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Pre and Post Concession Trend Analysis of the Operational Performance of Warri Port: 2000 to 2020 Era

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Abstract
The study analyzed the pre and post concession trend of the operational performance of the Warri Port between year 2000 and 2020. The targeted performance index was annual cargo throughput used in the assessment of the port's productivity for the two periods – pre-concession (2000 to 2005) and post concession (2006 to 2020) which marked ceding of port operations by the Government to private operators known as concessionaires. Two sets of research questions, objectives and hypotheses were formulated and tested with the use of moving averages of time series analytical tools. Annual Cargo Throughput was obtained from the Statistics Department of NPA Warri as secondary data. The analysis revealed that the concession actually had a positive effect on the productivity of the Warri port - the four-yearly pre-concession periods of 2000 to 2003 and 2004 to 2007 had 2,765,545 and 2,749,943.5 tonnes, respectively, while the four-year Average further declined to 2,389,847.5 tonnes in 2008. The concession then produced an astronomical growth from 6,366,055 tonnes in 2014 to 8,521,277 tonnes in 2020. Thus the 2 null hypotheses were rejected indicating that there was significant growth in cargo throughput which translated to increased productivity. It also shows that the port was more efficient in terms of infrastructural development and operational management. The study recommended curbing insecurity in and around the port to encourage importers' patronage; dredging the Escravos bar to allow passage for larger vessels to the port; and aggressive marketing aimed at reaching out to port users by participating in local and international maritime trade fairs to showcase the potentials and safe operating environment of the port.

Keywords: Concession, Operational Performance, Cargo Throughput, Productivity, Moving Average, Escravos Bar

1. Introduction

Maritime activities all over the world could be seen as a major lifeline of any coastal state. In many developing countries, the government owned, operated and financed the transport sector with the success and failure in the provision of such services largely dependent on government. This is rapidly changing with globalization and liberalization of national economies (Mai *et al* 2023) [10].

Increased commercialization and growth of international trade has led to considerable pressure on the operating environment of the existing port infrastructure. This enables the adoption of improved and more reliable strategies. Globalization has risen to usher in multinational corporations and alliances that have the strengths and technical know-how to operate and manage the world transport network. This has created a unique situation whereby countries which once closed their doors, are opening up their corridors for privatization and foreign investment (Kyove *et al* 2021) [9].

A port is established for reception of imports and exports of goods; thus, it is the flagship and gateway to a nation's economy. Obviously, without the port system, Nigeria's capacity to earn foreign exchange and her ability to import essential commodities would collapse. The concept of "no cargo no port" is very obvious here, as the presence and availability of cargo is a clear manifestation and affirmation of ports existence (Onikosi-Alliy *et al* 2023) [18].

Prior to 2006, Nigerian ports had been owned and operated by the government. The need to attract much fund for cargo handling expansion programme led to the issue of private operators coming in to boost efficiency and productivity in what become known as 'Concessioning'. According to Lee and Johnson (2012) [2], efficiency is the ability to deliver products or

services cost effectively without sacrificing quality. Ibe *et al* (2011) [8] posit that Productivity on the other hand means increase in product output using the same quantity of resources e.g., time, material, money etc. Operational performance of a port is determined by its level of efficiency and productivity. According to Ndikom *et al* (2019) [12], 'the relevance and efficiency of any port under concessioning process is based on the degree of cargo traffic that passes through it and concessioning is the process by which public assets of a state enterprise are entrusted for a limited period of time to a private operator, with the responsibility to manage them in good shape.

The structural and operational inefficiencies in the Nigerian Port System initiated the need for port reforms. Prior to the port reforms/concession agenda, Nigeria ports were over regulated which resulted in loss of cargo and traffic and diversion of shippers to the neighboring countries like Cotonou. (Ndikom, 2006). In the same vein, Obadan, (2000) [15] stated that the twin-problems of mismanagement and corruption encountered by the state-owned corporations constituted the impetus for the privatization and commercialization of corporations in Nigeria.

