Effect of Port Infrastructure on Performance of Eastern Nigerian Ports (2000-2022)

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DOI: https://dx.doi.org/10.47772/IJRISS.2023.71052

Received: 13 August 2023; Revised: 09 September 2023; Accepted: 13 September 2023; Published: 20 October 2023

ABSTRACT

This study examined the effect of port infrastructure on performance of Eastern Nigerian port (2000-2020). Port infrastructure is both the independent (predictor) variable as well as the dimension of the study. Also, performance of Eastern Nigerian ports serves as the key dependent variable or criterion variable under which the measures such as cargo throughputs and vessel turnaround time have been appraised. The population of the study consisted of 1527 staff of the four Eastern Nigerian ports. The study sampled 317 respondents out of which 302 of them were found useful and valid for the study analysis. The study collected data with the help of a structured questionnaire through Monkey Survey. Descriptive and inferential statistical tools were used to analyse data in the study. The study also, used Pearson Products Moment Correlation Coefficient (r) to test the hypotheses with the aid of SPSS 22.0. The reliability of the research instrument was tested using the Cronbach alpha to ascertain the reliability of the instrument which was 0.869 far above the 0.70 threshold. The study found that port infrastructures are veritable assets for achieving container terminal performance in Eastern Nigerian ports. The study also revealed that the quality of interaction of staff with customers enhances container terminal performance and that prompt, effective and efficient port services, offers real opportunities to optimize container terminal performance in Eastern ports. The study found that there is no political will on the part of government to provide enough infrastructure for the smooth running of the ports. The study also revealed that the quality and quantity of infrastructures in the port are good indicators to elicit efficient operational services and influence vessel throughputs. Conclusively, port infrastructure has a positive and significant relationship with cargo throughputs in Eastern, port infrastructure has a positive and significant relationship with vessel turnaround time in Eastern Nigerian ports Therefore, port management should make haste to ensure that all impediments to the provision of port infrastructures that would guarantee the optimization of cargo throughputs in ports are removed. Government of Nigeria needs to engage in huge investments to expand the port infrastructures such as roads, adequate berthing facilities, wharves, yard capacity, quayside, railway, as well as expand the hinterland road network. These port infrastructures are the key stimuli for vessel turnaround time, effectiveness and efficiency in the port.

Keywords: Port Infrastructure, Performance, Eastern Nigerian Port, Cargo Throughputs, Vessel Turnaround Time

INTRODUCTION

The situation of operations at the four ports in Eastern Nigeria since the pre-concession era demonstrates a very low level of cargo through put, inefficiency in labour performance/output, and high turnaround time for ships, low berth occupancy, low babour (stevedores) performance, and customer's service level. Some ports are still performing below expectation in spite of port concession policy (UNCTAD, 2018e). Eastern ports which are all landlord ports operate below expectations, instead of the forty-eight hours' international standard for a ship to berth, discharge her cargoes and sail; it takes two (2) to three (3) days, sometimes

weeks even a month for a vessel to complete her cargo operation, to discharge direct/indirect delivery of cargo general and containerized, and sail in Eastern ports. This means there are some problems responsible for delays at the Eastern ports. Could this problem be as a result of lack of infrastructure, poor funding, in accessibility to the ports and terminals? Could it be uncooperative stevedores' attitude? Stiff management bureaucratic bottle necks of government agencies like Nigeria custom service, could it be as a result of non-automation of operation in the ports or attitude of clearing agents in the ports.?

The number of vessels that called at the port in 2020 had a decline of 2.72% when compared to the previous year. Also comparing the operations data to that of the neighbouring ports shows that the performances of the neigbouring ports are more robust. Hence, Nigerian port operations need to be reviewed to enable the ports to improve their competitive position in the regional and global market (UNCTAD, 2020e).

The unfortunate condition of access roads to the Eastern ports complexes have created major setbacks for business operations in and around the busiest maritime gateways in Nigeria. The ports are congested and hundreds of businesses around the environs have closed shop. Notwithstanding several promises from the Federal Government, importers, terminal operators and other businesses around the Eastern ports continually suffer hardship from the deplorable state of the roads and the attendant traffic gridlock that have characterized the route ((Nwokedi et al, 2019).

Port congestions, high container dwell time, high turnaround time of vessels and trucks, inadequate of port facilities such as berths, etc have tremendously negated the operational performance of Eastern Ports. These drawbacks in port activities have made Eastern ports operationally inefficient leading to increases in demurrage charges and operating cost of vessels. The implied economic implication of the aforementioned inefficiencies is that most shippers will prefer to call at other ports with less congestion, better port facilities and sophisticated cargo handling equipment. The economy is also experiencing increases in the prices of consumable goods, cut-off-flow during operations by the production companies, decrease in per capital income of port employees and general decreases in the revenue accruable to the port (Onwuegbuchulam, 2012).

The basic function is then to transfer efficiently shipped cargoes from a maritime transport mode (container ship) to a land transport mode (rail and truck) and vice-versa. The efficiency of this transfer operation can be assessed based on the availability of sizable berths, berthing equipment such as bollards, port cranes, adequate transit areas for effective crane and truck operations, stacking areas for container sorting and other relevant activities are all carried out at the port terminals (Russ, et al, 2018). This paper investigated the effect of port infrastructure on the performance of Eastern ports in Nigeria.

Objective of the Study

The study evaluated the relationship between port infrastructure on performance in Eastern Nigeria ports. In line with above, the study sought to achieved the following specific objectives:

1. Assess how port infrastructure influences cargo throughputs in Eastern Nigerian ports;
2. Examine the relationship between port infrastructure and vessel turnaround time in Eastern Nigerian ports;

Research questions

The following research questions shall be answered in this study:

1. How does port infrastructure influence cargo throughputs in Eastern Nigerian ports?
2. What is the relationship between port infrastructure and vessel turnaround time in Eastern Nigerian

ports?

Research Hypotheses

The following hypotheses shall be tested in this study:

Ho_1: Port infrastructure influences cargo throughputs in Eastern Nigerian ports.

Ho_2: There is significant relationship between Port infrastructure and vessel turnaround time in Eastern Nigerian ports.

LITERATURE REVIEW

This section has been used to review the literature relevant to the study. To achieve the literature review objective, the study critically examined the theoretical foundation of the study such as queuing theory and liner wave theory. Also, the literature review has captured concepts like- port, port infrastructure, cargo throughputs, vessel turnaround time and empirical studies as well as the summary of the literature review with evidence of gaps in literature.

Theoretical Framework

This study examines the relationship between port infrastructure and performance of Eastern Nigerian ports. In this section, the theoretical framework underpinning the study has been explored. Queuing Theory or Birth-and-Death Process Theory has been x-rayed in this section.

Queuing Theory on Port Congestion (Birth-and-Death Process Theory)

In the context of queuing theory (Nyama, 2014; Okeudo 2013), the term birth refers to the arrival of a new customer into the queuing system, and death refers to the departure of a served customer. Only one birth or death may occur at a time: therefore, transitions always occur to the "next higher" or "next lower" state. The rates at which births and deaths occur are prescribed precisely by the parameters of the exponential distributions that describe the arrival and service patterns (Wilson et al. 2015). The state of the system at time t ($t \geq 0$), denoted by N(t), is the number of customers in the queuing system at time t. The birth-and-death process describes probabilistically how N(t) changes as t increases. More precisely, according to Wilson et al. (2015) the assumptions of the birth-and-death process are the followings:

Assumption 1. Given N(t) = n, the current probability distribution of the remaining time until next birth (arrival) is exponential with parameter λ_n (n = 0, 1, 2…).

Assumption 2. Given N(t) = n, the current probability distribution of the remaining time until the next death (service completion) is exponential with parameter (n = 1, 2, …).

