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Evaluation of the Impact of Security Threats on Operational Efficiency of the Nigerian Port Authority (NPA)

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Abstract

This research work addressed the security problem arising from the day-to-day activities of the Nigerian Port Authority and analyzed the impact this have on the overall efficiency.

The secondary source of data obtained from documented facts was used extensively for this study. The documented records was extracted and compiled from the annual financial reports of the Nigeria Port Authority, for a period of four years. And method of data analysis employed were moving averages, graphical representations, quantitative description (using operation efficiency model), and the statistical t-test of hypothesis.

The operational efficiencies were estimated over a period of 2009, 2010, 2011 and 2012 with corresponding calculated values of 20.04%, 37.39%, 37.29% and 12.20% respectively. This trend shows a dramatic increase which later plummeted in 2012. The relationship between the operational efficiency and security is therefore of inverse proportionality. This means that a surge in the security challenge will adversely affect the efficiency in operations, thereby reducing the IGR (Internally Generated Revenue).

From the statistical test of hypothesis estimated, it is apparent that the null hypotheses are to be rejected. The study therefore concluded that the security measures improvement have significant impact on the overall operational efficiency of a container ports. This is noticeable in the trend line generated by the Microsoft excel 2013®.

Keywords: Security; Operation; Efficiency; Nigerian Port Authority

Introduction

The most easiest and cheapest of all modes of cargo transportation is the shipping mode and this is due to its ability to handle cargo of large volume which is almost four times the capacity that rail and air transportation could carry [1]. Maritime transport therefore remains the most important form of international transport in terms of trade enhancement when compared to other form of transportation. The Containerization of this cargo is the process of using a standard box known as containers to transfer these goods from ship to the yard. This involves the use of powerful cranes, berths, tractors, trailers, and straddle carriers.

Steenken et al. [2] stressed the importance of container terminals being able to guarantee a speedy operation to reduce delay in goods organization, planning and control strategies employed. Among these are the strategies to be employed on securing the port and delivery to the ships, trains, and trucks and consequently reducing the transportation time. These operations are not without its security challenges and the efficiency of a given terminal therefore primarily depends on the internal security. Due to the expensive nature of securing container-port facilities, it is therefore desirable for the port administrators to make better decision in order to optimize their performance and thereby increasing the productivity of the terminal by minimizing the cost and time of operation.

This study is therefore to address the security challenges faced in the day-to-day operation of a container-port and the impact this has on the overall efficiency of its administration.

Every day, more than two million commercial container shipments move in the seas, and security plays a vital role in ensuring the fluidity of trade and commerce through cargo shipping. Maintaining or upgrading seaport security therefore requires a combined effort of video surveillance, access control, perimeter detection, management software, building technologies, and proper people and processes [3].

This research work focuses on the security challenge and its effects on the overall operational efficiency of the container-port. The need then arise to study and evaluate how the changing security policies affects the ports performance in terms of time and cost expended on the import and export of goods. Consequently, a security system for a seaport requires a great deal of flexibility and adaptability to function properly. Although security is always of paramount importance, a seaport is first and foremost a commercial enterprise, and interruption in the free flow of cargo and equipment has material and expensive ramifications. It is now of great necessity to critically access the security policies in place and recommend the best way to reduce the operational cost and time expended on security in order to improve the demand for shipping and make it more attractive to the importers, exporters and the cargo carriers. This research work is limited within the spectrum of a container-port only with the view to address the security challenges facing the day-to-day running of the port and to analyze the impact this have on the overall efficiency of port establishment.

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Literature Review

Preamble

The revolutionary development of container handling has increased the efficiency of worldwide trade (by about 9.5% per year) in the last thirty years and will continue to do so at an 8% growth rate in the coming years [2]. An increasing demand for container transportation therefore results in various issues, including risk of terminal congestion, delivery delay, and economic loss.

