global shipping directly influence the seaport cargo storage areas depending on the size of the ship that approaches the seaport channels and the ability to handles higher number of ships at a particular period of time (United Nations Conference on Trade and Development, 2012). Berth occupancy rate (BOR) serves as a key performance indicator for port efficiency, reflecting the utilization of berths by vessels over a specific period. This study aims to analyze the berth occupancy rates across the Eastern ports of Nigeria, specifically focusing on Onne Port, Delta Port, Calabar Port, and Rivers Port from 2018 to 2022. The analysis

will provide insights into the operational performance of these ports and highlight trends that may inform future port management strategies.

Objective

To evaluate the differences in Berth Occupancy Rate among the Nigerian Eastern Ports.

Research Question

Is there any difference in Berth Occupancy Rate among the Nigerian Eastern Ports?

Research Hypothesis

H_{O1}: There is no statistically significant difference in Berth Occupancy Rate among the Nigerian Eastern Ports.

Literature Review

The concept of berth occupancy rate has been extensively studied in maritime logistics and port management literature. According to Notteboom and Winkelmans (2001), a high berth occupancy rate indicates efficient use of port facilities, while a low rate may suggest underutilization or operational inefficiencies. Previous studies have highlighted the importance of various factors influencing berth occupancy, including terminal operator performance, vessel traffic, and port infrastructure (Song & Yeo, 2004; Wang et al., 2018). In the context of Nigeria, the performance of ports has been a subject of concern due to infrastructural deficits and operational challenges (Adebayo & Oduyoye, 2019).

Berth occupancy rate has always been an important performance indicator of seaport to actualize a maximum utilization of berthing space for ships even in the 80s, which is the reason the study of Branch (1986) which reported that seaport terminal operating with low occupancy rate, using productive gang to handle ships operation at berth and effective cargo handling equipment that fit the type of ship available at berth and the cargo onboard for marshalling of cargoes within the transit shed and can contain more volume or cargo throughput without reducing operational port performance has a low measure of increasing berth occupancy rate. The rates of berth occupancy by ships at the seaport terminals determine the volume of transactional terminal operator performance within these seaports, in order to measure the performance indicators of the Nigeria seaports. Hart (2019), states it clearly that the seaport performance indicator is measure by the speed of cargo operations within terminal operators, that makes berth area planning very essential in achieving good operational performance, through the reduction of human errors, increasing the quality of service delivery and minimizing storage yard congestion to reduce the operational cost of cargo deliveries for the cargo owners.

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However, the study of Anagor (2015), explains the possible improvements of berthing space by the terminal operators in Nigeria since the concession era in 2006 will help in utilization of berth occupancy rate, resulting in Nigeria seaports increasing in ship traffic rate and cargo throughput, due to expanded cargo storage areas. The study of Victor, Olusegun, & Adebambo, (2016) describe the ability to improve and expand berth at the port terminals helps in the expansion of the ship transit shed side of the terminals as the measurement proved by the ability of providing a functional cargo handling gears to place cargoes where it ought to have been for security purposes at the quay side.

Meurn, and Sauerbier, (2004) in their studies, analyze that seaport are not financially supportive if the berths expansion is not actively involved to aid the effective and smooth berthing of ships alongside the quay. The studies revealed that seaport revenue could be tied down due to the slow nature of the activities within idle berth that is not fully utilized. Berth engagement at the port terminals bring more revenue to the seaports through dues pay to the port for the services of tugs and pilots as well as the mooring gang and other berth tariffs attached to such berth depending on the type of operation, but if berth aprons are not suitable for berth of ships at the port or port with limited berthing space, will leads to congestions of the ships at anchorage areas. UNCTAD (2018), responded that port operational performance is improving tremendously as well as positive growth in seaports key performance indicators as vessels are now built with high carrying capacities to cut transport cost, seaports are also trying to meet up larger vessels expectation by increasing their berthing space to contain any type of ship calling at berth especially larger vessels that can keep the berth busy, thereby encouraging good utilization of berth.

Many studies have been conducted recently on the need to expand; repair berths areas to reduce over utilization of berths at seaports. Okoroafor, (2020) opine in his study that, there are needs for Nigeria seaport terminal operators to adopt high key performance indicators when handling different types of cargo shipped to their berthing area. Cargoes like break bulk, unitized, liquid bulk and dry bulk cargoes storage should be monitored to ascertain the terminal competence level in ensuring that cargoes are not staying too long at the cargo storage areas. Mala et al., (2020) explained that berthing area is a part of port infrastructure that is basic on the measurement of port performance of berth occupancy rate, which is directly responsible for the efficient and effective maritime transportation in

determining the need to berth ship or remain at the channel or anchorage until cargoes are effectively evacuated from the berthing area to the storage area, especially in terms of a bigger vessels that have onboard much loaded cargoes. It helps in improving port performance in terms of cargo dwell time, as ships could only be called to berth for operation instead of waiting for unprofitable clearing the berthing area and thereby running out of lay days in terms of voyage or time chartered. Berth occupancy rate is also influence not only by the storage condition of the berthing facilities, but the size of the ships navigating channel, as some of the cargo owners tend to reduce shipment transportation cost in loading, unloading and scheduling processes.