Assumption 3. The random variable of assumption 1 (the remaining time until the next birth) and random variable of assumption 2 (the remaining time until the next death) are mutually dependent. Furthermore, an arrival causes a transition from state n into state n+1, and the completion of a service changes the system's state from n to n-1. No other transitions are considered possible.

A fundamental flaw in the birth-and-death process structure is a reliance on equilibrium between birth and death rates. This assumes the overall population shall remain constant at long run (Ogunsanya, & Olawepo, 2010). The approach is based on the rate-equality principle (Melanie, 2009) or balanced population model.

Rate-Equality Principle states that the rate at which a process enters a state n **(≥ 0)** equals the rate which the

process leaves that state n. In other words, the rate of entering and the rate of leaving a particular state are the same for every state.

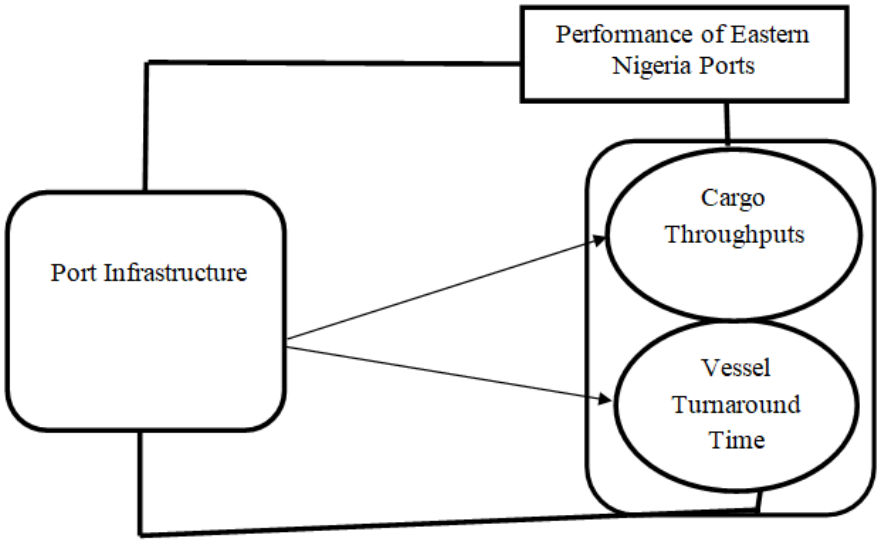
Rate in = rate out principle (Melanie, 2009). This principle implies that for any state of the system can be expressed by an equation which is called the balance equation for state n (n = 0, 1, 2…), and mean entering rate = mean leaving rate.

Ogunsiji (2011) did a comparative port performance efficiency measurement in developing nations found observed that there are many queuing models that can be formulated and used to analyze problems of port congestion. The port management was using queuing model to handling the vessels berth on the modality of First Come First Serve (FCFC) which helps to reduce dwell time, and ship turnaround time. It was advised the model to be tailored with computer systems and information technology in assigning vessels, berths and cranes.

Conceptual Review

The key concepts or variables used in the study have been critically reviewed under the subtopics of port infrastructure, performance of Eastern Nigerian ports, cargo throughputs and vessel turnaround time:

Figure 1: Operationalized Conceptual Framework of the Effect of Port Infrastructure on the Performance of Eastern Nigerian ports



Source: Onyema, H. K, Ahmodu K and Emeghara, G. C. (2015). Comparative Analysis of Port Performance in Nigeria: A Study of Ports in Rivers State International Journal of Business and Management, 100-107. www.theijbm.com.

Port Infrastructure

The port authority develops, owns and maintains the infrastructures – quays, sheds, warehouses, channels, aids to navigation, roads, railways, docks, locks, land and superstructures – cranes of various types, forklifts etc, including related services. It is responsible for the entire operation of the port as well as management of it, hence, referred to as operating port. It sometimes provides stevedoring activities and maintains direct industrial and commercial relations with port users while retaining its governmental powers (Onyema, Ahmodu & Emeghara, 2015). The Port Authority may play a role through an enterprise separate from itself in which it holds shares. A situation of this nature calls for a distinction between its governmental role and its role in industrial and commercial activities. Such policy is necessary when the port authority deems it essential performing the operating functions. Operating port system is common in the developing nations with less efficiency and usually controlled directly by the Ministry of Transport or Communications. This

guarantees unity of command and management but more power to unions. Port infrastructures are found in Singapore, Nigeria, Ghana, Kenya etc. However, the port of Singapore is a typical service and leading world port reckoned with for its effectiveness, efficiency and innovative management and operation system (UNCTAD, 2020a).

The Port authority provides all commercial services to ships and cargo, owns and operates every Port asset, and fulfills all regulatory functions, the port infrastructure. Authority can be either a publics entity, as used to be in former socialist countries, and in Singapore, or a private one, as in the case in felixtowe (United Kingdom), or Hong Kong are outstanding references as far as productivity of Port services are concerned, this could suggest that to some extent, ownership could be a secondary matter. However, the port infrastructure experience in former centralized economics clearly demonstrated its shortcomings, and the former Port of Singapore authority was turned in 1997 into PS A Corporation, a Port operating port, while regulatory powers were vested into the newly created Maritime and Port Authority (MPA) (Yeo, Pak & Yang, 2013).

The port infrastructure is the base for port operations to serve the vessel, cargo and passengers which pass through ports. The development of port infrastructures requires capital-intensive investments, a long lead-time and therefore long-term planning. This means that the design of port infrastructures should anticipate the needs of the seaborne, logistics and transport sector. This is an especially difficult task at a time when the transport and logistic sector is immersed in a deep transformation, as is currently the case, affecting both maritime and inland aspects (new fuels, autonomous transport and cargo handling, self-organising logistics, new business models, etc.). Furthermore, port infrastructures should also anticipate and adapt to the development of new maritime activities (blue growth) and to other external factors, such as new extreme weather conditions resulting from climate change. There is a need to design more flexible, intelligent and resilient port infrastructures which are able to adapt to future requirements. The Nigerian maritime sector should identify and develop different lines of research and innovation in order to adapt port infrastructures to this vision of the future.

The Maritime sector wishes to lead a long-term business transition; port infrastructures will become adaptive to new ships, vessels, inland waterways and offshore activities supporting blue growth, which are suited to further scalability. Connectivity and integration will be developed to ensure continuity among different transport modalities and different ships, vessels and vehicles. Infrastructure must be resilient to environmental challenges. To accommodate the fast implementation of the energy transition, clarity is needed on the most likely transition path. Furthermore, the development of new, more flexible solutions for bunkering and energy storage is required to enhance the resilience of investments in alternative fuels. Infrastructure should also integrate intelligent technologies and efforts should be made to allow infrastructures to be able to collect data in order to meet all requirements from the point of view of the market and the maintenance of the infrastructures themselves. Within Nigerian ports, infrastructure will be developed following the paradigm of city-port-nature oriented planning, cohesively linking shipping to the territory in a sustainable manner. The social, political and regulatory elements are fundamental to future changes in the sector. The workers and the inhabitants of the cities annexed to the ports, etc. are the sector's main assets as both customers and suppliers of labour to ensure the sustainability and viability of the infrastructures through which the cargo and the associated information move.

Eastern Nigeria Ports' Performance

That transport is central to development and civilization does not appear to have been appreciated in Nigeria as much it has been in many advanced nations. In concrete terms, transport is the ingredient for the socio-economic and political development of any nation. Development and transport are synonymous hence transport is the landmark of a developed nation. Man, is the center of universal activities and is always in constant movement in order to organize other activities and sustain his life needs. Based on this, man has

directly or indirectly moved products, materials and services from points of less demand to areas of higher demand. This has resulted in the expansion of national and world trades, (Nwokedi et al, 2019).