The main role of a container terminal major is the transfer and storage of containers. In a container terminal, it is important to guarantee fast operations to reduce delays in delivering goods to ships, trains and trucks, and consequently, to reduce sea, and road or rail transport time. Therefore, container terminals have a fundamental role in the interchange between roads, railway and sea networks, and therefore they are usually equipped with modern equipment, advanced transport systems and up-to-date information and communication technologies. In this context, the efficiency of a given terminal depends on its internal organization according to its planning and control strategies [4].

Basic operations in a container-port

The general overview of operations in a container terminal was described by Pesenti et al. [5] and the main operations of a typical container port classified into seven basic operations which include the following:

- Manoeuvring of ships between anchorage areas and berths;
- Berthing and de-berthing of ships;
- Positioning of cranes alongside ships;
- Loading and unloading of containers;
- Moving containers between the berth and the yard;
- Configuring and operating the yard;
- Moving containers between the yard and the gate.

The complexity of operation in a container port makes the matter of security issue encompassing more than the physical protection of facilities alone. But on a broader note, it addresses the control of some basic operation to obtain a high degree of efficiency, and these may include traffic control, personnel and cargo inspection and overall protection of the territorial waters. The major challenge is the integration of these interwoven operations and provision of easy interactions between these operations [6].

Factors affecting port operations and efficiency

In a world faced with the challenges of growing competition and globalization, the way a port industry could meet the customer's desire is by ensuring satisfactory service delivery. A port could only continue to be relevant to customers if it operates with minimum delay, utmost efficiency and at a reasonable cost to users. There are so many factors militating against an efficient running of ports operations.

Uzanya [7] Opined that the presence of so many government agencies in the port, all performing the same duty of physical examination of cargo causes delay in cargo clearances as well as high cost of doing business in Nigerian ports. According to him these illegal government agencies engage in money extortions from clearing agents and shippers thereby escalating the cost of clearing goods in the port. He compared the delay witnessed in clearing goods in both Cotonou and Lagos ports as three days in Cotonou as against seven days or more in Lagos port. Uzanya [7] Concludes that no amount of patriotism could make a shipper abandon a port where he could obtain quicker and cheaper services for where he would waste time, hence, the preference of Cotonou port to Lagos port by Nigerian shippers. According to U.S Department of Transportation [8], corruption is the greatest headache the ports in Nigeria have to tackle in order to remain relevant to the economic growth. This situation can only be achieved under an atmosphere of transparency, accountability and commitment to universal accepted ethical standard which will lead to universally accepted operational standard in terms of port costs and operational delay in the ports. He listed the following as reasons why corruption persists in some ports of the world and Nigeria in particular.

- Inadequate supply of crafts and plants which encourages some private inducement for serves to be rendered.
- Cumbersome documentation system which makes room for manipulation and collusion with relevant interests to deprive the port authority of relevant revenue. Dilapidated state of port infrastructure that result in reduced capacity utilization thus causing dock stacking of containers and unholy bargains for preferential treatment.
- Low labour productivity and volatile dock labour environment fraught with extortion and indiscipline.
- Delay in posting bills to ledgers and acknowledging payment for personal gains.
- Deliberate delay in performing official duties in order to elicit gratifications.
- Late submission of shipping documents especially in the area of manifest submission and application for ship Entry Notice (SEN).
- Submission of false documents and/or incorrect information e.g. under declaration of ship and cargo tonnage. Wrong declaration leads to faulty planning and preparation of cargo discharge, reception and clearing.
- Unholy, alliance between the shipping companies and stevedoring companies/labour and between clearing agents and stevedoring companies giving rise to non-declaration of services enjoyed e.g. extra and optional services.
- Incursion of miscreants into the ports thus jeopardizing port security.
- Deliberate manipulation of Debit Notes (DN) to avoid payment of correct charges and even times earn unmerited credit balance.
- Faking the port authority's receipts of payment, indicating that bills rose had been paid where the reverse is the case.
- Vandalization of port and navigable facilities e.g. buoys plants and equipment.
- Employment of sub-standard vessels on the sea routes resulting in accidents whose wreckage deter ships from accessing the entry channel easily and/or damage to port infrastructure and cargoes.
- Indiscriminate litigation and the resultant high incidence

of detentions of vessels at the berths thus delaying incoming vessels and prolonging the average turnaround time of vessels at the ports.