The type of ship, determine the type of berth allocated and the type of berth allocation will also determine the handling facility requires of the cargo. The study of Olabisi, & Oluwole, (2013), opine that unavailability of wide berthing area influences the berthing of bigger size of ship that can result to increase in cargo throughput of port. It will not only improve the seaport performance but most importantly the revenue generation ability of the seaport as it will also give birth to high ship turnaround time and minimum numbers of cargo throughput as well as increase numbers of ship traffic rate in terms of GRT. Song et al., (2013) explained the needs to expand berthing areas to accommodate more ships, due to the increase in the invention of larger technological vessels in the shipping industry. The expansion of cargo storage areas will fast track berthing of ships, while the expansion of route channels will aid safe berthing and improve port performance. The study also defined yard storage area and berth occupancy relationship as the determinant factor that measure port operational performance in a most critical aspect of port operations management. This is because of the simulation model assigned for ships to berth, through the schedule of the yard productivity

Many factors contribute to the underutilization of berth occupancy rate among the Nigerian seaports. Such as the Lack of large cargo storage capacity, which does not only affect the seaport performance but most importantly the revenue generation ability of the seaport because the port terminal operators will only accommodate cargo that match the storage capacity of the seaport, thereby affecting the port productivity in terms of ship occupancy rate at terminal berthing space. The type of ship, determine the type of berth allocated and the type of berth allocation will also determine the handling facility requires of the cargo. Cargo storing capacity is an expensive project just as the construction of berthing space for

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ship. The possibility of berthing ship at a congested cargo storage area remains impossible, because of the possibility of hindering cargo operation.

Nigeria Port Authority (NPA 2022,) report showed Eastern port terminal operators' performances, in respect draft, which can be a factor to the variations in berth occupancy rates of these ports. The study listed draft performance of Rivers port recorded a channel draft of 5.0 meters for BUA berth 1; and 7.5m for berth 6 to 8 respectively. The berth draft of 6.0; 7.5 meters for PTOL berth 2 to 4. The channel draft recorded for the port is 11.0m, connecting from the anchorage to the port berth. Onne port channel draft recorded 13m from anchorage connectivity to berth and the berth depth of WACT was recorded at 12m for berth 1 and 2. INTELS FLT B recorded 8.5m, 10m and 10m for berth 1, berth 2 and berth 3. INTELS FOT A recorded 10m for berth 1 to berth 3 and 12m for berth 4 to berth 6. BRAWAL recorded 7.5m with only 1 berth as OMT recorded 11.5m for berth 1, berth 2 and berth 3. The channel drafts show 13m, connecting from the bonny anchorage to the port. It shows the channel draft of Delta port is 6.4m and the berth depth shows that JBN berth 1 is measure 5m, berth 2, 4m and berth 3 with 3.5m depth and berth 4, with 4m INTELS A analysis shows 6.6m; 5.8m; 5.9m; 6.0m; 6.5m and 6.3m for berth 6 berths. INTELS B analysis reveals 4.2m; 4.8m; 5.3m and 6m for 4 berths. AMS with 4 berths as reveals in the analysis of 5.7m; 5.5m; 4.2m and 5.1m respectively for 4 berths. Ocean & and cargo also with 1 berth of 5m as revealed by the report. It also revealed that the channel draft meter of Calabar port was recorded at 6.2m and the berth draft record shows 9m for Eco marine berth 1 to 4 and 9m for INTELS with 2 berth as well as 8m for Shoreline 2 berths.

This study seeks to fill the gap in literature by providing a detailed analysis of berth occupancy rates in Nigerian Eastern ports over a five-year period and by identifying the differences in berth occupancy rates of the four ports that form the Nigerian Eastern ports, as well as analyzing the terminal operator's individual performance, to determine which port is over utilized or underutilized, so as to established the policy or operational changes require to reduce the excessive occupancy that may lead to congestion or the underutilization of the port infrastructure at the berths. This research also covers the gap of other researchers by analyzing quarterly performance of the Nigerian Eastern port terminal operators, showing how each port and the terminal operator's performances within the quarters of 2018 to 2022.

Materials and Methods

The study area is the Nigeria Eastern Seaport that comprises of Onne port operating with West Africa Container Terminal (WACT), Integrated Logistics Services (INTELS), Brawal Oil Services Limited and Onne Multipurpose Terminal (OMT), Port Harcourt port with BUA and Ports and Terminal Operators Nigeria Limited (PTOL), Delta port with Julius Berger, Integrated Logistics Services (INTELS), Associated Maritime and Ocean & Cargo and Calabar Ports with Ecomarine terminals Limited, Integrated Logistics Services (INTELS) and Shoreline Logistics Nigeria Limited all situated at the south-south geopolitical zone of Nigeria.