These unaccomplished goals of man had always led him to search for solace outside his environment. This ultimate search or unfulfilled goals and the burning desire to improve on his well-being as a man, had indeed led to the development of maritime operations. This in turn, has enhanced international trade between widely separated nations, involving an exchange of goods and money transfer in the process, (Nyama, 2014).

Comparatively, available cost figures have shown that maritime transport is the cheapest mode, for the transportation of bulk cargo, (UNCTAD, 2018). Jahn and Saxe (2017)., in a study of transportation of same by sea offered British steel the cheapest modal cost on freighting. Indeed, for a third world: country's port [as in Nigeria], the port helps to achieve greater functionalities and efficiency in operation, and that imports and exports passing through it benefit from cheap and economically competitive port charges, since the maritime transport services have strong relative connection's with port activities, it is pertinent to state that the degree of economic development in maritime industry depends wholly or partly on the average wailing time of vessels and the berth occupancy rate, (UNCTAD, 2018).

Specifically, the essence of maritime transportation is principally to facilitate the shipping activities by providing avenue through which large quantity of goods can be transferred from one place to another, with the help of water/mode. In order to realize the principal motive for the use of maritime transportation four important elements are necessary and these elements actually constitute transport system (Ibe, 2011). A system can be described as a group of interrelated objects interacting to form a complete whole. In order words, it constitutes discreet components known as subsystems.

These subsystems include the vessels or vehicles, the way, the motive power and the terminals. These have strong relationships to both maritime operation and port services. The link between both of them are dependent on the stated subsystem (Roso & Lumsden, 2010). The sub-systems to a very large extent have helped in commenting the already existing relationship between maritime and port operations. To this end, there is no way the four sub-systems of maritime activities will not exhaustively be discussed in terms of port reforms (concessioning) without the harmonization of port services or its attendant operations, in the context of port reform it is evident that both maritime and port operation work hand in hand and are inseparable to a very large extent. This has been indeed evidenced in the exploration of the benefit of shipping services, as reflected in the nation's local cottage industrial growth and economy (Ndikom, 2013).

Having identified the cargo handling equipment system as the most suitable structure for modernization of our ports, envelopment of the sector, and for involving private investment therein, it would be necessary to look at the practical steps to be taken towards granting concession of a port or part thereof. 58 Negotiation is a wide area on which a lot has been written, public sector negotiations however have certain factors that we can narrow down on, it is prudent to treat fundamental aspects of negotiation in the following arrangements. According to Eniola (2014). negotiation principle (should be taken very seriously. He reiterated the place of communication.

As a result of the compounded problems, the Nigerian seaports were rated as one of the costliest seaports in the world. Consequently, it adversely affected the patronage of our seaports (Russ, et al, 2018). Akinyemi (2016), also opined that the ills that bedeviled Nigerian ports before port concession in 2006 includes long turnaround time for ships, insecurity of cargo, unproductive labour force in NPA, multiple government agencies in the port, corrupt practices and excessive charges.

Arokoyu, Chepaka and Lawal (2016), held that Africa accounts for less than one percent of world container traffic. An extra 2,200 TEU vessel service from Europe to a small country in the West and Central Africa

sub-region would have a 27 percent market share whereas a 5,500 TEU vessel from the Far East to Europe would potentially generate a 3.6 percent market share taking into account market size. For shipping lines, port turnaround time has become an increasingly important factor to decide which port to call in the world. One extra day at a port costs more than US$35,000 to a shipping line for a 2,200 TEU vessel. He therefore suggested the need for reform.

Ndikom (2006) stated that many port premises and quay aprons had fallen to disuse and failed road sections inside the ports made movement of goods within port grounds cumbersome and very slow. Following the seaport congestion, complaints of untraceable or missing cargoes were being regularly lodged against the NPA, all to no avail. Security inside Nigerian seaports was compromised by the relentless ingress of multitudes of all shades of persons into the seaports. As a result, miscreants called wharf rats easily gained access into the ports and pilfered goods in storage or vehicle parts. In fact, security within port grounds was at the mercy of an elusive racket. Hee and Doo (2018) were of the view that the Sub-Saharan (SSA) Africa has been slower than some other regions to embrace private participation. By the late 1990s, only 10 percent of SSA's ninety main ports involved private participation beyond stevedoring services. By 2006, that situation had begun to change with concessions concluded for container and general cargo terminals in Tanzania, Cameroon, Madagascar, Mozambique, and other SSA countries.

Cargo Throughputs

It is worthy of note that average cargo throughput from 1956 to 2005 is 14,467,024 metric tons while the average cargo throughput from 2006 to 2012 is 67,240,231.86 metric tons. The yearly average cargo throughput of 67,240,231.86 metric tons of cargo from 2006 to 2012 over the yearly average of 14,467,024 metric tons from 1956 to 2005 shows a percentage increase of 456.69%. This shows the remarkable progress made in our port developmental efforts since the port concession era. In a nutshell, the pattern in Nigerian port traffic during the pre-concession era is sinusoidal while the post concession experienced a sharp progressive rise. The statistics on Table 1 shows that the cargo throughput increased from 46,150,518metric tons in 2006 to 77,104,738metric tons in 2012. This means that between 2006 and 2017, cargo throughput at the nation's ports increased by over 67 per cent. This was as a result of the landlord model of port management which was adopted in 2006 that led to the concession of sections of the ports to private terminal operators (Azmat, 2017).

Table 1: Cargo Throughput at Nigerian Ports (Pre-& Post Concession)

YEAR	INWARD	OUTWARD	THROUGHPUT
1961	1,386,480	1,356,480	2,742,960
1962	1,620,195	1,552,752	3,172,947
1963	1,680,222	1,419,552	3,099,774
1964	1,823,506	1,720,356	3,543,862
1965	2,110,440	1,482,901	3,593,341
1966	2,256,453	1,374,263	3,630,716
1967	2,350,087	1,664,431	4,014,518
1968	2,387,446	1,631,560	4,019,006
1969	2,527,730	1,830,576	4,358,306
1970	2,640,672	2,037,828	4,678,500
1971	2,853,627	1,997,834	4,851,461
1972	2,428,106	1,753,800	4,181,906
1973	2,272,681	1,562,887	3,835,568

1974	2,177,611	1,661,517	3,839,128
1975	2,719,518	1,507,964	4,227,482
1976	4,492,152	2,816,851	7,309,003
1977	5,281,466	2,831,638	8,113,104
1978	4,459,164	3,103,075	7,562,239
1979	5,256,724	3,218,696	8,475,420
1980	5,979,492	2,461,934	8,441,426
1981	8,481,284	2,518,241	10,999,525
1982	11,853,063	2,552,183	14,405,246
1983	15,694,964	2,419,808	18,114,772
1984	17,395,286	2,679,951	20,075,237
1985	15,600,380	2,356,815	17,957,195
1986	20,728,974	2,913,742	23,642,716
1987	20,073,797	2,537,432	22,611,229
1988	16,394,509	2,346,700	18,741,209
1989	12,372,417	2,278,685	14,651,102
1990	13,453,939	2,947,740	16,401,679
1991	9,851,059	2,423,520	12,274,579
1992	9,288,006	2,249,584	11,537,590
1993	7,773,258	3,402,088	11,175,346
1994	8,759,961	4,616,226	13,376,187
1995	9,338,801	6,830,356	16,169,157
1996	11,021,521	6,819,380	17,840,901
1997	13,414,501	5,487,925	18,902,426
1998	12,897,955	5,739,047	18,637,002
1999	9,579,969	4,281,879	13,861,848
2000	9,289,971	3,983,082	13,273,053
2001	10,224,300	5,251,001	15,475,301
2002	11,213,624	5,369,181	16,582,805
2003	14,286,864	5,038,854	19,325,718
2004	15,751,331	6,481,605	22,232,936
2005	19,230,496	9,702,384	28,932,880
2006	24,668,791	11,271,901	35,940,692
2007	35,544,965	35,544,965	57,473,350
2008	41,195,616	23,177,133	64,372,749
2009	45,757,149	20,018,360	65,775,509
2010	46,928,848	29,815,879	76,744,727
2011	52,022,105	31,439,592	83,461,697
2012	46,222,127	30,870,498	77,092,625
2013	50,005,603	28,276,031	78,281,634
2014	53,771,183	31,180,744	84,951,927
2015	48,111,361	29,276,277	77,387,638