- Unholy hurry to enjoy services thus resulting in abridging of laid down regulations and creating conducive atmosphere for bribery giving and taking.
- Supply of incomplete number of men in labour gangs and claiming pay for the full gang.
- Altering of or use of forged documents commonly referred to as Machined outside (MO) by clearing agents for cargo delivery in order to avoid payments of import duties and the due shore handling charges.

According to Uzanya [7], delay is the worst item of cost to a ship and this occurs at an alarming rate in Nigerian ports. Some factors which constitute delay factors include:

- Illegal strikes by dock workers
- Security agents interfering with ship and cargo handling operations.
- Lack of trucks and Lorries as well as rail wagons for direct delivery.

Major security challenge in container-ports

There is a dramatic increase in the various maritime crimes, such as smuggling of drugs and migrants, theft, and in-transit hijacking of entire containers. According to Gwandu [9], the maritime crime is being committed by highly organized and sophisticated criminal groups with the ability to exploit the international commercial shipping trades. Port security department must therefore be adequately prepared to counter the various security threats bedevilling the port and its operations. The various security threats are:

- Cargo Theft;
- Drug Smuggling;
- Money Laundering;
- Sea Robbery;
- Maritime Terrorism;
- Alien and Stowaways Smuggling.

Security policies on container-port operation

Port security refers to the defense, law and treaty enforcement and counterterrorism activities that fall within the port and maritime domain. These include the protection of the seaports, inspection of cargo and general maritime security against drug trafficking, deft, and stow-away.

This is an area of increasing concern from administrator of maritime industry. Many measures were proposed in an effort to stem the perceived security threats. According to Acciaro and Serra [10], this measures taken have the potentials of changing the port operations and may lead to a significant increase in shipping cost and time. Hence needs then arise to make a trade-off between the consideration of the economic point of view and the perceived threat to port operation.

Important parameters used as port security measures in NPA

The following are the parameters used as maritime security measures in container-port operations. These factors have a great impact on the internally generated revenue of the Nigeria Port Authority. These measures have a quantifiable cost impact on the output of the NPA. Comparing these factors with the total revenue of the Nigeria Port Authority will enable us estimate quantitatively their cost implication and subsequently their impact on the operational efficiency.

- Perimeter wall fence: Each port has a perimeter wall fence in order to prevent unauthorised persons from gaining entry into the port.
- Access Control: The access control gates are manned by NPA Security operatives. All the port users are properly screened at the gate to ensure that only those with port permit and have genuine business to carry out are allowed access to the port.
- Light: The entire port premises are well illuminated at night for the safety of the vessels in our ports. There are also back-up generators in the event of power failure.
- CCTV: There are Closed Circuit Televisions installed all over the ports to monitor the activities of port users. The CCTV is been manned 24 hours by the Security Department and the Port Terminal Operators (PTC).
- Patrol: A combined team of NPA Security Personnel and Port Police carry out joint patrol of the common user area and water front's at regular intervals.
- Port Pass: The Security Department is saddled with the responsibility of issuing port permit to port users to enable have access to the port to carry out their lawful activities within the ports.

The principle of operational efficiency

Operational efficiency can be defined as the ratio between the input to run an operation and the output gained from the operation. When improving operational efficiency, the output to input ratio improves [11]. This study will take into consideration a single-factored operational efficiency is given as:

$$P_{OUTPUT} / P_{INPUT} \quad (1)$$

The Inputs parameters are typically money (cost), people (headcount) or time/effort of all activities and materials expended on the port security. In contrast the outputs is typically the revenue, margin, cash), headcount productivity, innovation, quality, speed and agility, complexity or opportunities arising in the overall port operations.