Port Harcourt seaport was established in 1912 as the oldest seaport in the Eastern Ports, established in 1912 with up to 1300M^2 berthing line that can accommodate approximately 8 ocean going vessel at a time. The Onne Port is situated at Eleme LGA near the Bonny River; measuring 19km from Port Harcourt City L.G.A. Onne Port comprises three Local Government Areas of Rivers State, namely: Eleme LGA, Ogu-Bolo LGA and Bonny LGA. Onne port is a Hub and Logistics Centre for oil & gas sector; Centre for onshore and offshore activities with the total land area 2,538.175 hectares with two operational areas called Federal Lighter Terminal (FLT) with 4 berths, 2,022 metres quay length, 7.5 metre draft; Federal Ocean Terminal (FOT), operating with 11 berths 2,890 mtres quay length and 11.5 metres draft.

Warri port includes old port with 530,000 sqm and new port of 1,020,000 sqm with berthing draft of 8m depth also latitude and longitude 5°31'10"N and 5°42'26"E. Warri port was Established in 1979 to serve the logistics need of Imo, Anambra, Benue, Delta, Ondo, Edo, Kogi and Enugu states trading. Calabar seaport was established in 1979 and located in longitude 4°58'41"N and longitude 8°19'267"E in the Cross River State, with the distance of about 45 nautical miles from the fair way buoy to the upstream that requires dredging regularly to maintain safe passage for bigger ocean carriers, with the tidal variation of between +0.6 to +3.2m.

Research Design

This study employs a quantitative approach, utilizing secondary data collected from various terminal operators at the Eastern ports of Nigeria. The data spans five years (2018-2022) and includes berth occupancy rates for Onne Port, Delta Port, Calabar Port, and Rivers Port. The analysis involves calculating the average berth occupancy rates for each port and terminal operator, followed by a comparative analysis to identify trends and performance variations over the years. Statistical tools such

as descriptive statistics will be employed to summarize the data, while graphical representations will aid in visualizing trends.

Method of Data Analysis

The study employed the use descriptive statistics to treat the data extracted from the Nigerian Ports Authority. The descriptive statistics used was tested using the one-way analysis of variance (ANOVA) in testing the hypothesis. Nigeria Port Authority (NPA) data show the level of differences in berth occupancy rate among the Nigeria Eastern ports. Five years data were presented to assess the annual performances recorded from 2018, 2019, 2020, 2021 and 2022 respectively by comparing the berth occupancy rate port performance of Port Harcourt, Onne, Delta and Calabar ports.

Results and Discussions

To achieve the differences in berth occupancy rate among the Nigerian Eastern ports, data on berth occupancy rate from the four Eastern ports between 2018 and 2022 were sourced from the publications of Nigerian Port Authority (NPA) and used for the analysis.

Table 1: Onne Port Quarterly Berth Occupancy Rate Performance Assessment

Year	WACT	INTELS FOT 'A'	INTELS FLT 'B'	BRAWAL
2018	(%)	(%)	(%)	(%)
January - March	82.32	4.38	8.72	12.51
April – June	67.65	8.87	5.98	82.18
July - September	65.22	8.77	11.89	23.39
October - December	97.29	5.18	7.42	18.51
2019				
January - March	95.17	6.60	15.77	26.94
April – June	97.32	30.04	32.65	43.36
July - September	96.65	5.87	15.70	26.31
October - December	80.70	3.11	11.86	60.23
2020				
January - March	68.83	7.15	4.63	51.87
April – June	75.51	13.59	10.80	61.26
July - September	84.85	7.60	7.60	74.76
October - December	95.17	5.86	1.39	52.25
2021				
January - March	86.54	87.31	97.35	62.51
April – June	95.11	24.57	11.74	62.51

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July- September	93.93	38.13	7.17	60.54	
October-December	86.12	14.17	3.13	33.18	
2022					**OMT (%)**
January - March	26.46	5.06	7.61	26.46	17.61
April – June	33.82	17.81	6.88	50.69	14.61
July - September	37.30	14.97	2.24	31.90	20.95
October – December	86.12	14.17	3.13	33.18	26.67

Source: *NPA Reports, Monitoring and Regulatory (2018-2022)*

Table 2: ONNE PORT ANNUAL BERTH OCCUPANCY RATE

TERMINAL OPERATORS/ YEAR	2018	2019	2020	2021	2022
WACT	78.12	92.46	81.09	90.42	45.93
INTELS A	6.8	11.40	8.55	41.05	13
INTELS B	8.50	18.99	6.10	29.85	4.97
BRAWAL	34.14	39.21	60.04	54.68	33.56
OMT					19.96

