Measurement of Efficiency Level in Nigerian Seaport after Reform Policy Implementation.
Case Study of Onne and Rivers Seaport, Nigeria.

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Abstract:*This paper focuses on the impact of reforms on port performance using Onne and Rivers ports as a reference point. It analyses the pre and post reform eras of the ports in terms of their performance. The reforms took effect from 1996 after the Federal Government of Nigeria concessioned the ports to private investors. Parameters such as Ship traffic, Cargo throughput, Ship turn round time, Berth Occupancy and personnel were used as variables for the assessment. Secondary Data were collected from the Nigerian Ports Authority and Integrated Logistic Services Nigeria (Intels) for the period 2001 to 2010 and analyzed using Data Envelopment Analysis to assess the efficiency of the port. Analysis revealed a continuous improvement in the overall efficiency of both Ports Since 2006 when the new measure was introduced. Average Ship turn-around time improved in the ports due to modern and fast cargo handling equipment and more cargo handling space which were provided. There is an increase in Ship traffic calling at the ports, resulting in increased cargo throughput and berth occupancy rate at ports of Onne and Rivers. The reform also led to more private investment in the ports' existing and new facilities and the introduction of a World Class service in port operation. This study concludes that the Ports of Onne and Rivers are performing better under the reform programme of the Federal Government of Nigeria. It finally recommends the urgent need for a regulator to appraise the performance of the reform programme from time to time as provided by the agreement and for the full adoption and utilization of management information system (MIS) to aid performance efficiency.*
Keywords:*Performance, Ports, Reforms, ship Traffic, Cargo throughput, Ship Turnaround time, Efficiency.*

I.   Introduction

1.1 Background Of Study

       Ports always play a strategic role in the development of domestic and international trade of a country whether it is a developing or developed country. However, in a globalized world where distances are becoming squeezed, ports play an active role in sustaining the economic growth of a country.

       In the modern world of a fast growing technological era, ports are playing the role of an industry, not just passive actor in transportation but also in complete supply chain management. This is why it is said that "ports are more than piers" that is, more than just infrastructure or a complex infrastructure (Prakash, 2005).

       Today in any context and in any country, it is essential that ports provide efficient, adequate and competitive services. If they fail, ship-owners who find them too costly or too slow will go elsewhere. Hence if ports do not provide cost-effective services, imports will cost more for consumers and exports will not be competitive on world markets, national revenue will decline as well the standard of living of all people. Nigeria has a total of eleven ports and eight oil terminals organised in three zones of Western, Central and Eastern zones. The central zone with its headquarters in Warri and the Eastern zone with its headquarters in Port Harcourt are predominantly oil terminals, although Warri, Sample, Koko, Port Harcourt, Calabar and the Federal ocean terminal are important general cargoes. (Chioma, 2011).

       Ports not only a chain in transportation for inter-change, but they function as self-sustaining industry that is linked with domestic and international trade. At some places, ports also act as a foreign exchange earner not only in the form of transshipment or hub port but as part of supply chain management by providing logistics services to the industry. That is why a port needs to be treated as an industry. The management of a port should not only be concerned with the demand and supply of throughput but with institutional framework, application of technology, marketing strategy and ultimately economic impact of the development and implementation of projects or programmes (Prakash , 2005).

1.2 Statement of Research Problem

       Port technology have to change at a faster rate to commensurate with the pace of technological changes in shipping, for instance from handling of bulk palletized cargo to containerization. Ships and ports have never so technically advanced, never been so sophisticated, never been more immense, never carried/contained so much cargo, never been safer and never been as environmentally friendly as they are today. In order to support

the global and regional trade development, Nigerian ports have increasingly been under pressure to improve on efficiency and productivity by ensuring that port services are provided on an internationally competitive basis.

The performance of a port can be evaluated by observing both its utilization and the speed and reliability of movement of cargo; and services through the port (UNTAD, 2002). While there are a number of activities involved from entry to departure of a cargo into/out of the port, it is important to measure the performance of the ports or the total movement of cargo. This includes the throughput of the port, ship traffic, berth occupancy, ship turnaround time etc.