The terms operational efficiency, efficiency and productivity are often used interchangeably. An explanation to the difference between efficiency and (total factor) productivity was elucidated as a continuous improvement of operations in an establishment offering goods and services. This is not limited to this alone; it can also be applied to port operation to evaluate their performance. Hence operational efficiency is a performance based tools [12].

Measuring operational efficiency in container-ports: In order to obtain the effect of certain security input in container-port operation, we need to measure it in term of cost incurred on all security issue. And since operational efficiency is about the output to input ratio, it should be measured both on the input and the output side. Quite often, various management measures primarily on the input side, e.g. the unit production cost or the man hours required to produce one unit. Even

though important, input indicators like the unit production cost should not be seen as sole indicators of operational efficiency. When measuring operational efficiency, a company should define measure and track a number of performance indicators on both the input and output side. The exact definition of these performance indicators will vary from industry to industry, but typically these categories are covered. This is very applicable in measuring the port operational efficiency. The important parameters employed to measure and evaluate the impact of security on port operational efficiency is given below:

- Input: Operational expenditure on all security activities in a container-port
- Output: Internally generated revenue, quality, and growth of the port per annum.

Comparing and improving operational efficiency: When improving operational efficiency of container-ports, a few common alternatives available are:

- Same for less, i.e. same output for less input;
- More for same, i.e. more output for same input;
- Much more for more, i.e. much more output for more input;

It is a common misconception that costs, in absolute terms, are always cut when improving operational efficiency. It is true for the "same for less" alternative, but not for the two other alternatives. It can be operationally efficient to increase cost - as long as the output (revenue) is increasing more.

An example of a same for less alternative is when container-port reduces its total security personnel (and thereby reducing personnel cost) while still producing the yearly revenue. Also example of a 'more for same' alternative is when the port authority reduces its revenue without using spending more on the security resources. This can be achieved through use of quality management systems, addressing quality in existing training programs for personnel or introduction of higher quality requirements.

An example of a much more for more alternatives is when a manufacturing company invests in a new production plant which will enable them to produce products with a higher level of refinement than what could be produced in the old production plants. These products can be sold with a premium that more than compensates for the additional cost. Another example of "much more for more" is when a service company invests in expanding its customer service in order to increase customer satisfaction and customer loyalty.

Material and Methods

Study area

The Nigerian Port Authority was establish as s continuous Public Corporation by the Ports Act of 1954 to address the institutional weakness that bordered on lack of coherent policy framework as port development were done on ad hoc basis driven by changes on the level and demand of sea-borne trade. In 2003, the Federal Government of Nigeria initiated the drive towards improving efficiency at out Ports, and the landlord model was adopted for all the Nigerian Ports. This gave rise to the concession of 25 Terminals to private Terminal Operators with lease agreement ranging from 10-25 years. One of the concessions was a Build, Operate and Transfer (BOT) arrangement. Also in the process of reorganising the ports, the former eight ports were reduced to six major ports, with two ports in Lagos and four in the east namely; Lagos Port Complex, Tin Can-Island Port Complex, Calabar Port, Rivers Ports, Onne Ports Complex and Delta Ports Complex respectively.

In line with the reform programme, the transaction commenced with the advertisement for Expression of Interest on the 3rd of December, 2003, by the National Council on Privatization with the Bureau of Public Enterprise acting as the transaction agent. A total of 110 EOIs were harvested out of which only 94 were pre-qualified. Pre-bid conferences, Data room and physical due diligence were also done and request for proposals sent out to bidders. Technical bids were submitted and evaluated; the financial offers were also opened to determine the successful bidders. All the successful bidders negotiated their concession agreements with a Public Sector Team made up of Nigerian Ports Authority and the Bureau of Public Enterprise. Successfully negotiated agreements were signed. Transition programme initiated preparatory to handing over. Under this new arrangement, the Authority ceded to Private Sector some of her functions and responsibilities.