Source: *NPA Reports, Monitoring and Regulatory (2018-2022)*

Table 1 shows average berth occupancy rate performance assessment of Onne port analysis for 2018. WACT operator recorded highest berth occupancy rate of 97.29% on the fourth quarters for 2018, which mean that WACT berths were only idle for 2.71%, because the berths were always busy and occupied by ships. The analysis of WACT shows that there is a possibility of high port congestions because of the high BOR. BRAWAL on the also recorded a higher berth occupancy rate on the second quarter with 82.18%. The analysis shows that ships spend more days occupying WACT berth, followed by BRAWAL. Berthing occupancy rate of INTELS was recorded low and the best performing record for INTELS FOT A on the first quarters with 4.38%. The 2019 assessments of WACT also recorded a higher berth occupancy rate, followed by BRAWAL, INTELS FLT B and FOT A respectively as the highest BOR was recorded on the second quarter of WACT with 97.32% recorded and the least recorded by INTELS FOT A with 3.11% on the fourth period.

WACT recorded a higher BOR of 95.17% on the fourth quarters of 2020 and INTELS FLT B on the third quarter of 2020 recorded the low BOR of 1.39%. The analysis of 2020 shows that WACT has the highest BOR, followed by BRAWAL and INTELS FOT A and FLT B respectively. The analysis of 2021 shows that WACT recorded a higher BOR, followed by BRAWAL and the least was INTELS FLT B and FOT A respectively. INTELS FLT B on the

first quarter of 2021 recorded the highest BOR with 97.35% as well as the least on the fourth quarter with 3.13%. The BOR analysis 2022 shows that WACT recorded a higher BOR, followed by BRAWAL and the least was INTELS FLT B and FOT A respectively. 86.12% was recorded on the fourth quarter by WACT as the highest BOR and the least for INTELS FLT B with 3.13% on the fourth quarter. The implication of the terminal quarterly report, show that WACT berth were always over utilized, especially from 2018 to 2021 with higher berth occupancy rate of approximately 70%. In 2019 the terminal operator recorded the highest figure of 92.48%, followed by 90.42% in 2021, which could be link to the containerized nature of cargo handled by the terminal operator. BRAWAL on the other hand performed moderately among the Onne terminal operators, especially in 2021, and closely related in 2020. The report recorded the best BOR in the second quarter of 2022 with 50.69% as well as the first and fourth quarters of 2020 with 51.87% and 52.25% respectively. WACT performance indicated over utilization of berths compare to other terminal operators, while INTELS recorded underutilization of berthing spaces for both terminal 'A and B', except for the first quarter of 2019 that the berthing spaces were over utilized.

Table 2 shows that WACT recorded 78.12% in 2018; 92.46% in 2019; 81.09% in 2020; 90.42% in 2021 and 45.93% in 2022. INTELS A terminal recorded 6.8% in 2018; 11.40% in 2019; 8.55% in 2020; 41.05% in 2021 and 13% 2022. INTELS B terminal performances showed 8.50% in 2018; 18.99% in 2019; 6.10% in 2020 in 29.85% 2021 and 4.97% in 2022. BRAWAL also recorded 34.14% in 2018; 39.21% in 2019; 60.04% in 2020; 54.68% in 2021 and 33.56% in 2022. The report affirmed Okoroafor (2020) studies that, the type of cargo handling at the berth can determine the berth occupancy rate.

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Table 3: Delta Port Berth Occupancy Rate Performance Assessment

YEAR	JULIUS BERGER	INTELS 'A'	INTELS'B'	ASSOCIATED MARITIME	
2018	(%)	(%)	(%)	(%)	
January - March	4.62	-	-	5.80	
April – June	4.62	-	-	5.80	
July - September	4.62	-	-	5.80	
October - December	28.67	-	19.33	23.67	
2019					
January - March	-	-	-	-	
April – June	5.47	-	-	14.69	
July - September	-	-	4.09	-	
October - December	26.32	-	-	18.09	
2020					
January - March	14.82	-	-	14.82	
April – June	-	-	-	25.2	
July - September	21.49	-	-	24.99	
October - December	18.65	-	-	13.84	
2021					
January - March	25.90	-	25.30	18.95	
April – June	24.0	-	16.0	11.0	
July- September	18.65	-	14.86	13.84	
October-December	19.82	-	18	18.21	
2022					OCEAN & CARGO (%)
January – March	25.90	-	20.62	20.26	20.26
April – June	25.90	-	25.90	10.85	-
July - September	27.51	-	17.25	13.28	-
October – December	19.82	-	18.0	18.21	-

Source: *NPA Reports, Monitoring and Regulatory (2018-2022)*

Table 4: Delta Port Annual Berth Occupancy Rate

TERMINAL OPERATORS/ YEAR	2018	2019	2020	2021	2022
JULIUS BERGER	10.63	15.89	18.32	22.09	24.78
INTELS A	-	-	-	-	-
INTELS B	19.33	4.09		18.54	20.44
ASSOCIATED MARITIME	10	16.39	19.71	15.5	15.65
OCEAN & CARGO	-	-	-	-	20.26

