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Infrastructure Financing and Management: The Impact of Concession on the Operations and Performance of Nigerian Seaports

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Abstract This paper study examined the effect of privatization on the performance of Nigerian seaports, using pre- and post-privatization data. A Mann-Whitney Wilcoxon (MWW) test was applied to data (secondary) on two major indices of port operation (average berth occupancy and average turn-around time). The result of the analysis showed that on average, the berth occupancy and turn-around time improved from 51.35% to 72.47% and 8.18 days to 4.83 days respectively. It was also found that at a 0.05 level of significance, the concession of Nigerian ports has significantly improved average berth occupancy and average turnaround time of the vessels calling at Nigerian ports. The study emphasises the need to provide enabling environment through the formulation and implementation of effective policies as a way of ensuring optimal performance of the concession model.

Keywords*: port concession, port operations, average berth occupancy, average turn-round time*

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1. Introduction

Maritime activities could be seen as a life wire of any developing economy. Shipping has become the most effective mode of transportation in the international exchange of goods. Transportation of bulk goods over a relatively long distance is most economically done by sea. This is further facilitated through advances in technology which has brought about more efficient, reliable and demand oriented transportation system. It is estimated that over 90% of global commerce is seaborne [1]. This reflects the level of dependency on shipping for the movement of goods generated in international trade transactions.

Port reforms are policy measures by government aimed at enhancing efficiency and productivity of ports by revitalizing and strengthening the operational and functional modalities at the ports [2]. Within the Nigerian context, ports reforms were with a view to making Nigerian ports both user and investor friendly, thus enhancing smooth operations at the ports.

The reform model chosen by the Nigerian government was port concession, whereby the government retains ownership the infrastructure, and contracts out the management and operation of the facilities to the private sector on competitive basis for a specified period of time. Bousquet and Fayard [3] note that a concession arrangement is one in which the government (or her agency) grants the right to fund, build, own, improve, upgrade, maintain or operate a public infrastructure, and charge users for the cost of services, for a limited period of time to a private sector operator. The official view about concession in Nigeria seems to be contained in the Infrastructure Concession Regulatory Commission Act (2005) where concession is described as:

> *a contractual arrangement whereby the project proponent or contractor undertakes the construction, including financing of any infrastructure, facility and the operation and maintenance thereof and shall include the supply of any equipment and machinery for any infrastructure and the provision of any services [4].*

With respect to port operations, concession refers to lease of port terminals and re-organization of stevedoring companies [5]. The contractual arrangement embodies service criteria and specifies the technical qualities and practices expected from the concessionaire. Perhaps, it is because of the stake that the government still has in the venture that motivates government to ensure that her policies are implemented both in technical and social terms as noted by [6].

The improvement of port efficiency or productivity seems to be the major motivation for port concessions in Nigeria. However, the level of achievement of this objective is yet to be determined. This paper therefore

seeks to establish the impact of the reform by analysing the major indices of port operations performance in the port. This impact would be established by:

a. examining of the impact of port concession on cargo average berth occupancy in Nigerian ports
b. analysing the impact of port concession on turnaround time of vessels calling at the ports, and
c. drawing inferences and making recommendations based on the research findings

This study examines only the impact of concession on two major indices of port operation (average berth occupancy and average turnaround time), from 1995-2012 in Nigerian ports. Attention has been drawn to the ways concession has improved the efficiency of services in the Nigerian ports, with recommendations capable of assisting in the actualization of the aims and objectives of the exercise.

Although several studies such as [7,8,9,10] had studied the concept of privatization and how its application in seaports has increased competiveness and efficiency, these have not been specific to Nigeria. This study will complement these existing studies by establishing the impact of privatization (port concession) on average berth occupancy and vessels turn-around time of Nigerian seaports.