1.3 Objectives of Study
(a) To determine the impact of Port Reforms on the performance/efficiency of the port.
(b) To identify the pitfalls/constraints if any existing in the reform programme.
 ©To recommend solutions that will help to increase the productivity, operational efficiency.

1.4 Research Question.
(a) How has the Port Reform in Nigeria fared so far?
(b) Has the Port Reforms in Nigeria actually improved port productivity in the Seaports under study to a large extent?
(C) Has the Port Reform in Nigeria actually experienced any pitfall so far?
(D) What are the likely solutions and recommendations in order to achieve an effective and efficient Port system in Nigeria?

1.5 Research Hypothesis
H0: The general efficiency of Ports has not improved as a result of the reform

1.6   **Brief Description of Rivers Ports.**
A Rivers port as used in the research work comprises the Following;
(a) Port Harcourt Port
(b) Okirirka petroleum jetty
(c) Crude oil terminals of Bonny, Ima, Okwori, Obe,E.A Offshore, Erha, Brass, Okono, Bongaetc
(d) Other Jetties including Bitumen Delmar, Ibeto, Saipem, Kidney Island, Haastrup, Aker Base, Marine Base, Magcobar etc.

1.6.1 Port Harcourt Port (Hard Quay)
This is located at the capital of Rivers State and lies along the Bonny River, about 42miles (66Km) upstream from Gulf of Guinea in the South Western of the Niger Delta. It was founded in 1912 in an area traditionally inhabited by the Ijo people. It majorly served the export of coal from Enugu coalfield after the establishment of the rail link in 1916. Palm products, columbite and Tin from Jos, peanuts from the Northern states, and since 1958, petroleum products from fields in the eastern Niger Delta. It also served the industries in the region. The Port Harcourt port has a depth of about 7.8meters and quay length of about 1877meters. Port Harcourt was named after Lewis Viscount Harcourt, who was the Secretary of the State for the British Colonies.

1.6.2 ONNE PORT COMPLEX
Onne Port Complex is situated in the heart of Niger Delta, Nigeria's main Oil and Gas production area. It was created to supplement Port Harcourt's port capacity and traffic.TheOnne Oil and Gas free zone, located south of port Harcourt on Bonny River in Rivers State, was established by the Federal Government of Nigeria to provide an Oil Service Centre and Support Base to serve Nigerian onshore and offshore fields, whilst also providing easy access and duty-free distribution to the entire West African and Sub-Saharan oil and gas industry.TheOnne Oil and Gas free zone was established by Government Decree No.8, issued in the Official Gazette No. 12 on the 29th march, 1996 declaring an area of some 26square kilometers in Onne/Ikpokiri of Rivers state as dedicated "Oil and Gas Free Zone".

The port is made up of Federal Ocean Terminal (FOT) and Federal Lighter Terminal (FLT).

Federal Ocean Terminal (Fot)
Quay Length   ---------------------- 1,320 meters
Draft   ---------------------- 10 meters (low tide)
Industrial area ---------------------- 500,000 square meters
Warehouse   ---------------------- 46,000 square meters

1.6.2   Federal Lighter Terminal (Flt)
Quay Length   ------------------- 1,675 meters
Draft 1 & 2   ------------------- 8 meters (low tide)
Draft 3 & 4   ------------------- 10 meters (low tide)
Industrial area   ------------------- 400,000 square meters
Warehouse area ------------------- 33,000 square meters
Industrial area under development --- 900,000 square meters
It is important to note here that the West African Container Terminal (WACT) located at FOT Onne has a Container stacking area measuring about 165,000 square meters and berth length of 570 meters; managed and operated by Maersk Sea land.