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Source: *NPA Reports, Monitoring and Regulatory (2018-2022)*

Table 3 shows that Delta port berth occupancy rate (BOR) analysis of JBN recorded the highest berth usage on the fourth quarters with a record of 28.67%; 23.67 for AMS and 19.33 for INTELS. The least period of berth usage was recorded on the first quarter, second and third quarters with 4.62% and 5.80% for AMS. The record of 2019 shows that the performance of berth occupancy rate for JBN berth usage increased on the fourth quarter with a record of 26.32 as INTELS recorded the least usage with 4.09% on the third quarter. On the third quarter of 2020 JBN recorded the year most used berth occupancy with a percentage of 25.2 on the second and 24.99 on the third quarters, while AMS recorded on the third quarters with 21.49%, as the least berth occupancy rate was recorded by fourth and first quarters of AMS with 13.84% and 14.82% respectively. The analysis of 2021 shows that JBN berth occupancy rate was higher than INTELS B and AMS with first quarter recording 25.90%; 25.30% and 18.95% respectively. The least berth usage period was recorded on the second quarter with 11.0% for AMS. First and second quarters of JBN and the second quarter of INELS B recorded the highest berth occupancy rate of Delta port for 2022 with a rate of 25.90%. The least berth usage period was recorded on the second quarter with 10.85% for AMS.

Table 4 shows terminal operator's annual performance, Julius Berger recorded 10.63% in 2018; 15.89% in 2019; 18.32% in 2020; 22.09% in 2021 and 24.78% in 2022. INTELS Nig. Ltd recorded 19.33% in 2018; 4.09% in 2019; 18.54% in 2021; 20.44% in 2022. Associated Maritime Services (AMS) recorded 10% in 2018; 16.39% in 2019; 19.71% in 2020; 15.5% in 2021 and 15.65% in 2022. All the terminal operators' berths were underutilized, having recorded low BOR, as Julius Berger was recorded as the most performed terminal among the operators of Delta ports and 2022 records show the most active year for the por.

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Table 5: Calabar Port Berth Occupancy Rate Performance Assessment

YEAR	ECOMARINE (%)	INTELS (%)	SHORELINE (%)
2018			
January - March	38.92	-	63.72
April - June	27.04	-	41
July - September	39.07	-	37.98
October - December	33	-	25.37
2019			
January - March	18.72	-	15.33
April - June	40.8	-	36.7
July - September	16.69	-	21.05
October - December	26.0	20.04	15.19
2020			
January - March	49.86	32.68	5.36
April – June	39.99	32.68	5.44
July - September	31.44	-	-
October - December	49.39	-	53.60
2021			
January - March	70	-	56
April – June	70	-	56
July- September	65.01	-	51.09
October-December	65.01	-	49.90
2022			
January - March	95.15	61.83	51.18
April – June	95.15	61.83	51.18
July - September	94.43	53.84	24.71
October - December	65.01	-	49.90

Source: *NPA Reports, Monitoring and Regulatory (2018-2022)*

Table 6: Calabar Port Annual Berth Occupancy Rate

TERMINAL OPERATORS/ YEAR	2018	2019	2020	2021	2022
ECOMARINE	34.51	25.55	42.67	67.51	87.43
INTELS		20.04	32.68		59.17
SHORELINE	42.02	22.07	21.47	53.25	44.24

Source: *NPA Reports, Monitoring and Regulatory (2018-2022)*

The analysis of Table 5 shows that Calabar port recorded in the first quarter of 2018 BOR of 63.72 % for shoreline berth utilization followed by second quarter with 41%; Third quarter with

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37.98% and fourth quarter with the least of 25.37% berth occupancy rate of 2018, followed by Ecomarine second quarter with 27.04%; fourth quarters with 33%, on first and third quarters respectively with 38.92% and 39.07%.

The analysis of 2019 berth occupancy rate performance shows that Ecomarine recorded the busiest berth usage with 40.8% on the second quarter and Shoreline recorded the least occupancy on the fourth quarter with 15.19%. In order of BOR performance Ecomarine also on the fourth quarter recorded 26.0%; first quarter recorded 18.72; and 16.69 on the third quarter. The second quarter shoreline shows the most utilization of berth with 36.7% followed by the third quarters with 21.05%and the first quarter with 15.33%. INTELS also recorded on the fourth quarter 20.4%

The analysis of 2020 shows that Shoreline recorded the highest performance on the fourth quarter with 53.60% as well as the least with on first and second quarters with 5.36% and 5.44% respectively. INTELS on the first and second quarters recorded 32.68% and Ecomarine recorded on their order of performance, 49.86%; 49.39%; 39.99 and 31.44 for first, fourth, second and third quarters respectively.