2. Literature Review

2.1. The Concept of Privatization

Although the concept of privatization is an emotive ideological and controversial one that evokes sharp political reactions, its political origins, meaning and objectives are not ambiguous. Iheme [11] describes privatization as measures through which governments either exposes public enterprises to competition, or reduce the level of involvement of government by encouraging private sector ownership, control or management of public enterprises. However, in a strict sense, privatization means the transfer of the ownership (and all the incidence of ownership, including management) of the public enterprise to private investors. It is a shift from the public to the private sector ownership, and not a shift of ownership within sectors [12]. As such, the conversion of a state agency into an autonomous public authority or state owned enterprise (SOE) is not privatization, and neither is the conversion of a private non-profit organization into a profit, making form. An inference from [13] is that port privatization refers to steps (processes or even activities) taken in order to improve the commercial positioning of port operations, thus, leading to overall efficiency [9,14].

The high costs associated with business operations in Nigeria which discourages both local and foreign investors from establishing their business in Nigeria makes privatization even more appropriate in Nigeria. But, by introducing several measures aimed at minimizing the malaise in Nigeria's ports (e.g. the privatization of some publicly owned enterprises) the government seems to have risen to the challenges of creating a congenial business environment in Nigeria's seaports.

The rationale for the adoption of port privatization is that the creation of an enabling environment would ensure the development of Nigerian ports along global trends and standards (e.g. competitiveness, efficiency, and safety) would attract private capital for its development into industrial sites through targeted development plan. According to [15], concession arrangements are geared towards attracting investors, which in turn would lead to providing modern cargo handling plant and equipment, thus enhancing operational efficiency at the ports. Indeed, [16] observes that the transfers of port operations to private organizations Nigeria, brought about substantial level of improvement, increased investments in terminal infrastructure and cargo handling equipment, about 250% growth in cargo throughput over the last eight years, as well as a restoration of importers' confidence.

For privatization to take place, public enterprises which need to be converted into private enterprises must be in existence. There is the reasoning that private ownership or control or management would be better than public ownership. Privatization is premised on the fact that they are problem with public ownership or enterprises and privatization is part and parcel of a reform agenda to turn around these enterprises so that they can deliver goods and services more efficiently and effectively.

In Nigeria, the power to privatize SOEs is contained in the Privatization and Commercialization Act (1988)as well as the Bureau of Public Enterprises Act of (1993), wherein privatization was described as the relinquishment of part or all of the equity and other interests held by the Federal Government or any of its agencies in enterprises whether wholly or partly owned by the Federal Government.

2.2. Importance of Concessioning Schemes

Mundhe [17] notes that concessions are preferable in circumstances when public authorities are unable to maintain facilities procured with public fund. In Nigerian ports for instance, [18] observes that concession was employed as an efficiency and productivity improvement tool; first, in line with the views of [19], to instigate increased private sector participation, and secondly, to improve the operational and management capabilities of the ports [20]. Awam [6] posits that where concession is a chosen reform policy (irrespective of the options or models), the aim is to have an increased efficiency, productivity and management capability improvements; a reduction in the financial burden on the public sector and increased revenue generation; an enhanced service delivery for users as well as the derivation of good value for money from port services; a handover of specialized task of port management to the private sector, thereby reducing political exposure and ensuring a proactive approach to trade and globalization; a redistribution of wealth and other social objectives (e.g. curbing power and influence of labour unions and other monopolies involved in port operations); trade and business development for the region, country and port; a better risk and reward sharing between public and private sector; a stimulation of higher investment in the country, enhancing the role of entrepreneurs and the private sector; as well as better technology transfer and management skills development.

2.3. Port Concessionaires

There are number of seaports under the control of the Nigerian Ports Authority. Table 1 below shows the details (name, location, year of establishment, maximum berth depth, and quay length).

Table 1. Fundamentals Details about Nigerian Ports

S/N	PORTS	YEAR ESTABLISHED	LOCATION	MAXIMUM BERTH DEPT (meters)	QUAY LENGTH (meters)
1	Apapa Port	1992	Lagos	9.0	2459
2	Tin Can Island Port	1977	Lagos	11.5	204
3	RoRo port	1991	Lagos	11.5	705
4	Container Terminal	1984	Lagos	10.5	1005
5	Port Harcourt port	1913	Port Harcourt	7.8	1977
6	Delta Port	1979	Warri	11.5	2506
7	Calabar Port	1979	Calabar	11.0	1137
8	Federal Lighter Terminal Port	1982	Onne	5.7	1185

Source: Nigerian Ports Authority reports (various).