II.   Review of Related Literature.

2.1 Early Port Performance In Nigeria
The activities of the Nigerian Ports were commercialized in 1992 under the name, "Nigerian Ports Plc". However, considering the fact that the government still wholly owns the company, it reverted to its former name, Nigerian Ports Authority in October 1996. This reversion is however, not in conflict with commercialization efforts and commitment to improved services.
Okorigba (2008) observed that the efficiency improved at the ports after the reforms of 2006, as cargo dwell time and turn round time of vessels reduced to an average of 2.45days as compared to an average of 6.85days and 10.43days before the reforms.
He equally found out that infrastructural modernization and equipment enhancement reduced delays of cargo discharge at the ports thus increasing efficiency of the ports.
Ehbenine (2009) opined that port concession is very viable in a national economy because of it's significance as a global tool for port development and unquantifiable gains to the economy, eliminating poor quality services and delays at the ports. He concluded that private operators would be more reasonable in their dealings to avoid government revocation of their license and unnecessary public reaction; freeing up of government funds for other priority developmental projects; attracts and uses foreign investment and technology and also port concessioning will expose the private sector concern for a more efficient service than government (NPA) in port service delivery.
Josiah (2008) in his study of Lagos port complex (port performance) noted the following as the contributing factors to low port performance at Nigerian ports: (a) poor services and poor cargo handling (b) documentation procedures characterized by long procedures (c) poor labour performance (d) queuing for berths problems and allocation (e) poor customs and port authority relationship (f) corruption and port pilfering and so on. Josiah (2008) concluded by suggesting the following.
(a)   The use of satisfactory port traffic flow arrangement and reviewing them very often for the arrival and departure of vessels.
(b)   Improvement of documentation process in terms of information reliability and spread of efficiency using ship arrival message (SAM), which is a linkage of port networks that allows port computers to interact with each other so that as a soon as a ship departs a port, the next ports of call are notified automatically through this network. The ships travel, arrival times, at these ports of call, the type, volume of cargo to be delivered at each port of call, as well as the names of the consignees, the shipping agents, ships and nationality of the ship. This makes preparation for ships arrival fast and easier. This works on the principle of Electronic Data Interchange (EDI).
(c)   Efficient berth allocation policy that considers ships length, size, draught, volume and type of cargo etc hence reduction in waiting time, idle time and improved turn round time of the vessel.
Emeghara (1992) noted that from 1975-76, ship congestions at the Nigerian seaports was not due to lack of berthing facilities, but due to the fact that the cargoes stacking areas were not relieved of traffic as early as they should be. He further argued that lack of adequate, efficient and cost effective transport linkages with the hinterlands of the ports poses operational problems which mitigate against capacity utilization. He concluded that the Nigerian ports are under-utilized considering berthing and cargo handling capacities available hence the poor performance of the ports.
Adebayo (2005) equally identified cumber some clearing, system as one of the problems of poor port performance in Nigeria as the cargo clearing system depends on manual paper and physical movement of document to and from various processing centers located within and outside the ports. He also identified the non availability of multimodal transport system or rather the utilization of trucks rather than rail transport for the movement of goods to and from the hinterlands to the ports. This is also bad in some ports whereby no provision is made for the parking of the trucks prior to loading and so on.
Emeghara (2008) in his study on the various delay causative factors influencing the high turnaround time of ships in Nigerian port, he identified the following:

(a) Corruption at all levels in the port.
(b) Lack of cargo handling equipments.
(c) Lack of skilled manpower among dockworkers.
(d) The channel depth or drafts of the entry channels.

However, the Onne and Rivers ports has drastically improved on the quantity and quality of cargo handling equipments since after the reforms and also on the other issues raised by the researcher in his study hence the performance currently. He also alleged low productivity of an average Nigeria dockworker as well as the private terminal operator slow training and retraining of the abundant unskilled dockworkers.

These trends have reduced since after the reforms of the ports as they were evident in the ports prior to the port concessioning.

2.2 Port Performance Measurement

Performance measurement plays an important role in the development of an organization. As a result, all ports, without exception, use a variety of methods to examine their performance. Performance can be defined as the "Capacity to produce positive results" that is, depending on the expectations(Ducruet, C. 2009).