The BOR analysis of 2021 shows busy berth occupancy for Ecomarine with 70% for first and second quarters and 65.01% for third and fourth quarters. Shoreline recorded 56% for first and second quarters, followed by 51.09% and 49.90% for third and fourth quarters.

The analysis of 2022 shows the order of BOR performance with 95.15 for Ecomarine first and second quarters and the third quarter with 94.43 and 65.01 for fourth quarters. INTELS follows with 61.83% for first and second quarters and third quarter with 53.84%. Shoreline recorded 51.18% for first and second quarters, fourth quarter with 49.90% and third quarter with 24.71%.

Table 6 performances show that Ecomarine recorded 34.51% in 2018; 25.55% in 2019; 42.67% in 2020; 67.51% in 2021 and 87.43% in 2022. INTELS recorded 20.04% in 2018; 32.68% in 2020; 59.17% 2022. Shoreline recorded 42.02% in 2018; 22.07% in 2019; 21.47% in 2020; 53.25% 2021 in 44.24% 2022. This affirm Notteboom and Winkelmans (2001) report, a high berth occupancy rate indicates efficient use of port facilities, while a low rate may suggest underutilization or operational inefficiencies.

Table 7: Port Harcourt Port Berth Occupancy Rate Performance Assessment

Year	PTOL Analysis (%)	BUA Analysis (%)
2018		
January - March	44.55	24.73
April – June	44.68	36.94
July - September	44.68	36.94
October - December	56.15	43.81
2019		
January - March	56.64	47
April – June	50.62	32.46
July - September	63.84	N/A
October - December	35.95	N/A
2020		
January - March	72.58	63.41
April – June	76.95	64.92
July - September	63.84	75.79
October - December	72.58	62.37
2021		
January - March	69.03	49.97
April – June	75.43	56.97
July- September	75.43	56.97
October-December	63.84	56.21
2022		
January – March	63.84	56.21
April – June	63.84	56.21
July - September	61.56	56.21
October - December	63.84	56.21

Source: *NPA Reports, Monitoring and Regulatory (2018-2022)*

Table 8: Rivers Port Annual Berth Occupancy Rate

TERMINAL OPERATORS/ YEAR	2018	2019	2020	2021	2022
PTOL	47.51	51.76	71.49	70.93	63.27
BUA	35.60	39.73	66.62	55.03	56.21

Source: *NPA Reports, Monitoring and Regulatory (2018-2022)*

Table 7 shows that PTOL performed better than the BUA terminal for 2018 assessment and 2019, over utilization of berth was recorded in 2020, 2021 and 2022. BUA on the other hand under-utilized berth in 2018 and performed better in the first quarter of 2019, although was

suspended from operation in the third and fourth quarters of 2019. In 2020 BUA over-utilized berth, but recorded moderate berth utilization for 2021 and 2022.

The annual performance of Rivers port in table 8 recorded PTOL: 47.51% in 2018, 51.76% in 2019, 71.49% in 2020, 70.93% in 2021 and 63.27% in 2022. BUA recorded 35.60% in 2018; 39.73% in 2019; 66.62% in 2020; 55.03% in 2021 and 56.21% in 2022

Annual Berth Occupancy Rate

Table 9 performances revealed total annual average berth occupancy rates of the Nigerian Eastern Ports. Showing that, Delta Port recorded 20.28% for 2022 as the highest BOR and 12.12% in 2019 as the least under the review period. Rivers Port recorded 69.06% in 2020 as the highest BOR and 41.57% in 2018 as the underperformed year. Onne Port complex assessment shows higher berth occupancy rate of 54% in 2021 and the least with the record of 23.88% in 2022. Calabar Port assessment shows the highest berth occupancy rate of 64.5% for 2022 and 22.55% in 2019 as the least performing year.

The port-to-port analysis comparison further showed that in 2018 Rivers port recorded the most utilized berth occupancy rate of 55.818%, followed by the Onne port with 37.85; and the most underutilized port was Delta Port with 15.408% in all the year under considerations, followed by Calabar port with 37.016%. Furthermore, Rivers port analysis in the rear under review showed that, Rivers port BOR is moderate (Not over/underutilized), among the Nigerian Eastern Ports. The overall best performance was recorded in the year 2019 for Rivers Port with BOR of 45.74%.

This affirms the report of NPA (2022), that the berth and channel draft of the Calabar and Delta Port are shallow. Also, Okoroafor (2020) studies that, the type of cargo handling at the berth can determine the berth occupancy rate.