With a view to improving efficiency, the Government of the Federal Republic of Nigeria has approved the involvement of private sector participants in the operational activities of these ports as shown in the Appendix section.

3. Materials and Method

This study utilized secondary data collected from sources such as the annual reports of the Nigerian Ports Authority (NPA), abstract of ports statistics, seminar papers, journals, as well as maritime bulletins. Statistical tables were prepared from secondary data source which served as meaningful, valid and reliable data for the study.

The data used in this data may not satisfy the assumptions, such as that data must be drawn from a normally distributed population [21], needed in parametric analysis; therefore a non-parametric alternatives to t-test analysis, which does not make any assumptions about the data was used. The Mann-Whitney and Wilcoxon tests assess whether there is a statistically significant difference between the mean ranks of the two conditions [21]. According to [22], Mann-Whitney test is the non-parametric alternative to the t-test for independent samples, while the Wilcoxon test is designed for use with repeated measures. Mann-Whitney test is generally applied where there exists different participants in each condition, while the Wilcoxon test is used when there is the same or matched participants in both conditions [21]. In order to carry out the above tests, the following research questions (Section 3.1 below) and hypotheses (Section 3.2 below) were formulated.

3.1. Research Questions

i. To what extent has port concession affected the average berth occupancy of Nigerian ports?

ii. What is the impact of port concession on average turn-around time of vessels calling at the ports?

3.2. Hypothesis

The study is governed by the following formulated hypotheses.

1) H_0: Concession of Nigerian ports has no significant impact on the average berth occupancy of Nigerian ports

H_1: Concession of Nigerian ports has significantly increased the average berthoccupancy of Nigerian ports

2) H_0: The concession of the ports has no significant effect on the average turnaround time of vessels calling at Nigerian ports.

H_1: The concession of the ports has significantly improved the average turnaround time of vessels calling at Nigerian ports.

The null hypothesis is that the two samples are drawn from a single population, and therefore their distributions are equal. It requires the two samples to be independent and the observation to be ordinal or continuous measurements. In a less general formulation, the Wilcoxon-Mann-Whitney two-sample test may be thought of as testing the null hypothesis that the probability of an observation from one population exceeding an observation from the second population is 0.5. This formulation, $f_1(x) = f_2(x+\delta)$, requires the additional assumption that the distributions of the two populations are identical, except if there is possibly a shift.

An alternative interpretation is that the test assesses whether the Hodges-Lehman estimate of the difference in central tendency between populations is zero. The Hodges-Lehman estimate for a two-sample problem is the median of all possible differences between an observation in the first sample and an observation in the second sample. It is commonly thought that the MWW tests for differences in median, but this is not strictly true.The test involves the calculation of a statistic (U), whose distribution under the null hypothesis is known. In the case of small samples, the distribution is tabulated, but for small sample size above 20, there is a good approximation using the normal distribution. For large samples, a formula can be used.

All the observations are arranged into a single ranked series, without regard to the sample they are in. The ranks for observations which came from sample 1 are added. The sum of the ranks in sample 2 is also determined through calculation. Since the sum of all the ranks equals;

$$R_1 + R_2 = \frac{N(N+1)}{2}, \quad (1)$$

Where N is the total number of observations

Mann-Whitney statistics, U, is given by:

$$U_1 = n_1 n_2 + \frac{n_1(n_1+1)}{2} - R_1 \quad (2)$$

Or

$$U_2 = n_1 n_2 + \frac{n_2(n_2+1)}{2} - R_2 \quad (3)$$

Where n_1 and n_2 are the sample sizes for sample 1 and sample 2 respectively. R_1 and R_2 are the sum of the ranks in sample 1 and 2 respectively.

$$U_1 + U_2 = n_1 n_2 + \frac{n_1(n_1+1)}{2} - R_1 + n_1 n_2 + \frac{n_2(n_2+1)}{2} - R_2 \quad (4)$$

The sample distribution of U is symmetrical and has a mean (μ_u) and variance (δ^2_u).

