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Cargo Handling Equipment and Efficient Cargo Delivery in Nigerian Ports

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Abstract: *This study examined the relationship between cargo handling equipment and efficient cargo delivery in Nigerian Ports. The study adopted the cross-sectional survey in its investigation of the variables. Primary source of data was generated through self- administered questionnaire. The population of the study was 2,416 employees of six ports in Nigeria including Abuja office. The sample size of 344 was determined using the Taro Yamane's formula for sample size determination. The reliability of the instrument was achieved by the use of the Cronbach Alpha coefficient with all the items scoring above 0.70. Data generated were analyzed and presented using both descriptive and inferential statistical techniques. The hypotheses were tested using the Spearman's Rank Order Correlation Statistics. The tests were carried out at a 95% confidence interval and a 0.05 level of significance. The study findings revealed that cargo handling equipment positively and significantly influences efficient cargo delivery in Nigerian Ports. The result of the findings further revealed that tractor-trailer system, and heavy duty forklift system gave rise to efficient cargo delivery in Nigerian Ports. The study recommends that management of ports in Nigeria should devise strategies for successful operation of handling equipment which should involve devising ways to compensate for a number of factors that, individually or in combination, act to reduce the efficiency of their equipment.*

Keywords: *Marine Pollution, Maritime Environment, Oily-Water, Shipping Terminals*

INTRODUCTION

Cargo handling equipments are used to transport goods and materials from one location to another. Cargo handling equipment vehicle varies according to cargo type. Cargo handling equipment are employed widely in marines and railways for the transportation of heavy goods, containers, and components. Cargo handling equipment Vehicle generally comprises cranes, container handlers, yard tractors and forklifts (Sislian, Jaegler & Cariou, 2016).

The global cargo handling equipment market can be segmented based on propulsion, equipment type, application, and region. Based on propulsion, the cargo handling equipment vehicle market can be classified into diesel, electric, and hybrid. In terms of propulsion, the diesel segment accounts for a prominent share of the market. Based on equipment type the market can be segmented into Conveyer, Forklift, Truck, Aviation Dolly, Automated Guided Vehicles (AGV), Crane and various others.

Also, Sislian, Jaegler and Cariou (2016), highlight the regional outlook and segments the market into four main regions, Americas (Canada, Mexico, USA), Europe, Asia-Pacific and Row (Argentina, Russia, Brazil). Each of the regions is further divided into various countries. Asia-

Pacific is the largest market for cargo handling equipment market. China is the global leader in cargo handling equipment capacity and accounted for nearly 30% of the total cargo handled in 2017. The high cargo handling equipment capacities of the ports in China is driving the growth of the market in Asia Pacific. This trend is likely to continue in the coming years, leading to an increase in the demand for cargo handling equipment as well as automation at ports is expected in the region in coming years.

The assumption of the study on cargo handling equipment is a facilitating apparatus that determines level of port performance. It is common knowledge that ports play a key role in economic growth and development. Similarly, European Union (2013) reported that nearly 75% of the trade worldwide is handled in ports. This implies that effective cargo handling leads to positive outcomes to port performance and countries economic growth and development.

According to Sislian, Jaegler and Cariou (2016) the process of cargo clearance in its international standards should take three to four days. But this is not the case in African port where the processes take 15 days to three weeks. Their assumption is that dwell time and clearance time are major commercial instruments used to attract cargo and revenues. In a similar manner, Alderton and Saieva (2013) notes that cargo handling is the backbone of a port. This is in line with Rigot (2012) who suggest that the port performance indicators that focus on the cargo-handling are very important in evaluating the performance of a port. Based on the analysis provided above no one can deny that cargo handling equipment have effects to port performance. Therefore, more plans and efforts geared towards developing cargo handling equipment at ports should be given a priority. This is due to the fact that Tongzon (2007) recognized that there are factors influencing the decisions to route cargo through a certain port over the other.

As noted by Esmer (2008) ports have become an intersection node in logistic chains, in which goods engage in additional operations taking advantage of proximity or their stay in transit to other places. Hence, port efficiency is an important requirement in order to survive in the competitive world of shipping industry. Different facilities in the port are expensive to run and purchase. Hence, under-utilizations will result in capital loss and higher cost for running the port. Vessel tracker (2012) shows that cargo clearance at port is a serious problem. While UNCTAD (2012) noted that internationally, it should take between two to three days to clear the cargo, but in Nigeria it takes between ten to seventeen days for customers to clear their local imports and transit imports through.