Table 9: Annual Berth Occupancy Rate among Nigeria Eastern Ports

Name of Seaport	2018	2019	2020	2021	2022	AVR BOR
Delta Port Complex	13.41	12.12	12.67	18.56	20.28	**15.408**
Rivers Port Complex	41.57	45.74	69.06	62.98	59.74	**55.818**
Onne Port Complex	31.9	40.52	38.95	54	23.88	**37.85**
Calabar Port Complex	25.51	22.55	32.27	40.25	64.5	**37.016**
AVERAGE BOR	**28.0975**	**30.2325**	**38.2375**	**43.9475**	**42.1**	**36.523**

Source: *NPA Reports, Various Issues (2018 – 2022)*

Hypothesis

H_O: There is no statistically significant difference in berth occupancy rate among Nigeria Eastern seaports.

H_A: There is a statistically significant difference in berth occupancy rate among Nigeria Eastern seaports.

A one-way analysis of variance was conducted to evaluate the null hypothesis that there is no statistically significant difference in berth occupancy rate among Nigeria Eastern seaports (N = 20). The result of the descriptive analysis presented on Table 6 for the stated hypothesis three showed that the independent variable, port location had four groups: Delta Port Complex (M= 15.41, SD = 3.74, n = 5), Rivers Port Complex (M = 55.82, SD = 11.69, n = 5), Onne Port Complex (M = 37.85, SD = 11.18, n = 5) and Calabar Port Complex (M = 37.02, SD = 16.81, n = 5).

Table 10 indicates the assumption of homogeneity of variances that was tested and found tenable using Levene's Test, F (3, 16) = 1.85, p = .179. The significance value for the test of homogeneity of variance .179 is greater than 0.05, (i.e., 0.179 > 0.05), we have not violated the assumption.

Table 11 revealed that the ANOVA was significant, F (3, 16) = 9.797, p = 0.001, n^2 = .000. Thus, there is significant evidence to reject the null hypothesis and conclude that there is a statistically significant difference in the berth occupancy rate among Nigeria Eastern seaports. Furthermore, the actual difference in the mean scores between groups was quite big based on Cohen's (1988) conventions for interpreting effect size.

Table 10: Descriptive Analysis of Annual Berth Occupancy Rate among Nigeria Eastern Ports

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Delta Port Complex	5	15.4080	3.74069	1.67289	10.7633	20.0527	12.12	20.28
Rivers Port Complex	5	55.8180	11.68972	5.22780	41.3033	70.3327	41.57	69.06
Onne Port Complex	5	37.8500	11.17726	4.99862	23.9716	51.7284	23.88	54.00
Calabar Port Complex	5	37.0160	16.80779	7.51667	16.1464	57.8856	22.55	64.50
Total	20	36.5230	18.25697	4.08238	27.9785	45.0675	12.12	69.06

Source: *NPA Reports, Various Issues (2018 – 2022)*

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Table 10: Test of Homogeneity of Variances for Annual Berth Occupancy Rate

Levene Statistic	df1	df2	Sig.
1.846	3	16	.179

Source: *NPA Reports, Various Issues (2018 – 2022)*

Table 8: ANOVA for Berth Occupancy Rate

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	4100.721	3	1366.907	9.797	.001
Within Groups	2232.301	16	139.519		
Total	6333.022	19			

Source: *NPA Reports, Various Issues (2018 – 2022)*

Table 9 showed the Post Hoc comparisons to evaluate pair wise differences among group means were conducted with the use of Turkey HSD and LSD test since equal variances were tenable. Tests revealed significant pair wise differences between the mean scores of berth occupancy rate of Delta port complex and Rivers port complex; Delta port complex and Onne port complex; and Delta port complex and Calabar port complex, $p < 0.05$. The mean scores of berth occupancy rate of Rivers port complex do not significantly differ from the other two groups that comprise Onne port complex and Calabar port complex, $p > 0.05$. Also, the mean scores of berth occupancy rate of Onne port complex do not significantly differ from that of Calabar port complex, $p > 0.05$.

The mean plots for the berth occupancy rate among the Nigeria Eastern ports were also presented in Figure 1. It indicates that Rivers port complex had the highest mean plot of 55.82 while Delta port complex had the lowest mean plot of 15.41.

Table 9: Post Hoc Tests for Berth Occupancy Rate

Multiple Comparisons							
Dependent Variable: Average Berth Occupancy							
	(I) Name of Port	(J) Name of Port	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	Delta Port Complex	Rivers Port Complex	-40.41000*	7.47044	.000	-61.7831	-19.0369