2016	43,470,646	26,894,390	70,365,036
2017	43,099,088	28,436,548	71,535,636
TOTAL	913,471,484	468,416,622	1,368,271,526

Source: Nigerian Ports Authority (1961-2017)

Table 1 shows the inward cargo trend from 1961 to 2017. It follows the same pattern like the cargo throughput trend. The trend of cargo throughput follows the same pattern as import trend. It means then that the trend of cargo throughput is greatly determined by the trend of import or inward cargo movement. In a nutshell, the pattern in Nigerian port traffic during the pre-concession era is sinusoidal while the post concession experienced a stable and continuous growth as indicated with the blue line. The trend concurs with that witnessed in total cargo throughput which is clear evidence that the pattern of Nigeria's port traffic is controlled by imports. During the period 1961-2017 import traffic overwhelmed exports. Table 1 also, shows the outward cargo trend from 1961-2017 the export trend was analogous which means there was no improvement in export activities. However, small improvement was recorded from 1971-1974 with a slight upward tilt of the trend line. The situation reversed to the parallel trend from 1975-1987. This means that there was a downward tilt of the trend line. The period 1988-1999 witnessed a slight improvement in export activities with a slight upward tilt of the trend line while the trend line experienced a sharp upward movement from 2000-2017.

Table 1 shows the volume of cargo throughput handled at the Nigerian ports from 1956 to 2012. Cargo throughput is the sum of both the inward and the outward cargo processed by the ports in the given period. There was a slow growth in cargo traffic from 1956 to 1974; and the fall noticeable in-between 1966 and 1970, as a result of the civil war, was not enough to utterly obscure the growth trend. The rise in traffic between 1975 and 1979 was significant although the rise began in 1970. The abrupt rise was not preceded by port development sufficient enough to handle the traffic. The result was the 1975-1978 congestion problems which stemmed from the massive importation of cement called 'cement armada' and other construction material for the rehabilitation of infrastructure destroyed by the civil war. Traffic dropped from 20,075,237 metric tons in 1979 to 17,957,195 metric tons in 1980, peaked again in 1981 and then suffered serious decline that coincided with the global economic recession. This downward trend can be ascribed to the austerity measures introduced by the then government with the view to revamping the ailing economy. The downward trend continued for about nine years with the total cargo throughput in 1989 falling to 13,376,187metric tons. The traffic picked up again in 1990 only for a brief period as it fell during the county's political uncertainty of 1992 and 1993. Since 1996 there has been a rapid rise in cargo throughput culminating in an unprecedented volume in 2016 with a slight decline in 2017 (UNCTAD (2020b).

Vessel Turnaround Time

Turnaround times directly impacts port container performance from both economic and operational point of view (Mokhtar & Shah, 2006). The higher the turnaround time the lower the container performance and the higher the port congestion. In this case, the salient feature of any port is to optimize its throughput and eventually to decrease the turnaround times of vessels or ships.

The vessel or ship turn-around time is an accumulation of the two critical times, ship service time at berth and waiting time or the time the ship spends in port from its arrival within the limits of the port up to its departure (Bao & Chunxia, 2018). Based on statistics provided by KTO for the last two and a half years, 1999-2001, ships' turn-around time was equivalent to the ships' service time at berth as there was no waiting time. This indicator is one of the most common measurements of port performance in the world because the survival of ports totally depends upon the satisfaction of the ship-owner its primary customer. The shortest ship turn-around time is the most advantageous for the ship-owners because their profits are

highly influenced by the time spent in port. Thus, the shorter the staying time of ships in ports the higher the profit. Bao and Chunxia, (2018) submits that time in port is 35 approximately 18% of distribution of port expenses. Ship turnaround time however includes waiting time, manoeuvring time between the entrances to the berth or mooring point, ship service time at berth, shifting time between berths and manoeuvring time to leave the port.

The total gang idle time was due to awaiting docking, quarantine clearance, down time at the end of each worked vessel, as gangs were not transferable to other shipping lines and operational delays. Over the period January 2007 to June 2018, there was an increase in service time to vessels by 12%, i.e. an increase from to 1.16 service time per day for each vessel, which also increased the turn-around time of the vessels in the port. With the terminal's aim to reduce vessel stay in port this does not augur well for the terminal and careful examination is needed at this point in time (UNCTAD, 2020c).

Empirical Studies

Nyema (2014) in his study of factor influencing container terminals efficiency at Mombasa Port; revealed that factors such as inadequate quay/gantry crane equipment, reducing berth times and delays of container ships, dwell time, container cargo and truck turnaround time, custom clearance, limited storage capacity, poor multi-modal connections to hinterland and infrastructure directly influencing container terminal inefficiency/port congestion. Data were analyzed by using the Statistical Package for Social Sciences (SPSS) and Microsoft Excel 2013. It was revealed the same problems facing Dar es Salaam Port which needs comprehensive strategic plan to alleviate. Russ et al. (2018), in their World Bank research report on "Why Does Cargo Spends Weeks in Africa Ports" the case study of Douala, Cameroun found that, the ports efficiency is attributed to improving berths operations, clearance procedures, timely handling of ships, truck operations, gates operations and behavioral change of the players. This improvement would necessitate the reduction in dwell times leading to the smooth movement of cargo within and outside the port area. The study also proposed that for the port congestion to be alleviated there should be modernization of customs administration. But in Dar es Salaam port the situation is still the unconformity persist due to the unilateral planning and operations at the port.

Bao and Chunxia (2018) in their study on why do cargo spend weeks in sub-Saharan African ports used a mix of databases, individual questionnaires, and aggregated statistics from customs agencies and terminal operating companies in eight countries. They found that the primary indicators of operational performance in ports are dwell, ship turnaround time and port through put. This phenomenon has been pertinent for a long time, other criteria such as asset performance are also widely used to compare berth, yard, or gate performance of different ports.

Arvis (2010), in the study of long duration of container stays in the port using the study of different ports in Africa it identified the unpredictability of cargo dwell time as a major contributor to trade costs because shippers need to be compensated for the uncertainty by raising their inventory levels. Laine and Vepsalainen (1994) in their report revealed that it is possible to organize containers at the port to allow very high traffic rates, but there are several problems involved in the optimization of service facilities and scheduling of congested queuing networks. This situation causes low utilization of large ships and of port and land transportation facilities while occasionally leading to thousands of containers congested at the port.

Paixao and Marlow (2003), found that most of researchers conduct in port container performance is based on quantitative measures. Efficiency is very crucial in determining moves per hour for loading and unloading of container from and into the vessel. Where by productivity lays on as measurement for container moves per hour for every vessel. The researcher determines port efficiency by using Regression model. However, JIT replaces inventory and makes use of information available which attributes towards a better chain management. The result was differed by Yang's (2010) impact of the container security

initiative on Taiwan's shipping industry as he emphasized on the role played by the gates operations. Gates operations involve the two operations which are export delivery by the freight forwarders and import receiving from the yard. Gates operations depend solely on the gates utilization which aims at facilitating the smooth outgoing and incoming to and from the port. Proper gates utilization leads to efficient terminal operations.