Some of the reviewed literatures suggest that many ports are facing similar problems related to cargo handling equipment. One of the main reasons for this shift as explained by Kiwanuka (2013) resulted from poor cargo handling equipment. It is noted that cargo clearance at the port are surrounded with several problems including the delay in clearance. Therefore, since maritime trade in Africa on domestic economies, accounts for more than 90% of the continent's imports and exports, ports therefore play a fundamental role in facilitating Africa's integration to international trade. However, with reference to the fact explained above it seems that cargo handling equipment in Nigeria port have been given little attention. The assumption is that Nigeria has the opportunity to become a vital International Hub for landlocked countries such as Uganda, Rwanda, Burundi and DRC. The general shift in trade to the East (China and India) is likely to be beneficial to Nigerian sea ports in the form of increasing demand (Sislian, Jaegler & Cariou, 2016).

The various activities within the maritime sector of any nation's economy could be seen as the life wire for growth and development. Shipping operations being a major aspect of maritime transport remain the most effective means of transportation in the international exchange of goods. The primary function of a seaport is to transfer cargo between maritime and inland transport, quickly, efficiently and at a reasonable cost (Stephens and Ukpere, 2011), with the aid of various equipment designed to handle specific types of cargo for transhipment. Cargo transfer efficiency can be enhanced with the use of adequate cargo handling equipment.

The purpose of the study was to examine the relationship between cargo handling equipment and efficient cargo delivery in Nigerian Ports.

Furthermore**,** this study was guided by the following research question:

i. To examine the relationship between tractor-trailer system and efficient cargo delivery in Nigerian Ports.
ii. To examine the relationship between heavy duty forklift and efficient cargo delivery in Nigerian Ports.
iii. To examine the relationship between crane system and efficient cargo delivery in Nigerian Ports.

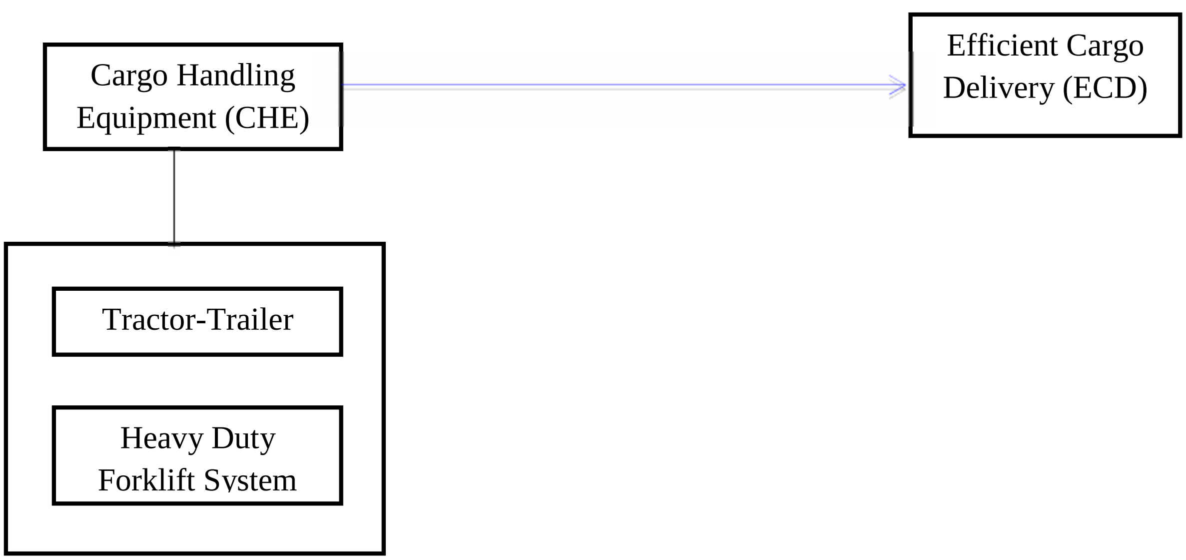

Figure 1.1: Conceptual Framework of Cargo Handling Equipment and Efficient Cargo Delivery Time in Nigerian Ports

Source: Desk Research (2019).