Port congestion which is also a major problem was noticed in our ports in the early 1970's during the era of cement armada during which ships awaiting time to gain access to some Nigerian ports was over 100 days. It was very disturbing in Nigeria when ships were reported to have waited for 10 months or an average of 240 days especially at our premier ports in Lagos, Tin can port, Onne port, and Warri port as well as in other ports in Nigeria before gaining access to allocated berth. Such situation had led to bunching of vessels which was never good for ports productivity and competitiveness of ports (Ndikom 2006).

The government in a bid to finding a lasting solution to the problem, embarked on construction and expansion of new port facilities and later instituted a port decongestion committee which recommended the establishment of bonded warehouses and inland container deport alongside concession arrangement.

In the 2006 concession agreement, Warri port was handed over to four operators viz:

Table 1: Port Terminals and Operators in Warri Port

S. No	Operators	Terminals
1	Messrs' ocean & cargo Terminal Services	Terminal B, Old Port Warri
2	Messrs Julius Berger Nig Ltd	Old Port (Canal Berth) Warri
3	Messrs Associated Maritime Services	Terminal A, New Port Warri
4	Messrs Integrated Logistics (Intels) Nig. Ltd	New Port B

Source: NPA Statistics Office, Warri Port

The Warri port also controls operations from private jetties such as NNPC and other private jetties/tank farms which receive wet (petroleum) cargo that also makes up the total cargo throughput of the port.

The need to evaluate post-concession efficiency and productivity of the Warri port relative to the pre-concession era, is the focus of this study.

The aim therefore, is to assess port operational performance (productivity) in Warri port from pre-concession to post-concession era between year 2000 to 2020.

The specific objectives include the following:

1) To determine the difference between the cargo throughput of the pre and post concession periods.
2) To determine port productivity in post-concession period relative to pre- concession period in Warri Port Complex using cargo throughput index.

The research questions were:

1. What is the difference between the cargo throughput of the pre and post concession periods of the Warri port?
2. What is the extent of port productivity in post-concession period relative to pre-concession period in Warri Port?

1.1 Research Hypotheses

Two Null Hypotheses were formulated viz:

***H0*$_1$:** There is no significant difference between cargo throughputs in post concession period relative to pre concession period in Warri Port.

***H0*$_2$:** There is no significant difference between port productivity in post concession period relative to pre concession period in Warri Port using annual cargo throughput.

1.2 Literature Review

According to Emeghara (2008) [5] productivity is an extension of efficiency that is, the increase in output when input or cost of production remains constant. In other words, productivity is the ratio of output increase when input is steady. De Monie, (1987) [4] argued that port productivity should be measured with respect to: Duration of a ship's stay in port, quality of cargo-handling, and quality of service to inland transport vehicles.

Barid (2000) argued that port ownership has an inverted U-shaped effect on port operation efficiency because due to long-term payback and high capital cost in the port industry, an almost total dependence on the private sector will result in significantly delayed investments on the crucial operation of facilities and equipment. Estache *et al*. (2002) [7], on the other hand, based on analysis of the Malmquist Productivity Index (MPI), claimed that the reform of decentralization and privatization taken at Mexican ports has generated large short-term improvements in the average performance of the port industry. Njoku and Ibe (2021) [14] in their study of impact of Concession Regime on the Performance of Nigerian Seaports, tried to find out if the landlord port model adopted in 2006 is better than the service port model used since 1956. Employing the t-test statistic to analyze the general port performance using cargo throughput, turnaround time and berth occupancy ratio as variables, their analysis revealed that the pre concession era witnessed a fluctuation in cargo throughput while the post concession era recorded spectacular increase in throughput. Okere, C.C. (2022) [17] established a significant relationship between cargo handling equipment and Ports Performance in Nigeria and went on to recommend the deployment of modern cargo handling equipment as a step towards delivering efficient and timely port services. Somuyiwa and Ogundele (2015) [19] posited that handling plants and equipment in Nigerian Ports are either old, obsolete, malfunctioning, broken down or insufficient, with adverse effects on cargo handling operations, while Monday *et al* (2021) [11] argued that the variation in cargo throughput experienced over the last ten years in the Eastern Ports of Nigeria was as a result of

unfavorable government policies; such as high cost of shipment to Eastern Ports, inadequate berthing space, security threats, and choice of port for clearance by cargo owners. They also established a significant relationship between port infrastructure and cargo throughputs in Eastern Nigerian ports.