Study population

The study population was made up of the cumulative expenditures, security cost estimate and internally generated revenue by all the ports under the Nigeria Port Authority.

Sources of data

The data for this study was obtained through documented fact and it's therefore a secondary data. This was curled and compiled from the annual financial reports of the Nigeria Port Authority for a period of four years. The Table 1 is the internally generated revenue (IGR) of the Nigeria Port Authority for a period of four years and Table 2 shows the report of expenditure from where the percentage of cost incurred from security related activities was estimated in Table 3.

Method of data analysis

The methods of data analysis for this study are:

Method of moving averages: The method of moving averages is one of the smoothing techniques used in time–series analysis to establish an overall trend in a data set. It is based on the mathematical concept of arithmetic mean. It is extremely useful for forecasting a long-term trend. Therefore a trend line is established for the time series between 2009 and 2012.

Year	2009	2010	2011	2012
IGRA(₦MILLION)	2,507.15	6,747.38	8,298.87	4,594.11

Source: Performance of revenue generating agencies- civic data [12].

Table 1: Internally generated revenue subventions of Nigeria Port Authority (NPA: 2009-2012).

Year	2009	2010	2011	2012
EXP(₦MILLION)	14,265.35	12,305.16	13,087.39	15,670.95

Source: Performance of revenue generating agencies- civic data [12].

Table 2: Expenditure of the Nigerian Port Authority (NPA: 2009-2012).

	2009	2010	2011	2012
% OF SECURITY EXPENDITURES	12%	15%	16%	25%
VALUE(103)	12,511.842	18,045.774	22,253.982	37,667.738

Source: Port authority: performance profile: security expenditure 2009 – 2012.

Table 3: An estimate of cost incurred on security related operations.

Quantitative-descriptive analysis using the formula for calculating the operational efficiency as shown in equation (2). Hence operational efficiency is given by the expression below:

$$P_{OUTPUT} / P_{INPUT} \quad (1)$$

This is summarized as shown in equation below:

$$IGR / EXP \quad (2)$$

Where IGR and EXP are the internally generated revenue and expenditure on security related issues of the Nigerian Port Authority.

- Graphical visualization(histogram, pie chart and scattered diagrams) to make comparison;
- **Statistical tool:** The test statistics used under this study is the two sample t-test. This is employed when testing the difference between two percentages (proportions). The critical value of t is determined based on a table of values, which determine the critical value based on the selected level of confidence.

Under the Ho, the test statistics is given as:

$$t = \frac{\overline{X_1} - \overline{X_2}}{\sqrt{\left\{(S_1^2 / n_1) + (S_2^2 / n_2)\right\}}}$$

Where x_1 and x_2 are the means while, s_1 and s_2 are the variances of the two populations respectively.

The computed t is compared to the critical value to determine if there is significant. If the t-calculated is greater than the critical value the null hypothesis is to be rejected at a level of significance (α).

Analytical procedure

The research problem can be answered and hypothesis tested from the analysis and interpretation of the secondary data. This analysis involves the ordering and breaking down of the documented data into constituent parts.

The objective 1 involving the identification of various security threats prominent in the container-ports and these threats plays a significant impact on the throughput of various ports in Nigeria Maritime industry as it will be seen later under our result analysis.

The objective 2 can be explained explicitly from the data collected in Tables 1 and 3 to calculate the single factored operational efficiency with the output being the internally generated revenue and the single factored in out being the cost incurred on security related activities in the Nigerian ports. Percentage efficiency obtained from this estimation depicts the impact of security on the efficiency of port operation in quantitative value.

Bearing the percentage contribution of security cost on the total expenditure of the Nigerian Port Authority, it is worthy of note from objective 3 that cost implication of security related activities in Nigerian ports is significantly high. This cost tells on the levy on the port users.