However, if the elements of the samples to be considered are greater than 20, the U statistics could be converted to the Z statistics to make the computation reliable.

The approximated value of Z is given by:

$$Z = \frac{2R_1 - n_1(N+1)}{\sqrt{n_1 n_2 (N+1)/3}} \quad (5)$$

Or

$$Z = \frac{2R_2 - n_2(N+1)}{\sqrt{n_1 n_2 (N+1)/3}} \quad (6)$$

Where Z is the Z statistics value and N is the summation of the number of elements in the two samples.

4. Data Presentation and Analysis

4.1. Data Presentation

The data used for analysis is contained on Table 2 below. The data relate to number of vessels per year, the percentage average berth occupancy, the average daily turnaround time, grouped into pre- and post-concession periods

Table 2. Data presentation

YEAR	NUMBER OF VESSELS	AVERAGE BERTH OCCUPANCY (%)	AVERAGE TURNAROUND TIME (days)	GROUPING DUMMY
1995	3023	30.36	15.51	0
1996	3202	39.8	6.33	0
1997	3585	41.9	6.44	0
1998	3972	38.21	6.01	0
1999	3762	57.82	6.34	0
2000	4087	50.96	7.4	0
2001	4473	57.41	8.11	0
2002	4143	64.58	11.34	0
2003	4315	63.48	6.46	0
2004	4553	61.84	7.57	0
2005	4586	58.45	8.46	0
2006	4800	73.14	3.52	1
2007	4644	87.21	3.83	1
2008	4477	54.22	5.2	1
2009	4620	72.1	6.61	1
2010	4962	73.24	5.1	1
2011	5935	76.05	4.32	1
2012	4697	71.32	5.2	1
Total	**77836.00**	**1072.09**	**123.75**	**7.00**
General Average	**4324.22**	**59.56**	**6.88**	**0.39**
Pre-Concession Average	**3972.82**	**51.35**	**8.18**	**0.00**
Post-Concession Average	**4876.43**	**72.47**	**4.83**	**1.00**

Dummy Variable: Pre-concession = 0, Post-concession = 1

Source: Computed from NPA Abstract of Port Statistic and CBN Statistics.

4.2. Time Series Analysis of Data

Figure 1 below shows that the average berth occupancy peaked after concession and declined in 2007. It bounced back in 2009 and appeared stable throughout the period. The substantial decline in 2007 could be seen as a natural trend or pattern observable in relationships portraying changes in demand and supply capacities of goods and services.