Somuyiwa, and Ogundele (2015) [19] in their study of the relationship between cargo handling equipment and port productivity in Tin Can Island Port, Apapa, Lagos, further postulated that because cargo handling equipment were few, unserviceable and obsolete, cargo throughput during the pre-reform period dropped considerably resulting to lack of patronage of the port and loss of foreign exchange earnings for the government. However, in the post – reform era, more equipment and latest cargo handling plants were procured and best global shipping practices have been put to use by concessionaires leading to improved productivity.

Chukwuma *et al* (2016) [3], in their study of the activities/policies of privatization and commercialization of public enterprises in Nigeria, opined that privatization is a good policy measure, which must be pursued with vigor, truth, sincerity, and transparencies, but privatization and commercialization in Nigeria could be a mirage unless institutional reforms take place. In the same vein Obed (2013) [16] also found a strong relationship between port privatization policy and port productivity and the revenue generated at the seaports which increased since the inception of port privatization policy in Nigeria. He further advocated for the need to make the ports more user friendly by putting in place strategies that will have positive impact in the operation of the ports.

2. Materials and Methods

The study employed secondary data as collected from existing documents/published materials like NPA annual reports, Hand Book, Abstract of Port Statistics, Seminar Papers on port productivity and Current Journals. Also reviews of some written past research works in the field of study were used. Statistical tables were prepared from the secondary data obtained from the sources which serve as meaningful valid data for study relative to the Warri Ports Complex.

The study made use of both qualitative and quantitative techniques to analyze the data collected and collated. The focus was on port productivity during pre-concession and post concession periods measured in the context of Cargo Throughput (CT) thus:

Port productivity = Total tonnage in post concession period relative to Total Tonnage pre concession period.

There is productivity if cargo throughput is higher during the post concession relative to the pre-concession period. i.e.

CTpre < CTpost

Where,

CTpre = Productivity pre concession period

CTpost = productivity post concession period

The optimization technique of time series as applied in its aspect of moving average was used to analyze the data. The modified moving average technique (MMAT) looks at productions or services rendered over a long period. It could also be used as a forecasting model to predict the future. The choice of time series as an analytical tool is obvious as it was used to establish the mathematical relationship between the pre concession and post concession periods. Also, the choice of modified moving averages was based on the need to understand the productivity situation over the two periods for comparison.

The model for modified moving average (MMAT) which is an aspect of Time Series Analysis (TSA) is thus:

$$F = \frac{3m_1 + 2m_2 + m_3}{6}$$

Where m_1 = latest year's info

m_2 = info from 2 years ago

m_3 = info from 3 years ago

The essence of the moving average is to enable the user draw a smooth curve from which projection or prediction could be made. A moving average helps in smoothening the up and down graph often visualized in time series analysis.

3. Results and Discussion

3.1 Results

Table 2: Cargo Throughput at Warri Port Complex (Pre and Post Concession)

1	2	3	4	5
Year	**Cargo Throughput (tonnes)**	**Four Years Averages**	**Four years Trend Moving Averages**	**Modified moving Average:** $F = \frac{3m_1 + 2m_2 + m_3}{6}$
2000	2,185,812	-	-	-
2001	2,860,808	-	-	-
2002	3,178,379	2,765,545	2765546	-
2003	2,837,183	-	2860800	2907094
2004	2,566,831	-	2956323	2954853
2005	3,242,898	2,749,943.5	2749944	2758873
2006	2,352,862	-	2624673	2949923
2007	2,336,100	-	2549297	2685202
2008	2,265327	2,389,847.5	2389848	2492820
2009	2,605,101	-	2544688	2303507
2010	2,972,223	-	2702685	2447010
2011	2,968,087	2,941,524	2941524	2732033
2012	3,220,686	-	4454539	2908968
2013	8,657,160	-	5676683	3095076
2014	7,860,797	6,366,055	6366055	5896823
2015	5,725,575	-	6988873	7352900
2016	5,711,960	-	6451907	6925913
2017	6,509,294	6,716,762	6716762	6074638
2018	8,920,217	-	8162101	6112896
2019	11,506,933	-	10148601	7581867
2020	13,657,959	8,521,277	8521277	9811755