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		Onne Port Complex	-22.44200*	7.47044	.038	-43.8151	-1.0689
		Calabar Port Complex	-21.60800*	7.47044	.047	-42.9811	-.2349
	Rivers Port Complex	Delta Port Complex	40.41000*	7.47044	.000	19.0369	61.7831
		Onne Port Complex	17.96800	7.47044	.116	-3.4051	39.3411
		Calabar Port Complex	18.80200	7.47044	.095	-2.5711	40.1751
	Onne Port Complex	Delta Port Complex	22.44200*	7.47044	.038	1.0689	43.8151
		Rivers Port Complex	-17.96800	7.47044	.116	-39.3411	3.4051
		Calabar Port Complex	.83400	7.47044	.999	-20.5391	22.2071
	Calabar Port Complex	Delta Port Complex	21.60800*	7.47044	.047	.2349	42.9811
		Rivers Port Complex	-18.80200	7.47044	.095	-40.1751	2.5711
		Onne Port Complex	-.83400	7.47044	.999	-22.2071	20.5391
LSD	Delta Port Complex	Rivers Port Complex	-40.41000*	7.47044	.000	-56.2466	-24.5734
		Onne Port Complex	-22.44200*	7.47044	.008	-38.2786	-6.6054
		Calabar Port Complex	-21.60800*	7.47044	.011	-37.4446	-5.7714
	Rivers Port Complex	Delta Port Complex	40.41000*	7.47044	.000	24.5734	56.2466
		Onne Port Complex	17.96800*	7.47044	.029	2.1314	33.8046
		Calabar Port Complex	18.80200*	7.47044	.023	2.9654	34.6386
	Onne Port Complex	Delta Port Complex	22.44200*	7.47044	.008	6.6054	38.2786
		Rivers Port Complex	-17.96800*	7.47044	.029	-33.8046	-2.1314
		Calabar Port Complex	.83400	7.47044	.912	-15.0026	16.6706
	Calabar Port Complex	Delta Port Complex	21.60800*	7.47044	.011	5.7714	37.4446
		Rivers Port Complex	-18.80200*	7.47044	.023	-34.6386	-2.9654
		Onne Port Complex	-.83400	7.47044	.912	-16.6706	15.0026

*. The mean difference is significant at the 0.05 level.

Source: *NPA Reports, Various Issues (2018 – 2022)*

Means Plots

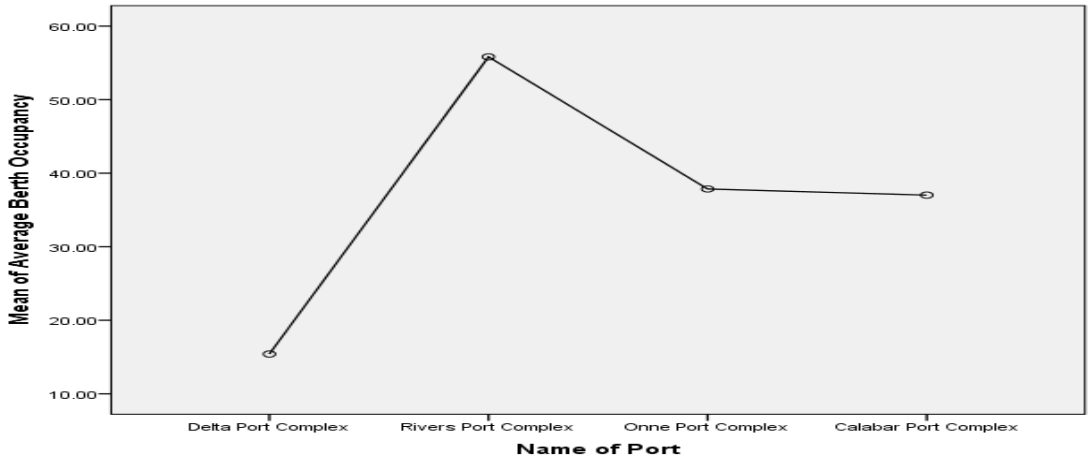

Figure 1: Means plots of berth occupancy rate among Nigeria Eastern ports

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Source: *NPA Reports, Various Issues (2018 – 2022)*

Conclusion / Recommendation

The berth occupancy rate performance among the Nigerian Eastern ports presents a mixed picture, with significant disparities in operational efficiency. While some ports, like Calabar, show promising trends, others, such as Delta Port, require strategic interventions to enhance their performance. The analysis of berth occupancy rates reveals significant variations among the Eastern ports of Nigeria. Onne Port, particularly through WACT, exhibited the highest occupancy rates in 2019, indicating optimal utilization of its facilities. However, a sharp decline in 2022 suggests potential operational challenges or reduced vessel traffic. In contrast, Calabar Port demonstrated a remarkable increase in berth occupancy rates, particularly in 2022, indicating improved operational efficiency and possibly enhanced infrastructure.

Delta Port's performance remains relatively low compared to other ports, with terminal operators showing inconsistent occupancy rates. This inconsistency may reflect underlying issues such as inadequate infrastructure or limited operational capacity. Rivers Port, while showing moderate occupancy rates, indicates a stable performance over the years, suggesting a balanced operational capacity among its terminal operators.

Onne Port should allocate more berthing space to West Africa Container Terminal (WACT) to enable the port improve in berth occupancy rate performance, since the terminal operator is the most over utilized terminal operator in berth occupancy rate among the Nigerian Eastern port operators. This study underscores the importance of continuous monitoring and evaluation of port operations to inform policy decisions and improve the overall efficiency of Nigeria's maritime sector.

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