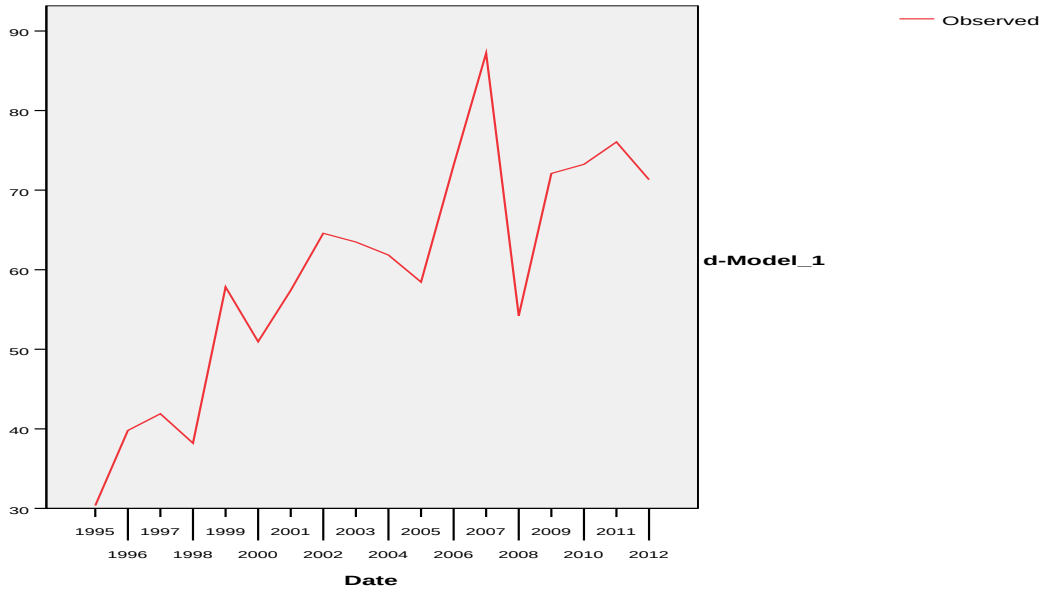

Figure 1. Time series model of average berth occupancy

From Figure 2 below, the average turnaround time declined from 2005 to 2009; getting to the lowest immediately the ports were privatized. It increased marginally from 2007 to 2009 and dropped from 2009 to 2011. It remained essentially low throughout the period considered; and this is not an impressive result.

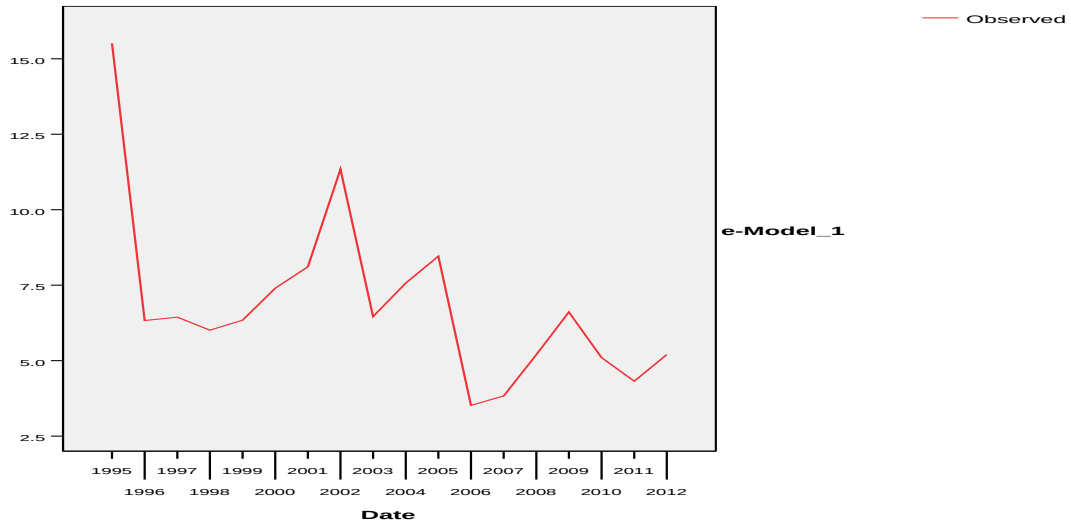

Figure 2. Time series model of average turnaround time

4.3. Non-parametric (NPr) Tests: Mann-Whitney Test

Table 2 and Table 3 below show the Mann-Whitney test ranks and Mann-Whitney test statistics respectively.

Table 2. Mann-Whitney Test Ranks

	Grouping Dummy	N	Mean Rank	Sum of Ranks
Average Berth Occupancy	0	11	6.55	72.00
	1	7	14.14	99.00
	Total	18		
Average Turnaround Time	0	11	12.55	138.00
	1	7	4.71	33.00
	Total	18		

Table 3. Mann-Whitney Test Statistics [b]

	Average Berth Occupancy	Average Turnaround Time
Mann-Whitney U	6.000	5.000
Wilcoxon W	72.000	33.000
Z	-2.943	-3.036
Asymp. Sig. (2-tailed)	.003	.002
Exact Sig. [2*(1-tailed Sig.)]	.002[a]	.001[a]

a Not corrected for ties.
b Grouping Variable: Grouping Dummy.

4.4. Discussion of Results

The result of the analysis presented above shall be discussed in relation to the hypothesis proposed in Section 3.2 above.