Source: NPA (Warri Port Statistics Office/Author's Computation)

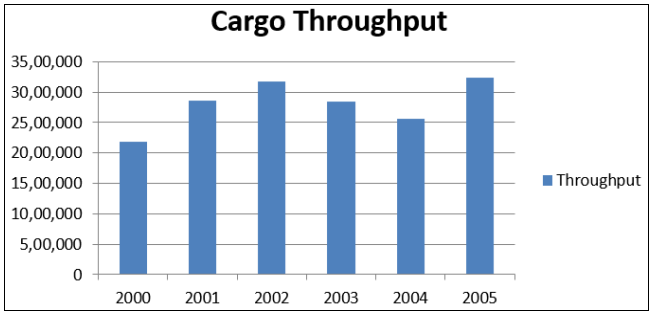
The cargo volume presented in table 2 includes the wet cargo such as petroleum products imported through the adjoining NNPC jetties which are controlled from the main Warri port.

In table 2, column 1 (one) represents the years or the period of the study 2000 to 2020. Column 2 (two) shows the cargo throughputs of Warri Port complex over the study period. Column 3 (three) represents the four years averages. During the pre-concession period, the output for the first period (2000 - 2003) four years period stood at 2,765,545 tons. In the next four years period 2004 – 2007, the output dropped slightly to 2,749,943.5 tons. The four-year Average further declined to 2,389,847.5 tons in 2008. As the concession took root, it rose to 2,941,524 in 2010 after which there was an

astronomical growth producing 6,366,055 in 2014; 6,716,762 in 2017 and 8,521,277 in 2020.

Productivity, as depicted in column 4 (Four years Trend Moving Averages), actually improved during the post-concession periods from 2006 to 2020, though it declined in the first concession four years in the port from 2006 to 2009, most probably due to hostilities caused by tribal wars between Itsekiri and Urhobo on the one hand and Itsekiri and Ijaw on the other hand. For instance, from 2010 to 2013, the cargo throughput or output performance of Warri port complex stood at 5,676,682.5 tons. The cargo throughput or the output for the consequent four years period of 2013 to 2016 stood at 6,451,906.5 tons while the four years period 2017 to 2020 stood at 10,148,600.75 tons.

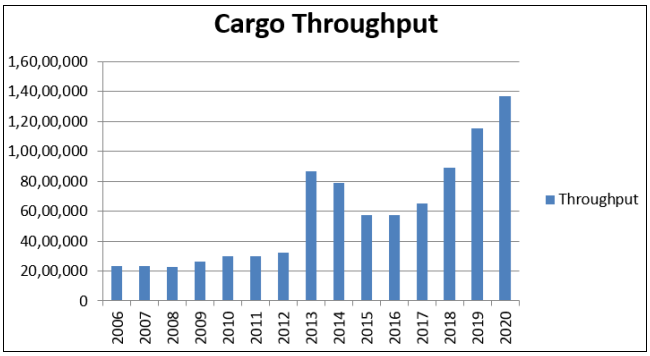
Figures 1 – 3 depict these trends from the pre-concession period (2000 to 2005) to the post concession period (2006 to 2020) and a combination of both periods.



Source: Table 2 – ref: NPA Warri Port Statistics Office/Author's Computation

Fig 1: Cargo Throughput, Warri, Pre-concession period 2000 to 2005

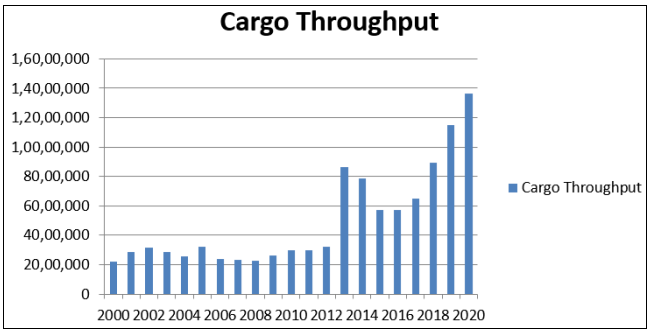
During pre- concession, cargo throughput rose moderately from 2.18 million in year 2000 to 3.24 million tonnes in 2005 with a middle peak of 3.18 in 2002 and a trough of 2.57 in 2004.