Ports are essentially providers of service activities, in particular for vessel, cargo, and inland transport. As such, it is possible that a port may provide sound service to vessel operators on one hand and an unsatisfactory service to cargo or inland transport operators on the other. Hence, port performance cannot normally be accessed on the basis of a single value or measure, rather evaluations are made by comparing indicator values for a given port over time as well as across ports for a given time period (De Monie, 1987).

Despite the importance of port performance measurement, however, it is surprising to note that there are almost no standard methods that are accepted as applicable to every port for measurement of its performance (Cullinane, 2002). More surprisingly, it is even harder to find standard terminology to describe port production, with different container ports using different terms to describe port production. "Measurement will always have a natural tendency to be terminal-specific" (Robinson, 1999).

As reported by De Monie (1987), the measurement of port productivity has been greatly impeded by the following factors:
(a) The sheer number of parameters involved.
(b) The lack of up-to-date, factual and reliable data, collected in an accepted manner and available for dissemination.
(c) The absence of generally agreed and acceptable definition.
(d) The profound influence of local factors on the data obtained.
(e) The divergent interpretation given by various interests to identical results.

Port operations are increasingly specialized and processed in dedicated terminals but many flows of goods are still handled at general purpose berth; as in the case of Port Harcourt port and Onne ports.

For instance, both ports in reference handles General cargoes, bulk, containers, refined petroleum products, oil exploration equipments and so on; hence there is no homogeneity of products/terminals for comparison.

Depending on the case, port performance should be assessed for an homogenous set of berths or terminals. It is usually expressed as the average number of calls and the average flow-volume or weight of goods over a standard period of time, number of calls per berth and per year, volume or weight of cargo handled per hour, per call or per day, per gang or per crane or based on the new port performance indicators (PPI).

In addition, other criteria can be used to see how existing capacity and performance meet the requirements of
(a) the shipper or the ship owner: mainly average waiting time of ship, dwelling time of cargo and data related to quality (value).
(b) Port Authority/concessionaire: basically berth occupancy rate and global traffic and so on.

2.2.1 Performance Measurement Studies Using Dea

Data Envelopment Analysis (DEA) which is a non-parametric efficiency evaluation model based on mathematical programming theory which was developed byCharnes et al (1978). It is used in operations research and econometrics for multi-variant frontierestimation and ranking which can be used in calculating efficiency levels within a group oforganizations.

The concept of DEA is developed around the basic idea that efficiency of a DMU is determined by its ability to transform inputs into desired outputs. This concept of efficiency was adopted from engineering which defines efficiency of a machine/process as output /input = 1. In this approach, efficiency is always less than or equal to unity as some energy loss will always occur during transformation process.

In the last 10 years, measurement of port efficiency using Data Envelopment Analysis (DEA) and Stochastic Frontier Analysis (SFA) has been symbolic. For instance, Tongzon (2001) investigated port

efficiency of selected Australian ports and benchmarked them with other international ports based on DEA estimates. Lee et al. (2005) examined efficiency of ports in the Asia Pacific region applying Recursive DEA, while Cullinane and Wang (2006) studied the efficiency of European container ports by using DEA and Ablanedo-Rosas et al. (2010) evaluated the relative efficiency of 11 major Chinese ports using adopted version of DEA. Song and Yeo (2004) investigated the competitiveness and efficiency of container ports in China using the Analytic Hierarchy Process (AHP) framework. Pang (2006) analysed and evaluated 50 major ports in China by using DEA and dynamically evaluated their efficiency based on 3 years of consecutive data. A related study is developed by Zhou et al. (2008), who evaluated the comparative efficiency of Chinese third-party logistics providers by means of DEA. Roll and Hayuth (1993) were probably the first attempt to apply DEA to investigate the port efficiency.

However, their study was not truly involved with the real data analysis. Martinez-Budria et al. (1999) divided 26 ports into three groups: high-complexity ports, medium- complexity ports, and low complexity ports.