The first hypothesisproposed that:

H_0: Concession of Nigerian ports has no significant impact on the average berth occupancy of Nigerian ports

H_1: Concession of Nigerian ports has significantly increased the average berth occupancy of Nigerian ports

From the result of the analysis, the Z value of Mann-Whitney U-Test calculated for berth occupancy was -2.943, which is outside the acceptable range of the null hypothesis. The null hypothesis is therefore rejected on this basis. With a one-tailed p-value of 0.02 < 0.05, the alternative is accepted. **Hence, the concession of the ports has significantly increased the berth occupancy of Nigerian ports.**

In the second hypothesis, it was proposed that:

H_0: The concession of the ports has no significant effect on the average turnaround time of vessels calling at Nigerian ports.

H_1: The concession of the ports has significantly improved the average turnaround time of vessels calling at Nigerian ports.

The Mann-Whitney U-Test returned a Z value of -3.036 for the average turnaround time of vessels. Since this value is not within the acceptable range of Z, the null hypothesis is rejected. With a one-tailed p-value of 0.001 < 0.05, the alternative is accepted. **Hence, the concession of the ports has significantly improved the vessels' turnaround time of Nigerian ports.**

5. Summary of Findings, Recommendation and Conclusion

5.1. Summary of Findings

The section highlights the following important findings from the analysis carried out:

1. Concession as a form of privatization has indeed revolutionized Nigerian port system.
2. The concession of the ports has significantly increased the berth occupancy of Nigerian ports.
3. The concession of the ports has also significantly improved the vessels' turnaround time of Nigerian ports.
4. Concession has introduced the healthy competition being experienced in the Nigerian port system today. So administrative bottleneck and prohibitive costs have been drastically reduced in the ports.

5.2. Conclusion

This research has examined port operations and port concession to ascertain the impact of concession on port

operations. It has been shown through existing literature and analysis of available data that concession is a vital means of improving port performance, productivity, and competitiveness of Nigerian ports, and has made the ports more appealing to shipping companies, importers and the freight forwarders, which are the major port stakeholders (operators).

It could be concluded within reasonable limits of accuracy that ports concession impacts positively on ports operations, this serving as a boost to the economy through revenue generation, reduction in cost of importation, as well as in employment generation. However, it is acknowledged that the productivity of Nigerian ports could still be enhanced through a targeted formulation and implementation of effective improvement policies; the recommendations of this study would be a good starting point.

5.3. Recommendation

Based on the research findings, the following recommendations are made:

1. Government should create enabling environment for private sector participation by providing favourable policies and incentives.
2. For Nigerian ports to be user friendly, Government should encourage terminal operators to provide modern cargo handling plants and equipment that would enhance smooth operations at the ports.
3. There is equally a need to ensure that a vibrant training and re-training (skilling or up-skilling as the case may be) policy is put in place. And considering the contribution of Nigerian port to national development, it would be in the interest of Government to ensure the training and retraining of the maritime labour in line with the international practices.

5.4. Limitations

The concession started in 2006 and has only lasted for 7 years. Hence, the post-concession data was limited to only 7 years of operation. However, the non-parametric test deployed was adequate for analysis comprising data for only 7 years. In spite of this limitation, the result of the test is deemed reliable at 0.05 level of significance.

Also, the performance of the ports is not the general productivity that should take account of all the input and output factors. The performance here looks at only the ports operations performance. Hence, the basis for the analysis was the two major indices of efficiency in ports operations (average berth occupancy and vessels turn-around time)

5.5. Areas for Further Studies

There is a need to determine the impact of port concession on port traffic. The port traffic will involve the vessel traffic, cargo traffic (throughput) and container traffic.

Similarly, the research could be extended to determine the impact of port concession on the Nigerian economy. This will demand an investigation of ports productivity in terms of employment, revenue and cargo throughput on one hand and the gross domestic product (GDP) on the other hand.

Also, the investigation should be extended to the seaports of neighbouring nations. The Federal Airport Authority of Nigeria (FAAN), National Electric Power Authority (NEPA) and other public authorities and agencies that have been privatized should also be investigated to ascertain the impact of privatization on their operations.

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