Ward (2005) in his article "Port Congestion Relief" revealed that port capacity is all about 'velocity'. The faster the freight moves, the more the port facilities can handle on a fixed resource base. By making a better use of existing facilities, ports could avoid time consuming and difficult new development. This approach is obvious, however, ports like Dar es Salaam cargo outlet facilities such as railways operated far below the expected performance and hence called for more space to keep containers either in the port or in Inland Container Deports (ICDs). Velocity is simply distance over time Wards farther said, "at sea container freight moves at 25 knots. For example, to cover a distance of 6300 miles from Hong Kong to Los Angeles can take 11 to 12 days. But this is not the final destination, because of some constraint; this velocity will be reduced when it comes to inland transport. All the while that the container is moving at low speed, it is consuming valuable port and urban resources which are berths, terminal yards, urban roads and regional high ways. The slower it moves the more it consumes time". Therefore, we have to attack the velocity problem at all points simultaneously so that each element of the transport chain is capable of taking up the strain as neighboring links are improved.

This study is related with Twinstar case study, it revealed that the importance of quick cargo handling has been identified as a significant factor affecting profitability of shipping. An interesting question is how the loading speed could be raised in practice. The two possibilities are either to invest in port facilities or on-board cargo handling facilities. These solutions are possible in ports with sufficient container stacking space. For the case of Dar es Salaam port container stacking is now six high. Offloading the ship may be quicker, but what about loading vehicles out of the terminal to give room for other incoming containers, suppose when the first container has to be taken! This means five containers will be shifted first to give accessible to the first container. Ziaul and Hans (2018) examined the impacts of port infrastructure and logistics performance on economic growth: The mediating role of seaborne trade. The suggested factors to be considered includes optimization of cargo handling systems and equipment, improvement on labor productivity, introduction of information and technology into the port systems, standardization port process and strengthening of port infrastructures such as roads, rails and berths. Whereas Huynh (2009) in his study analyzed reducing truck turn times at marine terminals with appointment scheduling and transportation research record in Dar es Salaam Port. This case is related with Dar es Salaam Port where by congestion increases dwell time and hence causes pure port performance.

Arvis (2010), in the study of long duration of container stays in the port using the study of different ports in Africa identified the unpredictability of cargo dwell time as a major contributor to trade costs because shippers need to compensate for the uncertainty by raising their inventory levels. In other words, delay is not the only issue of importance when considering the impact of dwell time on the performance of trade; predictability and reliability of cargo dwell times are equally important because they have major impact on the total costs of trade logistics. Yeong and Jung. (2017) in their study of identifying the container ports competitiveness by examining factors in Asia and use Hierarchical Fuzzy Process to evaluate it. The study found port authority itself can not comply with all issues such as the process of unloading or loading containers from and to the vessels, store it and conduct all procedure of clearing the containers exit at the port. They also need to allow other private firms to assist them with clearance of cargo at the port so as to increase the speed of cargo clearance to avoid congestion at the port. Nwoloziri (2007), also analyzed the effects of port congestion and gave some suggestions to curb velocity problem such as extended gate hours, off- dock container yard, fast rail shuttle, integrated maritime and rail movement, and high-speed gates. However, none of the above approaches is sufficient by itself to relieve ports from congestion in a

significant way.

Okeudo, (2013) found that Ports around the world play strategic roles in the development of domestic and international trade of any country whether it is a developing or developed country. Furthermore, that in a globalized world where distances are becoming squeezed, ports play an active role in sustaining the economic growth of any maritime nation.

Nigerian Ports (2019), added that in the modern world of a fast-growing technology, ports are playing the role of an industry, not just passive actor in transportation but also in complete supply chain management and this is why it is said that "ports are more than piers" that is, more than just infrastructure or a complex infrastructure. It is essential that ports provide efficient, adequate and competitive services to the satisfaction of ship-owners and other port users including the concessionaires and host nations particularly in terms of revenue generation (Okeudo, 2013). If the ports fail, ship-owners who may see the ports too costly or too slow would likely not find it beneficial doing business in such an unproductive port. They will definitely go elsewhere to have their desired satisfaction. 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.

Bhandari (2017), revealed that ports are not only functioning as a logistics chain in transportation for inter-change, but they function as a 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 other logistics services to the industry. That is why a port needs to be treated as an industry rather than just a pier.

The effective performance of any port is essential as it functions as the main access and interface for shipping activities and plays integral roles in the logistics chain and as well as the determinant of the profitability of any given port or shipping port, hence, need to be managed efficiently to enhance overall profitability in the logistics activities (Nwoloziri, 2016).

Delay or congestion and long turnaround time of vessels at the Port is detrimental to the port and the shipping companies. These stagnations in port activities is sign of operationally inefficiency, which in turn results to longer dwell time of containers in the ports, prolong ship turnaround time, higher demurrage on importers, higher operating cost of vessels by shipping companies, inadequate berth space utilization which in turn hampers port revenue generation etc. The implication is that shippers will divert to other ports with better performance. The effects of delay on the shipping industry and Nation's economy include; high handling cost of containers, man hour lost; increased prices of consumer goods; stampede on the operations of production companies, long vessel turnaround time, which in summary would result to huge financial loss to shipping companies and overall logistics chain operations (Emeghara, Nwokedi & Nwoloziri 2018). Emenike et al. (2018), investigated the assessment of vessel traffic and customers' patronage at the rivers seaport, port harcourt, rivers state, Nigeria. The study found correlational out between the two key variables.

The concept of efficiency is very vague and proves difficult to apply in a typical port organization extending across production, trading and service industries. Ports are complex and multi-parts organizations in which institutions and functions often intersect at various levels (Onyema et al, 2015; Okeudo, 2013). There are many ways of measuring port efficiency although it could be reduced to three broad categories viz. – physical indicators, factor productivity indicators and economic and financial indicators (Taehee & Hyunjeong, 2017).

METHODOLOGY

The research design applied in this study was cross sectional research design with the aid of survey research

method. The population of the study consisted of all the staff in the four ports in Eastern Nigerian ports. Therefore, the population of the study was 1527 staff, distributed as follows:

Warri Port	=	424
Calabar Port	=	347
Port Harcourt Port	=	479
Onne Port	=	277
Total	=	1527

Source: NPA, (2023)

The sampling technique used in this study was the simple random technique. The study used Prof. Taro Yamane's Sample Size Formula to determine the sample size as follows:

$$n = \frac{N}{1+N(e)^2}$$

Where:

n = Sample Size

N = Population of the Study

e = Level of Significance selected at 5%

Accordingly; the sample size (n) for the study was calculated thus:

$n = 1527/1+1527\ (0.05)^2 = 1527/\ 4.8175 = 316.96$ i.e. 317

Sample Size = 317 staff

Data collection in this study was done through primary and secondary sources for the purpose of the study analysis.

Reliability refers to whether a repetition of the study would give the same results or not. In this study, the reliability was confirmed by conducting a confirmatory test of internal consistency on the instrument with our sample, using the Crombach alpha value with the aid of the computerize SPSS software. Hence, only result of 0.7 and above were considered acceptable.

Table 2: Test of Reliability

Construct	No of items	Alpha(α)
Port infrastructure	5	0. 793
Cargo throughputs	5	0. 921
Vessel turnaround time	5	0. 895
Total		2.609
Mean Reliability	2.609÷ 3 =	0.869

Source: Survey Data, 2023, and SPSS Window Output, Version 22.0

From the alpha results shown in the Table 2 above, the instrument is seen to be a reliable one and generally related to the subject matter examined in this study. The data collection instrument was tested for reliability using Cronbach's Alpha and the study is within the acceptance range of 0.70 and above as the overall reliability test of instruments is 0.869

In this study, percentages, ratios, frequency distribution, scaling, ranking and other statistical tools were used to analyse data. Also, Pearson Product Moment Correlation Coefficient (r) and t- test would be used to test the hypotheses formulated in the study.