The results of Martinez-Budria et al. (1999) showed that the high-complexity ports were more efficient than the medium- and low complexity ports by using DEA–BCC (Banker et al., 1984). Others like Tongzon (2001) used DEA–CCR (Charnes et al., 1978) and DEA–additive variation models to measure the efficiency of selected Australian and other international ports. Valentine and Gray (2001) analyzed 31 out of 100 world's top container ports by using DEA–CCR. Park and De (2004) used a four-stage DEA to investigate the efficiency of the North American seaport Infrastructure productivity from 1984 to 1997. Di'az-Herna'ndez et al. (2008b) studied the cargo handling productivity in Spanish ports. Min and Park (2008) proposed a hybrid DEA-simulation model to evaluate the relative efficiency of major container terminals in South Korea. Wu and Lin (2008) performed an international comparison of logistic port operations with a focus on India. Ablanedo Rosas and Ruiz-Torres (2009) used DEA to evaluate the efficiency of cargo and cruise operations in major Mexican ports.

Some researchers have measured the impact of these reforms; a specific case is the relationship between privatization and the relative efficiency within the container port industry that has been studied by Estache et al. (2004), Tongzon and Heng (2005), Cullinane et al. (2005a), Pallis and Syriopoulos (2007).

Furthermore, after the reforms, ports' performance has been investigated based on financial factors such as Park and De (2004). While Ablanedo-Rosas et al (2010) used a financial ratio-based data envelopment analysis to examine the relative efficiency of 11 major Chinese ports. Pang (2006) analyzed 50 ports in Mainland China by using DEA and dynamically evaluated their efficiency based on 3 years of consecutive data. Danijela et al. (2011), evaluated efficiencies of River ports in Serbia using Window-based DEA the result showed variability and very low efficiency scores among the ports.

2.3 Operational Performance Indicators (Productivity).

Primary measures of vessel performance are the ship turn-round time and the tonnage handled per ship day in port.

2.3.1 Ship Turn Round Time

The ship turn-round time is the duration of the vessel's stay in port and is calculated from the time of arrival of the vessel to its departure as earlier explained in the tables.

As a productivity indicator, ship turn-round time is a function of the following:
(a) The volume of cargo
(b) The facilities available at the port for cargo handling
(c) The composition or nature of cargo.

Hence from the above, it's necessary that the port differentiate the basic ship-turn round time for the different vessels like tankers, bulk carriers, container vessels and general cargoes vessels in relation to the ports or berth allocated to them, as such is not fully considered in the ports of Onne and Rivers Ports, excepting those of crude oil terminals.

There is also the need to sub-divide these vessels into domestic trade, regional trade and ocean going vessels.

(A) Volume of Cargo

The tonnage handled per day or hour for a vessel in port is a more useful measure of a vessel performance based on the fact that a vessel's stay in port is influenced by the volume of cargo that it works.

(B) Cargo Handling Facilities

Also the cargo handling facilities or gang output/tonne/hour or the crane moves per hour is also relevant in determining the performance. These are the factor productivity indicators of the ports. The major ones are:

(a) Labour output: Labour/tonne/hour or gang/hr or tonne/berth/day or hour or ton/ship day etc. and
(b) Crane productivity relating to the number of cranes available and the moves they make per hour between the ship and shore and also if (TEU) loaded or empty.

The tonnage handled per ship day (hour) is a measure of the volume of cargo handled per unit of the time of the vessel in port hence productivity in port is generally measured in terms of tonnage of cargo handled per unit work station per hour. General cargo work station is the gang while container is the crane or hook.
Productivity is measured in terms of:
(a) Tonnes per gang hour for general cargo
(b) Tonnes per pump hour for liquid cargo while pump is the work station and
(c) TEUs per crane or hook hour.

The size of the gang is a material factor hence the larger the gang size, the greater its output.
In establishing the size of the gang, like in Onne and Rivers ports, it should be of note that they have separate stevedoring and wharf gangs while some ports operate an integrated gang that works on board vessels (stevedoring) as well as at the apron (wharfingering).