Source: Table 2 – ref: NPA Warri Port Statistics Office/Author's Computation

Fig 2: Cargo Throughput, Warri Port, Post-concession period 2006 to 2020

A weak rise from about 2.35 million in 2006 to 3.22 million in 2012 and then a sharp rise to 8.66 million in 2013 from where it dropped to 5.7 million in 2015 and 2016. Then a steady rise to a peak of 13.66 million in 2020.

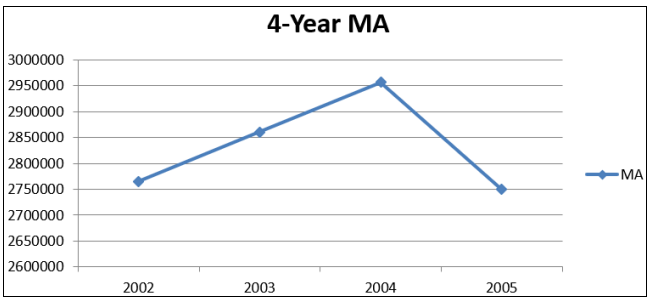


Source: Table 2 – ref: NPA Warri Port Statistics Office/Author's Computation

Fig 3: Cargo Throughput of Warri Port 2000 to 2020 (pre + post concession)

Fig 3 is a combination of both periods; from 2.18 (approx. 2.2) million in 2000 to 13.65 (approx. 13.7) million in 2020 with middle peaks and troughs in between.

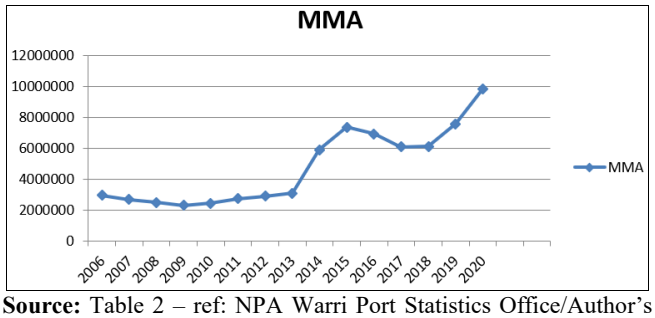
The Four years trend moving average (column 4) was applied as a smoothening technique to establish a trend relative to the time series, while the Modified Moving Average (Column 5) was used to strengthen the smooth curve for forecasting purpose. These trends are depicted in figures 4 – 6 showing pre-concession, post-concession and a combination of both periods using cargo throughput.



Source: Table 2 – ref: NPA Warri Port Statistics Office/Author's Computation

Fig 4: Trend Pre-Concession Period using 4-Year Moving Average 2000 – 2005

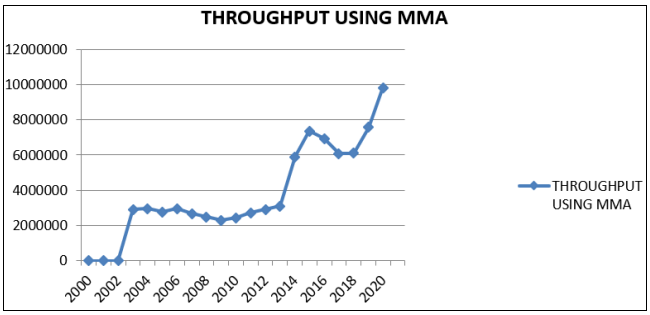
A cumulative rise from year 2002 to a peak in 2004 and a drop to an ebb in 2005 as shown in column 4 of table 2 (4 years Moving Average).



Source: Table 2 – ref: NPA Warri Port Statistics Office/Author's Computation

Fig 5: Trend Post-Concession Period using Modified Moving Average 2006 – 2020

This is consistent with the steady rise of cargo throughput in the post-concession period (2006 – 2020) with middle peak and trough at 2015 and 2018 respectively.



Source: Table 2 – ref: NPA Warri Port Statistics Office/Author's Computation

Fig 6: Trend Cargo Throughput 2000 to 2020 using Modified Moving Average

Here, the Modified Moving Average calculation zeroed out year 2000 to 2002 and started with a cumulative at 2003 from where a it rose to a peak in 2020 with middle peak and trough at 2015 and 2017 respectively.