Objective 4 involves proffering adequate measures in reducing the effect of security challenges on the port operations in Nigeria. These measures include perimeter wall fence, access control, light, CCTV, patrol, and port pass. These measures are without its cost implications.

Furthermore, the statistical test was performed to either accept or reject the null hypothesis and enable us determine quantitatively the impact of security on the overall efficiency of port operations.

Results and Analysis

Analysis of the secondary data

Analysis of the secondary data is shown in Tables 1-3.

Results

The result of this analysis is divided into three:

- The results on moving averages
- Quantitative estimation of operational efficiency.
- Statistical tests of hypothesis

Results on moving averages: Results on moving averages are shown in Tables 4 and 5 and Figures 1 and 2.

Statistical tests of hypothesis: The test statistics employed under this study is a one-tailed t-distribution. These compared the mean values of the efficiency and the security percentage. By this the effect of the security percentile on the overall operational efficiency can then be better understood.

Under the null hypothesis the test statistics is given as

Year	IGR	Moving Averages	Standard Error
2009	2,507	#N/A	#N/A
2010	6747	4,627.265	#N/A
2011	8298	7,522.690	1595.882
2012	4594	6446.005	1,419.737

Table 4: Results of moving averages on the IGR.

Year	Security Cost	Moving Averages	Standard Error
2009	12,512	#N/A	#N/A
2010	18,046	15,279	#N/A
2011	22,254	20,150	2,457.957
2012	37.668	29,961	5,649.100

Table 5: Results of moving averages on the security cost.

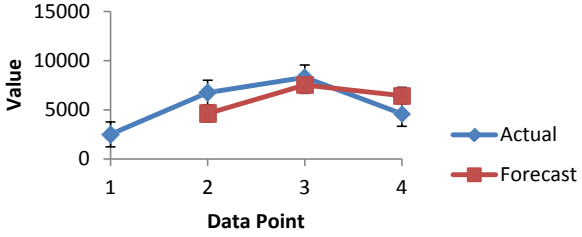

Figure 1: Trend-line showing the Moving Average on IGR.

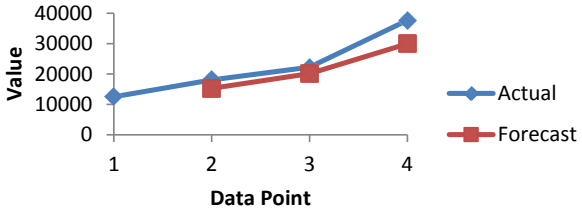

Figure 2: Trend-line showing the Moving Average of Cost Incurred on Security.

$$t = \frac{\overline{X_1} - \overline{X_2}}{\sqrt{\left\{(S_1^2/n_1) + (S_2^2/n_2)\right\}}} \quad \text{.....(*)}$$

H_0: μ1= μ2

The significant level is assumed to be 15% i.e α =0.15% (Tables 6 and 7).

$t_{Calculated} = 1.41$

Using the t-distribution , the t-value on the t-table at a level of significance of 0.15 is given as 1.190. Comparing this with the value of the $t_{calculated}$ of 1.41. It is clear that it is greater than the one obtained from the t-table i.e $t_{Calculated} > t_{Critical(table)l}$. The null hypothesis is therefore to be rejected.

Discussion

Discussion on moving averages and operational efficiency

The moving averages is used to determine the trend of the data obtained from both the internally generated revenue (IGR) and security expenses of the Nigeria Port Authority and subsequently forecast the future value. The trend-line in Figure 1 shows an increase in the IGR from 2009 to 2010 up to 2011. But experienced a sharp drop from 2011 to 2012.

However the Figure 2 shows a trend-line with a steady increase in the security cost from 2009 to 2012. This may be attributed to the rising level of insecurity in the Nigerian Ports. This calls for an urgent consideration by relevant authority. This will be discussed latter under the recommendation from this study. Also form the value obtained for the operational efficiencies for each year, it shows that an increase in the security cost leads to a drop in the IGR, this is an indication that security threats affect the revenue generated by the NPA. This is better explained using the trend-lines where an upward trend of security cost leads to a corresponding downward trend for the internally generated revenue.