(C) The Composition Or Nature Of Cargo
The composition or nature of cargo and the size or quantity has an influence on the performance of the workstation or gang.
The large and more homogeneous the cargo the greater is the productivity.
As in the case of liquid cargoes, the temperature, viscously, distance etc influences the productivity or the output.

2.3.2 Cargo Dwell Time In Port
This is another port performance indicator based on importer/exporter point of view and it is basic as the only indicator of interests to them. A high cargo dwell time is generally an indication that all is not well with the port; cargo dwell time in Onne and Rivers ports is mostly attributed to the customs procedure, non-utilization of EDI (Electronic Data Interchange) and e-payments, etc. It should be equally noted here that the importance of dwell time obviously varies with the nature of cargo. These cargo dwell time problems must be addressed if Nigerian ports generally must attain the 48 hours cargo clearing time.

III. Methodology
The reforms took effect from 1996 after the Federal Government of Nigeria concessioned the ports to private investors. Parameters such as Ship traffic, Cargo throughput, Ship turn round time, Berth Occupancy and personnel were used as variables for the assessment. Secondary Data were collected from the Nigerian Ports Authority and Integrated Logistic Services Nigeria (Intels) for the period 2001 to 2010 and analyzed using Data Envelopment Analysis to assess the efficiency of the port.
The study made use of various statistical tools and techniques in analyzing the data collected for the period 2001 to 2010 (10 years) which overlaps the pre and post concession era of the ports in the study. These statistical tool include descriptive tools such as the percentage, frequency, tables and charts, The two-sample t Test was also used to test the difference between the sample means for the pre reform era and the post reform era to validate if there exists any statistically significant contribution of the reform policy and the **Data Envelopment Analysis (DEA) which** is a non-parametric efficiency evaluation model based on mathematical programming theory was utilized to check the relative efficiency levels of the seaport under study

3.1 DEA Applications to Seaport Efficiency Measurement
Data Envelopment Analysis (DEA) which is a non-parametric efficiency evaluation model based on mathematical programming theory which was developed byCharnes et al (1978). It is used in operations research and econometrics for multi-variant frontierestimation and ranking which can be used in calculating efficiency levels within a group oforganzations.
The concept of DEA is developed around the basic idea that efficiency of a DMU is determined by its ability to transform inputs into desired outputs. This concept of efficiency was adopted from engineering which defines efficiency of a machine/process as output /input = 1. In this approach, efficiency is always less than or equal to unity as some energy loss will always occur during transformation process.
From the study, one output and four inputs were utilized in the derivation of the efficiency level.
- Output- Cargo Throughput
- Input 1- Total Ships Traffic
- Input2- Berth Occupancy

- Input 3-Turn around Time
- Personnel Strength.

Data envelopment analysis (DEA), occasionally called the frontier analysis was first put forward by Charnes , Cooper and Rhodes in 1978. It is a linear programing model for evaluating the performance of administrative units . Example of such Decision Making Units (DMU) to which DEA has been applied to are Banks , mutual fund , hospitals , tax offices , defense offices etc. DEA can be applied to both profit and nonprofit making organisations. DEA can handle multiple imputs and outputs as opposed to other techniques such as regression and ratio analysis. The performance of a unit is evaluated by comparing its performance to the best performing units of the sample. The Best Units form the efficiency frontier . Hence, DEA is called a frontier Analysis. The aim of DEA is to quantify the distance of the effiency Unit from the frontier for every DMU. The measure of the efficiency unit is measured in terms of an efficiency score . After the evaluation of the relative efficiency of the present set of Units . The analysis show how inputs and output have to be changed in order to maximize the efficiency levels of the target Decision making Unit. (kumar, 2008).