From the foregoing analyses, there was significant difference in cargo throughput volume between the two periods with post-concession period having higher volume. Thus the 2 null hypotheses were rejected, indicating that the concession produced a significant increase in productivity derived from increase in cargo throughput resulting from improved efficiency.

3.2 Discussion of Findings

The concession actually had a positive effect on the productivity of the Warri port as depicted in increased cargo throughput during the period. The first four-year pre-concession period (2000 - 2003) had 2,765,545 tonnes. The next four years period (2004 – 2007), dropped slightly to 2,749,943.5 tonnes while the four-year Average further declined to 2,389,847.5 tons in 2008. The concession produced an astronomical growth from 6,366,055 in 2014 to 8,521,277 in 2020. This corresponds with the findings of Njoku and Ibe (2021) [14] which states that the pre concession era of ports in Nigeria witnessed a fluctuation in cargo throughput while the post concession era recorded spectacular increase in throughput; and Somuyiwa, and Ogundele (2015) [19] that in the post – reform era more equipment and latest cargo handling plants were procured and best global shipping practices have been put to use by concessionaires leading to improved productivity.

Productivity actually improved during the post-concession periods from 2006 to 2020, though it declined in the first concession four years in the port from 2006 to 2009, most probably due to hostilities caused by tribal wars between Itsekiri and Urhobo on the one hand and Itsekiri and Ijaw on the other hand. The astronomical increase could also be attributed to the 4th Party Logistics of the Escravos Gas -To-Liquid (EGTL) Projected that was effectively handled through the port by Intels, one of the concessionaires, between 2008 and 2014 which also created enabling assurance of safety to the 'Southern Swamp Associated Gas Solutions (SSAGS)' Project executed by Saipem Contracting Company Limited for Shell Petroleum Development Company (SPDC) Limited between 2016 and 2019 (Eru, 2018) [6].

Though the study has highlighted increase in cargo throughput and productivity attributed to concession, the general utilization of the port, reflected in reduced operations leaves much to be desired. A physical tour of the port reveals gross underutilization of port infrastructure and idle berths which corresponds with the opinion of Chukwuma *et al* (2016) [3] that without institutional reforms, privatization and commercialization in Nigeria will be a mirage.

4. Conclusion and Recommendations

4.1 Conclusion

The study investigated port operational performance of the pre-concession and post-concession periods in Warri port complex spanning year 2000 to 2020 with concentration on port efficiency and productivity. Pre-concession was from 2000 to 2005 while post-concession was from 2006 to 2020. It is a reflection of Nigerian ports during the pre-concession and post concession periods using Warri Ports Complex as a study. The study relied heavily on secondary data as collected from the statistics department of Warri Ports Complex. The data analysis relied on a quantitative tool, using time series and modified moving averages as the analytical tool which helped in smoothening the line graph and creating a trend for better forecasting or prediction of the future port operations. This is to ascertain the performance of the port right from the time of public sector management and operation of the port to the present time of private port operators. The concessionaires (private operators) brought in more infrastructure, cargo handling equipment in both quality and quantity as well as management expertise which led to improved efficiency. The study concluded that there was significant difference in cargo throughput volume between the two periods with post-concession period having higher volume. Therefore, the concession produced a significant increase in both cargo throughput translating to higher productivity derived from improved efficiency.

4.2 Recommendations

As stated under findings (section 3.2), a physical tour of the port reveals gross underutilization of port infrastructure and idle berths. Therefore, in order to further realize the benefits inherent in the concession arrangement, following recommendations were put forward:

1. The Government of Delta State should take steps to curb all forms of perceived insecurity in the port environment and Niger Delta creeks which seem to scare importers and ship owners from using the port. This is in line with the institutional reforms' opinion of Chukwuma *et al* (2016) [3] and Obed (2013) [16].
2. There is need to dredge the Escravos bar to allow passage of vessels with larger draughts to call Warri port to increase container import to the port.
3. The port's marketing unit should make concerted efforts to reach out to port users by participating in local and international maritime trade fairs and aggressive marketing to showcase the potentials and safe operating environment of the port.

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