RESULTS AND DISCUSSION

Port infrastructure

Table 3 gives the detailed analysis on how port infrastructure as a dimension of port operation has been examined to determine its relationship with container terminal performance in Eastern Nigerian ports and to show its descriptive statistical outcome based on the directional statements deposed.

Table 3: Port infrastructure as a Dimension of Port operations

Directional Statements	N	Mean	Standard. Deviation
The quality of interaction of staff with customers enhance container terminal performance.	302	3.2509	1.06722
Prompt, effective and efficient port services offer veritable opportunities to optimize container terminal performance.	302	3.3004	1.04418
The quality of interaction of staff with customers relate to the port operational services and influence vessel throughputs.	302	3.3286	1.03217
Passing customers' service information to all the staff together is to achieve the expected port results.	302	3.6325	.84169
There are rooms for staff to suggest new ways or approach for meeting customers satisfactorily in service.	302	3.7385	.72604
Valid N (listwise)	302		

Source: Survey Data, 2023, and SPSS Window Output, Version 22.0

Table 3 reveals that with the mean and standard deviation scores of 3.251±1.067, the respondents indicated that the quality of interaction of staff with customers enhance container terminal performance in the ports. With respect to the second statement item in this segment, it was aimed at finding how prompt, effective and efficient port services offer veritable opportunities to optimize container terminal performance. The mean score and standard deviation scores of 3.300±1.044 indicate that prompt, effective and efficient port services offer veritable opportunities to optimize container terminal performance. The 3rd statement item sought to determine whether the quality of interaction of staff with customers relate to the port operational services and influence vessel throughputs. The mean score and standard deviation scores of 3.329±1.032 show that the respondents agreed that The quality of interaction of staff with customers relate to the port operational services and influence vessel throughputs. The 4th statement item was to find whether passing customers' service information to all the staff together is to achieve the expected port results; The mean score and standard deviation score of 3.633±0.842 also imply that descriptively passing customers' service

information to all the staff together is to achieve the expected port results. In the case of the 5th item, with the mean and standard deviation scores of 3.739±0.726, the respondents agree that there are rooms for staff to suggest new ways or approach for meeting customers satisfactorily in service.

Cargo throughputs

Table 4 shows the descriptive results on cargo throughputs which is measured with five statement items on the 5-point scale. The response distribution as shown by the results is indicative that cargo throughputs will enhance container terminal performance in Eastern Nigerian ports.

Table 4: Descriptive Results on Cargo throughputs

Directional Statements	N	Mean	Standard Deviation
Effective port operations boost the container terminal performance of your port.	302	2.258	1.22354
Staff always involved in important port activities that improve container terminal performance.	302	3.3039	0.99621
Supervisors consider the opinion of others before making important decision that affects cargo throughputs	302	3.0318	0.95039
Senior port's staff discuss issues concerning the increase of cargo throughputs in port.	302	3.2544	0.98873
Cargo throughputs are often used as a key performance index (KPI) to review the effectiveness and efficiency in port.	302	3.3216	1.06481
Valid N (listwise)	302		

Source: Survey Data, 2023, and SPSS Window Output, Version 22.0

Table 4 reveals that the first statement item which borders on effective port operations boost the container terminal performance of your port had the mean score and standard deviation scores of 2.258±2.258 which imply that respondents agreed that effective port operations boost the container terminal performance of your port.

The second statement item sought to determine whether Staff always involved in important port activities that improve container terminal performance. The result showed the mean score and standard deviation scores of 2.258±0.996 indicating that the consensus opinion of the respondent is that Staff always involved in important port activities that improve container terminal performance. In the case of the 3rd statement item, the option had a statistical result of the mean and standard deviation scores of 3.032±0.951 indicating that supervisors consider the opinion of others before making important decision that affects cargo throughputs. With respect to the 4th statement item, the mean and standard deviation scores of 3.254±0.988 implying that Senior port's staff discuss issues concerning the increase of cargo throughputs in port. For the 5th statement item which sought to determine if cargo throughputs are often used as a key performance index (KPI) to review the effectiveness and efficiency in port, the mean score and standard deviation scores of 3.322±1.065. This means that the respondents agreed that cargo throughputs are often used as a key performance index (KPI) to review the effectiveness and efficiency in port.

Vessel turnaround Time

Table 5 shows how vessel turnaround time as a measure of container terminal performance in Eastern Nigerian ports was examined and is empirically expressed through the raising and descriptive analysis of 5 statement items.

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS |Volume VII Issue IX September 2023

Table 5: Descriptive Results on Vessel turnaround time

Directional Statements	N	Mean	Std. Deviation
Ports value giving satisfactory services to customers in order to engage them for patronage leading to vessel turnaround time.	302	3.3110	0.88938
Vessel turnaround time level is often used as a key performance index (KPI) to review the effectiveness and efficiency in your port.	302	3.2332	0.97597
Ports give rooms for staff to engage customers for the vessel turnaround time	302	3.2438	1.09184
Ports allow customers to make variety of choices through appropriate service engagements that elicit vessel turnaround time.	302	3.2085	1.11518
Staff in port have the requisite skills to engage customers for the increased vessel turnaround time of the of the port.	302	2.7314	0.97775
Valid N (listwise)	302		

Source: Survey Data, 2023, and SPSS Window Output, Version 22.0

Table 5 reveals that the first statement item's result indicated that ports value giving satisfactory services to customers in order to engage them for patronage leading to vessel turnaround time. This is so because the mean and standard deviation scores of 3.311±0.876 which are the evidence to prove the respondents' agreement.

The second statement item with the mean and standard deviation scores of 3.233±0.976 are indication that vessel turnaround time level is often used as a key performance index (KPI) to review the effectiveness and efficiency in your port. The third statement item has the mean and standard deviation scores of 3.244±1.0918 which implies that ports give rooms for staff to engage customers for the vessel turnaround time.

The 4th statement item also sought to determine if ports allow customers to make variety of choices through appropriate service engagements that elicit vessel turnaround time. The mean and standard deviation scores of 3.208±1.115 indicate that ports allow customers to make variety of choices through appropriate service engagements that elicit vessel turnaround time. The 5th statement item also sought to determine if rural dwellers have the requisite skills to engage commuters for the increased vessel turnaround time for the transformation of the village/community. The mean score and standard deviation scores of 2.73±0.978 indicate that staff in port have the requisite skills to engage customers for the increased vessel turnaround time of the of the port.

Statistical Test of Hypotheses and their Interpretations

The study has sought in chapter one to determine the nature of relationship between port operations and container terminal performance in Eastern Nigerian ports. As a result, six research questions and six hypotheses were raised to that effect. The next step of the study analysis sought and tested outcomes of the examined dimensions and measures of the variables in terms of relationship. Therefore, this section tested and interpreted the hypotheses formulated in this study.

Port infrastructure and cargo throughputs in Eastern Nigerian ports

A research question and a hypothesis have earlier been raised to determine the relationship that exists between port infrastructure and cargo throughputs in Eastern Nigerian ports.

Ho1: There is no significant relationship between port infrastructure and cargo throughputs in Eastern Nigerian ports.

Table 6: Results of Port infrastructure and cargo throughputs in Eastern Nigerian ports

Statistics	Port infrastructure (PI)	Cargo throughputs (CT)
Pearson correlation Port infrastructure(PI) Sig(2-tailed) N		0.893** 0.000 302
Pearson correlation- Cargo throughputs(CT) Sig(2-tailed) N	0.893** 0.000 302	

**correlation is positive and significant at the 0.05 level (2-tailed)

Source: Survey Data, 2023, and SPSS Window Output, Version 22.0

The port infrastructure and cargo throughputs result of H_{O1} shows that the rho outcome is 0.893 @ p0.000 <0.05, meaning that a strong positive relationship exists between the examined variables and it is also significant. This implies that the null hypothesis 1 (H_{o1}) is rejected and the alternate hypothesis 1 (H_{i1}) accepted, hence; "there is significant relationship between port infrastructure and cargo throughputs in Eastern Nigerian ports.