The Basic Mathematical Formulation of DEA has the following form**:**

Maximize

Maximize

$$E_B = \left\{ \sum_{r-1}^{R} u_{rb} y_{rb} \right\} / \left\{ \sum_{i-1}^{I} v_{rb} x_{rb} \right\}$$

Subject to:

$$\left\{ \sum_{r-1}^{R} u_{rb} y_{rj} \right\} / \left\{ \sum_{i-1}^{I} v_{ib} x_{ij} \right\} \le 1, \forall i, j = 1, 2, \ldots, N$$

And u_{rb}, $v_{ib} >= c$ for all r, i (where r = 1,2,….,R and i = 1,2,…,N)
Where
Eb is the efficiency of any unit b;
y_{rj} is observed quantity of output r produced by unit j = 1,2,…,N
x_{ij} is observed quantity of input I used by unit j = 1,2,…..,N
u_{rb} is the weight (to be determined) given to output r by base unit b
v_{ib} is the weight (to be determined) given to input i by base unit b
c is a very small positive number.

IV. Data Analysis

This section focuses on the presentation, analysis and discussion of the data for the study. It assesses the performance of the ports of Onne and Rivers using such parameters like the Cargo throughput as the output, Ship Traffic, Berth Occupancy, Ship Turn round time and Personnel strength are used as the inputs.

The research problem in this study is the evaluation of the reform programme as to know how efficient it has performed. The data were collected from the Nigerian Ports Authority (NPA), the landlord operators of the ports in view.

4.1 Data Envelopment Analysis (Dea) Of the OnneAnd Rivers Port Efficiency Level From (2001-2010).

As earlier stated in section three above. The DEA analytical tool measures the efficiency of an organization and clearly points out the areas of inefficiencies. The concept of DEA is developed around the basic idea that efficiency of a Decision Making Unit (DMU) which in this study stands as the Pre and the Post concession eras are determined by itsability to transform inputs into desired outputs which from the study the inputs are the Ships call, the Berth Occupancy rate, Turnaround time and the Personnel Strength. All these input contribute to form the output which can be likened to a dependent variable which in the study is the Cargo throughput within the stated year under study. This concept of efficiency was adopted fromengineering which defines efficiency of a machine/process as output /input = 1. In this approach, efficiency is always less than or equal to unity as some energy loss will always occur duringtransformation process.

Table 4.1 Analysis of the Performance for Onne Port								
	Outputs	Inputs						
	1	1	2	3	4		DEA	
DMU	Throughput	Total Ship Traffic	Occupancy	Turnaround	Personnel strength		Focus	Efficiency
2001	9,056,487	3,412	44.44	3	375	1	2001	42%	1

2002	10,951,729	4,203	62.96	5	393	2	**2002**	41%	2
2003	12,032,149	3,978	74	1.87	392	3	**2003**	50%	3
2004	13,699,975	3,579	74	1.87	388	4	**2004**	72%	4
2005	13,818,843	3,585	71	1.82	361	5	**2005**	73%	5
2006	15,820,381	4,033	71	1.96	336	6	**2006**	77%	6
2007	21,558,925	4,311	70	2	217	7	**2007**	100%	7
2008	22,089,920	3,457	34	3	206	8	**2008**	100%	8
2009	17,180,233	3,828	36	3.42	202	9	**2009**	75%	9
2010	23,825,586	4,086	35	2.5	203	10	**2010**	100%	10
Include Factor:	1	1	1	1	1			
Trial Weights:	4.64128E-08	0.000168	0	0.1404624	0.0004822			

Source: DEA analysis using excel add in 2010.

V. Interpretation

The table above displays the result of the analysis run for the Onne& Rivers Seaport and the result clearly displays efficiently managed input variables (turnaround time, berth occupancy ship traffic and the personnel in order to bring about a level of efficiency in the cargo throughput. From the results a rising performance level as the year increased from the pre reform era to the period after the reform was observed. Note that the reform took place from 2006 in the Port Harcourt and the Onne ports and from the result it can be seen that the performance continually improved.