Discussion on the statistical test of hypothesis

From the t-test of the hypothesis where obtained a $t_{Calculated} > t_{Critical\ (table)1}$. The null hypothesis is therefore to be rejected. i.e., H_0. The security measures improvement have no significant impact on the overall operational efficiency of a container ports. This means that security measures improvement have a significant impact on the overall operational efficiency of a container ports.

Year	2009	2010	2011	2012
Operational Efficiency (%)	20.04	37.39	37.29	12.20
Security Cut (%)	12.00	15.00	16.00	25.00

	Efficiency (%)			Security (%)		
	x1	Deviation	(Deviation)²	x2	Deviation	(Deviation)²
2009	20.04	-6.69	44.77	12.00	-5.00	25.00
2010	37.39	1.66	113.64	15.00	-2.00	4.00
2011	37.29	10.56	111.51	16.00	-1.00	1.00
2012	12.20	-14.53	211.12	25.00	8.00	64.00
TOTAL	106.92		481.04	68.00		94.00

Table 6: Results showing the percentile of security cost and the calculated operational efficiency.

S/N	Mean (X)	Variance (S)
1	26.73	160.35
2	17.00	31.33

Substituting these values into the t-formula in equation (*) above: t Calculated= 1.41

Table 7: The variances of the two populations.

Conclusions

The data for this study was obtained through documented fact and it's therefore a secondary data. This was curled and compiled from the annual financial reports of the Nigeria Port Authority for a period of four years and the operational efficiencies of was estimated over this period of 2009, 2010, 2011 and 2012 with the corresponding calculated values of 20.04%, 37.39%, 37.29% and 12.20%respectively. This shows an upward trend which later experienced a sharp drop in 2012 as shown in Figure 1. The relationship between the operational efficiency and security is therefore of an inverse proportionality. This means that a surge in the security challenge adversely affect the efficiency in operation and thereby reduces the IGR (Internally Generated Revenue). From the statistical test of hypothesis, it is therefore apparent that the null hypotheses H_{01} are to be rejected. The study is therefore concluded that the security measures improvement have significant impact on the overall operational efficiency of a container ports. This is noticeable in the trend line generated in Figure 2 by the Microsoft excel 2013®.

Reference

1. Nokia Siemens Networks (2009) Efficiency and beyond-forward-thinking solutions for improving efficiency.
2. Steenken D, Voss S, Stahlbock R (2003) Container terminal operation and operations research- a classification and literature review. Spectrum, Springer-Verlag Gmb H 26: 3-49.
3. Yeo G, Pak J, Yang Z (2013) Analysis of dynamic effects on seaports adopting port security policy. Transportation Research part A: Policy and practice 49: 285-301.
4. Gudelj A, Krcum M, Twrdy E (2010) Models and Methods for Operations in Ports Container Terminals. Intermodal Transport Preliminary Communication 22: 43-51.
5. Pesenti R, Ukovich W, Castelli L, Longo G (1998) Quantitative Models and Methods for Locating Logistics Nodes in Maritime Transportation 8: 47-58.
6. Porter ME (1996) What is Strategy? Harvard Business Review.
7. Uzanya (2000) High clearing costs in Nigerian Ports. 6: 1895.
8. (1997) Port Security: A National Planning Guide Series, U.S Department of Transportation 1-30.
9. Gwandu B (2000) Corruption: A bane of efficient Port Services: A paper Presented at a National Seminar on Eradication of Corruption and Sharp Practices in Nigerian Ports.
10. Acciaro M, Serra P (2013) Maritime Supply Chain Security: A Critical Review. IFSPA 636-651.
11. Timothy JC, Rao DSP, O'Donnell CJ, Battese GE (2005) An Introduction to Efficiency and Productivity Analysis. Springer.
12. http://www.civiccodeathon.com/