From the inferential analysis so far, it can be stated that: Port infrastructure as a dimension of port operation has a positive and significant relationship with cargo throughputs as a measure of container terminal performance in Eastern Nigerian ports. This simply means that port infrastructure has strong relationship with cargo throughputs which is one of the key performance indicators for measuring container terminal performance in Eastern Nigerian ports.

Port infrastructure and Vessel turnaround time in Eastern Nigerian ports.

A research question and a hypothesis have earlier been raised to determine the relationship that exists between port infrastructure and vessel turnaround time in Eastern Nigerian ports.

Ho2: There is no significant relationship between port infrastructure and vessel turnaround time in Eastern Nigerian ports.

Table 7: Results of port infrastructure and vessel turnaround time in Eastern Nigerian ports

Pearson correlation Port infrastructure Sig(2-tailed) N	(PI)	0.827** 0.000 302

Pearson correlation- vessel turnaround time (VTT)	0.827**	
Sig(2-tailed)	0.000	
N	302	

**correlation is positive and significant at the 0.05 level (2-tailed)

Source: Survey Data, 2023, and SPSS Window Output, Version 22.0

Table 7 above shows the results of the test of hypothesis, Ho2. The results of the hypothesis tested show strong positive relationship. Hypothesis 2 (H_{O2}) – port infrastructure and vessel turnaround time, the rho outcome of 0.827 @ p0.000 <0.05 reveals that there is a strong positive relationship between port infrastructure and vessel turnaround time in Eastern Nigerian ports and it is also significant; which means that the null hypothesis 2 (H_{o2}) is rejected and alternate hypothesis 2 (H_{i2}) accepted indicating that; "there is significant relationship between port infrastructure and vessel turnaround time in Eastern Nigerian ports".

From the inferential analysis so far, it can be stated that the outcome of the relationship between port infrastructure as a dimension of port operation and the measure of container terminal performance in Eastern Nigerian ports which is vessel turnaround time, is positive and significant. This simply means that port infrastructure is an asset and it helps to which to facilitate vessel turnaround time in Eastern Nigerian ports.

Table 8: Summary of the Results on Test of the Research Hypotheses

Research Hypotheses	Rho Value	Result	Decision
$H_{01:}$ There is no significant relationship between port infrastructure and cargo throughputs in Eastern Nigerian ports	0.893	Positive and Significant	Reject
$H_{02:}$ There is no significant relationship between port infrastructure and vessel turnaround time in Eastern Nigerian ports	0.827	Positive and Significant	Reject

Source: Survey Data, 2023, and SPSS Window Output, Version 22.0

Table 8 has revealed in summary that the study rejected all the null hypotheses and accepted the alternate hypotheses: $H_{i1:}$ There is significant relationship between port infrastructure and cargo throughputs in Eastern Nigerian ports; $H_{i2:}$ There is significant relationship between port infrastructure and vessel turnaround time in Eastern Nigerian ports.

DISCUSSION OF FINDINGS

The findings of this study were drawn from the analyses of the results in the previous section. In this section, the study discussed the findings and drew the conclusions there from.

Relationship between Port infrastructure and cargo throughputs in Eastern Nigerian ports

The findings connected to the relationship between port infrastructure and cargo throughputs in Eastern Nigerian ports revealed that port infrastructures are used to achieve container terminal performance objectives in Eastern Nigerian ports. A critical assessment of the finding reveals that a strong, positive and significant relationship exist between port infrastructure and cargo throughputs leading to container terminal

performance in Eastern Nigerian ports with rho value of 0.893. Port infrastructure facilitates the possibility of improving efficiency and effectiveness in the management of cargo throughputs (Bao & Chunxia, 2018). The critical role that port infrastructure plays in favouring the economic development of a country or region is well established. The finding of the study in this regard aligns and agrees strongly with the position of Ziaul and Hans (2018) as they submit that port infrastructure is the necessary condition for efficient cargo handling operations and adequate infrastructure is needed to avoid congestion, foster trade development as well as securing deep-sea container connectivity for economies heavily dependent on international trade. Taehee and Hyunjeong (2017) revealed that port infrastructure, however, needs to be complemented by efficient hinterland transport connections if the port is to fully exploit its potential as growth catalyst and supply chain node. The study found that it is not uncommon for development projects to focus exclusively on enhancing the infrastructural capabilities of the port, without adequate consideration of the benefits arising from the cargo throughputs in the ports.

The finding of the study reveals that the operational staff of Nigerian Port Authority agreed that the dwindling variation experienced over the last ten (10) years were as a result of unfavourable government policies; ranging from high of shipment to Eastern Ports, operational challenges such as berthing space, security threats; piracy attacks, choice of Port for clearance by cargo owners and delay in vessel turnaround time at various Port. The study found out that Eastern Ports such as Onne, Rivers, Delta and Calabar seaports have noticeable improved vessel turnaround time, dwell time and berthing spaces in that order of operational advantages. It is in view of these similar findings above that Emenike, Amamilo and Ajayi (2018) assert that the maritime industry has been performing quite well except in recent time where government policies are having an adverse effect on vessel traffic, which is the essence of any maritime sector. Their findings are in line to the current study survey, which revealed that seaport terminal operators acknowledged the fact of Eastern seaports across the nation is operating at 30 percent to 40 percent of its usual capacity.

The study found that prompt, effective and efficient port services offer veritable opportunities to optimize container terminal performance in Eastern ports. This finding is very essential in the optimization of cargo throughputs in ports. This study agrees with the stance of Yeong and Jung (2017) that as port capacity cannot be developed as rapidly as increases in demand, any overcapacity is eventually exhausted and episodes of congestion ensue even in the most efficient terminals. This calls for a phased but continuous and well-coordinated effort in expanding container capacity at terminals. Terminal operations are affected not only by the larger number of vessel calls but also by the increased variability of call sizes and cargo throughputs.

The study also, found that the quality of interaction of staff with customers relate to the port operational services and influence vessel throughputs. Gertjan and Bart (2018) found that the urgency of looking at port and terminal development in conjunction with their hinterland connectivity is exacerbated by the pressure on container terminals to increase their efficiency levels resulting from the rapid growth of containerizedcargo traffic flows and their increased variability.

Kokila and Abijath (2017) argue that this measure concentrates container flows on a few mega-ports, in turn impacting berth and crane productivity of the terminal and adding pressure on hinterland links, often with adverse effects on congestion and the environment.

Surykant and Ranjit (2017) opine that generally, port infrastructure is divided into physical and soft elements. Physical infrastructure includes not only the operational facilities such as the number of births, the number of cranes, yards and tugs and the area of storage space, but also the intermodal transport such as roads and railways. Whereas, the soft infrastructure refers to the manpower employed. Maximum deployment of both types will assist in reducing vessel turnaround, thereby increasing the terminal capacity to accommodate more containers. Ships are continually increasing their carrying capacity and

container made for large transport units in overseas container transport are under consideration. The study found that this scale enlargement requires new and capital-intensive transshipment facilities in gateway ports. Particularly, inter-modality is essential for the speedy transport of cargoes into and out of port. Without proper linkages, the efficiency of container terminal operation may decline due to congestion and delays.

The study found that port infrastructure offers veritable opportunities to optimize port operation as it helps to build cargo throughputs and vessel turnaround time. The implication of this finding is that without sufficient port infrastructure work in the port will be hampered and cargo throughputs would shrink drastically.