DMU	Throughput	Total Ship Traffic	Occupancy	Turnaround	Personnel strength		Focus	Efficiency	
2001	9,056,487	3,412	44.44	3	375	1	**2001**	42%	1
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Include Factor:		1	1	1	1	1			
Trial Weights:	4.64128E-08	0.000168	0	0.1404624	0.0004822			

Source: DEA analysis using excel add in 2010.

4.2 1 Dea Comparative Analysis Of Performance Of Onne& Port Harcourt Port.
A comparative analysis was carried out here to determine the performance of the Onne Port and the Rivers Port.

Fig 1.0comparative **Analysis of Performance of Onne& Port Harcourt Port.**
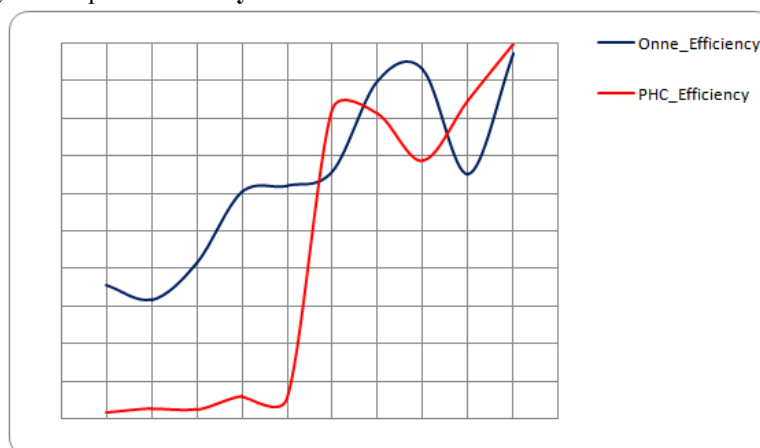
Source: DEA Comparative Analysis, 2013.

As stated   earlier in the introductory note on DEA as an analytical tool for measuring efficiency in an organization. The efficiency level ranges from zero to one (1) and the closer the value to one also indicates a better efficiency with unity (1) as the maximum efficiency. Obviously, it can be seen from the comparative analysis of both ports that the efficiency was initially low but there was an improvement to it.

5.1 Result
From the analysis above, it can be deduced thatone port has better performances over the past 10 years than that of Port Harcourt port. But for the reform in 2006, Rivers Port made giant strides that superseded the performances of Onne port. Also, both ports are very close substitutes in both ship traffic and efficiency. This can be observed from the relationship shown above fig 4.1 (graph) above that a drop in one port results in an increase in the other (inverse relationship) and reformimplemented in 2005 made positive improvements to the efficiency of both ports.

5.2 Conclusion
The study found that reforms have been beneficial to the ports and the economy as there is an observed improved cargo throughput at One and Rivers ports,Berth Occupancy rate dropped at Onne and Rivers Ports, Fast vessel and cargo turn round time due to more and modern cargo handling equipment, Increase inship traffic and ship size too and an overall Improved port efficiency;

5.3. Recommendation.
• There is a need for a Regulator:
The concession agreement made provision for an appraisal for the reform operation but there is non-implementation of such as contained in the agreement. There is also the problem of arbitrary increase in charges by the shipping companies hence there is an urgent need for a regulator to check the excesses of the shipping companies. The terminal operators ought to always publish its rates, charges and the conditions.
• Reduction in Government Agencies:
The too many government agencies in our ports has resulted to high cost of doing business at Nigerian ports hence loss of revenue to both Government and Concessionaires.
• Full Utilization of e-payment system: The use of e-payment will go a long way in reducing cash gratification and delays thereby realizing the 48hours cargo clearance.
• Stoppage of siting of Oil Depots (Tank Farms) in the port Areas:
The siting of oil depots (Tank Farms) in the port areas is not in line with World standard. It occupies most land spaces for port expansion, creates vehicular traffic to the ports and its fire attendant risk is better not experienced because of the volatility of the oil products stored in the tanks. The Department of Petroleum Resources (DPR) and the Federal Government of Nigeria should reverse this trend in our ports for safety reasons.

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