Relationship between Port infrastructure and Vessel Turnaround Time in Eastern Nigerian ports

A critical assessment of the finding reveals that positive and significant relationship exist between port infrastructure and vessel turnaround time that aid container terminal performance in Eastern Nigerian ports with rho value of 0.827. Gertjan and Bart (2018) found that port infrastructures play significant role in fastening vessel turnaround time as they aid in quick and efficient discharging of vessels for subsequent journeys. When port infrastructure is properly provided it encourages speedy vessel turnaround time in port. Emenike et al. (2018) note that vessel turnaround time maintains a continuous increase in trend alongside cargo throughput and port revenue, utility derivable by ship operators (port customers) for port service consumption cannot be maximized but may rather decline. Filani and Shomoyiwa (2009) posit that since the cargo stays longer in port or at berth it means that more money is paid for time wastages due to poor infrastructural condition and low services. Port authorities in this case loose customers and subsequently revenue.

The study found that vessel turnaround time is often used as a key performance index (KPI) to review the effectiveness and efficiency in ports. The provision of adequate port infrastructure allows the vessel turnaround time to be on the speedy lane. Filani and Shomoyiwa (2009) argue that the port infrastructure policy implication is that Nigeria port's charging system is such that ship operators pay more as they spend longer time in port and pay less when time spent in port/berth decreases. However, the increasing trend in vessel turnaround time in the Nigerian ports is evidence that investment in necessary port infrastructure that quickens vessel handling and reduces time stay at berth is still inadequate.

Also, Hee and Doo (2018) found that robust port investment policy is needed to push the consciousness of the port authority to the need for routine investment in port infrastructures and drive them to make such investments, so that more vessels can be worked on in lesser time period. Such a policy must recognize that port revenue levels are directly affected more by cargo traffic, vessel traffic and turnover while ship turnaround time affects directly port choice by operators and vessel traffic. Port investment policy that recognizes the role of adequate provision of port infrastructure will thus cause decline in ship turnaround time, while improving cargo throughput and port revenue

The study revealed that port effective capacity utilisation offers genuine opportunities to optimize cargo throughputs in the port and that there are opportunities to develop the staff on the use of sophisticated port infrastructure to achieve efficiency and attract customers to the port. Kokila and Abijath (2017), see vessel turnaround time as the process needed for loading, discharging and servicing a vessel from berthing until vessel's departure. This period starts from actual arrival of a vessel at berth to its actual departure from the berth. The way of measuring vessel turnaround

SUMMARY, CONCLUSION AND RECCOMENDATIONS

This study examined the relationship between port infrastructure and performance of Eastern Nigerian ports.

The study adopted the descriptive and inferential statistical techniques in the investigation of the operational relationship between the variables. The study used structured questionnaire instrument to collect data from the respondents.

Summary

The study found that port infrastructures are veritable assets for achieving container terminal performance in Eastern Nigerian ports. The study also revealed that the quality of interaction of staff with customers enhances container terminal performance and that prompt, effective and efficient port services offer real opportunities to optimize container terminal performance.

The study found that there is no political will on the part of government to provide enough infrastructure for the smooth running of the ports.

The study also revealed that the quality and quantity of infrastructures in the port are good indicators to elicit efficient operational services and influence vessel throughputs

Conclusion

This study has been embarked upon to empirically examine the relationship between port operation and container terminal performance in Eastern Nigerian ports. The port operations indicators that were assessed included port infrastructure, cargo handling equipment and port automation while container terminal performance was measured with cargo throughput, and vessel turnaround time. Apart from the fact that the findings of this study could guide the policy and decision making of government particularly in ports operations and generally in shipping, it has revealed that effective port operations are important in boosting container terminal performance in Nigeria.

From the test of the hypotheses in this study it is evident and conclusive that:

- Port infrastructure as a dimension of port operations has strong relationship with cargo throughputs which is one of the key performance indicators for measuring container terminal performance in Eastern Nigerian ports.
- Port infrastructure is an asset which facilitates vessel turnaround time in Eastern Nigerian ports.

Recommendations

This study examined the relationship between port operations and container terminal performance in Eastern Nigerian ports. Based on the findings and conclusions of the study, the following recommendations have been made:

1. Port management should make haste to ensure that all impediments to the provision of port infrastructures that would guarantee the optimization of cargo throughputs in ports are removed.
2. Government of Nigeria needs to engage in huge investments to expand the port infrastructures such as roads, adequate berthing facilities, wharves, yard capacity, quayside, railway, as well as expand the hinterland road network. These port infrastructures are the key stimuli for vessel turnaround time, effectiveness and efficiency in the port.
3. The port authorities should invest more on training and development of staff and employees on the maintenance of port infrastructures. This will also minimize some of the human errors and duplications of business processes that normally occur on the job site and allow for effective staff that would work to improve cargo throughputs in the ports

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Computing Pearson Product Moment Correlation Coefficient Between Port Infrastructure (X) and Cargo Throughputs (Y) In Ports in The Eastern Region of Nigeria

The stated hypotheses are as follows:

H_0: $\rho_s = 0$: There is no significant correlation between port infrastructure and cargo throughputs (y) in ports in the eastern region of Nigeria;

H_1: $\rho_s \neq 0$: There is a significant correlation between port infrastructure and cargo throughputs (y) in ports in the eastern region of Nigeria;

Correlations

			Port Infrastructure	Cargo Throughputs
Spearman's rho	Port Infrastructure	Correlation Coefficient	1.000	.893**
		Sig. (2-tailed)	.	.000
		N	302	302
	Cargo Throughputs	Correlation Coefficient	.893**	1.000
		Sig. (2-tailed)	.000	.
		N	302	302
**. Correlation is significant at the 0.01 level (2-tailed).				

Source: SPSS version 22.0 Output window

From the SPSS output window, the correlation coefficient of the variables x and y is 0.893.

INTERPRETATION

This positive large value of *r* (= 0.893) says that there is a strong positive correlation between Port infrastructure (x) and Cargo throughputs (y) in ports in the eastern region of Nigeria.

Because of the positive value of *r* direction is said to be the same: That is, as one increases, so also does theother.

Since the p-value (= 0.000) is less than the level of significance, α (= 0.05), we therefore, reject the nullhypothesis and conclude that:

H_1: $\rho_s \neq 0$: There is a significant correlation between port infrastructure and cargo throughputs (y) in ports in the eastern region of Nigeria;

COMPUTING PEARSON PRODUCT MOMENT CORRELATION COEFFICIENT BETWEEN PORT INFRASTRUCTURE (x) AND VESSEL TURNAROUND TIME (y) IN PORTS IN THE EASTERN REGION OF NIGERIA

The stated hypotheses are as follows:

H_0: $\rho_s = 0$: There is no significant correlation between port infrastructure and vessel turnaround time (y) in ports in the eastern region of Nigeria;

H_1: $\rho_s \neq 0$: There is a significant correlation between port infrastructure and vessel turnaround time (y) in ports in the eastern region of Nigeria;

Correlations				
			Port Infrastructure	Vessel Turnaround Time
Spearman's rho	Port Infrastructure	Correlation Coefficient	1	.827**
		Sig. (2-tailed)	.	0
		N	302	302
	Vessel Turnaround Time	Correlation Coefficient	.827**	1
		Sig. (2-tailed)	0	.
		N	302	302
**. Correlation is significant at the 0.01 level (2-tailed).				

Source: SPSS version 22.0 Output window

From the SPSS output window, the correlation coefficient of the variables x and y is 0.827.

INTERPRETATION

This positive large value of r (= 0.827) says that there is a strong positive correlation between Port infrastructure (x) and Vessel turnaround time (y) in ports in the eastern region of Nigeria.

Because of the positive value of r direction is said to be the same: That is, as one increases, so also does the other.

Since the p-value (= 0.000) is less than the level of significance, α (= 0.05), we therefore, reject the null hypothesis and conclude that:

H_1: $\rho_s \neq 0$: There is a significant correlation between port infrastructure and vessel turnaround time (y) in ports in the eastern region of Nigeria;