LITERATURE REVIEW

Theoretical Foundation

Queuing Theory

Large numbers of ports are facing some challenges related to cargo handling equipment especially delay in cargo clearance and delivery. It is assumed that this delay leads to port congestions. In so doing queuing theory can best explain the impact of this delay through its concepts such as waiting line and its impacts to service provision and delivery. Queuing theory is the mathematical study of waiting lines, or queues. In queuing theory, a model is constructed so that queue lengths and waiting time can be predicted. The Theory has its origins in research by Agner Krarup Erlang in 1909 when he created models to describe the Copenhagen telephone exchange. János (2012) explain that Queuing theory deals with one of the most unpleasant experiences of life, waiting and queuing are quite common in many fields. According to him, queuing theory was raised by calls, Erlang was the first who treated congestion problems in the beginning of 20th century by using queuing theory.

The theory also can be used for performance measurements. To characterize a queuing system, we have to identify the probabilistic properties of the incoming flow of requests, service times and service disciplines (János, 2012). The arrival process can be characterized by the distribution of the inter-arrival times of the customers, denoted by A (t), that is:

A (t) = P (inter-arrival time < t).

In queuing theory these inter-arrival times are usually assumed to be independent and identically distributed random variables. The other random variable is the service time, sometimes it is called service request, work. Its distribution function is denoted by B(x), that is: B(x) = P (service time < x).

The theory shows that the service times, and inter-arrival times are commonly supposed to be independent random variables. The theory continues to explain that the structure of service and service discipline tell us the number of servers, the capacity of the system, that is the maximum number of customers staying in the system including the ones being under service (János, 2012). The service discipline determines the rule according to which the next customer is selected. The most commonly used laws are FIFO - First in First Out: who comes earlier leaves earlier; LIFO – Last In First Out: who comes later leaves earlier; RS - Random Service: the customer is selected randomly and priority.

It is important to note here that, the aim of all investigations in queuing theory is to get the main performance measures of the system which are the probabilistic properties that is distribution function, density function, mean, variance of the following random variables: number of customers in the system, number of waiting customers, utilization of the server/s, response time of a customer, waiting time of a customer, idle time of the server, busy time of a server (János, 2012). Of course, the answers heavily depend on the assumptions concerning the distribution of inter arrival times, service times, and number of servers, capacity and service discipline. It is quite rare, except for elementary or Markovian systems, that the distributions can be computed. Usually their mean or transforms can be calculated (János, 2012).

Cargo Handling Equipment

As used in this study cargo refers in particular to goods or produce being conveyed generally for commercial gain either by ship, boat or aircraft (Jean-Francois *et al*, 2015). Nonetheless, the term is now often extended to cover all types of freight including that carried by train, van, track and intermodal container. On the other hand, the term is also used in case of goods in the cold chain, because the perishable inventory is always in transit towards a final end use, even when it is held in cold storage or other similar climate-controlled facility.

On the other hand, Cambridge Dictionaries online defined cargo handling equipment as an activity of moving goods on and off ships, planes, trucks (Cambridge University Press 2015). This implies Multi-modal container units, designed as reusable carriers to facilitate unit load handling of the goods contained. They are also referred to as cargo, especially by shipping lines and logistics operators. Cargo handling equipment includes equipment used to move cargo (containers, general cargo, and bulk cargo) to and from marine vessels, railcars, and on road trucks. The equipment typically operates at marine terminals or at rail yards and not on public roadways or lands. This inventory includes cargo handling equipment of 25 hp or greater using diesel, gasoline, or alternative fuels.

Due to the diversity of cargo, there is a wide range of equipment types. The majority of the equipment can be classified into one of the following equipment types: Forklift. Rubber tired gantry (RTG) crane, Side handler, Sweeper, Top handler, Tractor-Trailer, Heavy Duty Forklift, Straddle-Carrier, Yard Tractor and others.

Sislian, Jaegler and Cariou (2016) posited that Cargo Handling Equipment (CHE) includes all the equipment at ports, rail yards, and warehouse distribution centers used to either handle freight or perform other on-site activities such as maintenance or repair activities. Cargo handling equipment is as diverse a group of equipment as the cargo that it handles and the tasks it performs. Cargo that arrives and/or departs by ship, truck, or train, can include liquid, bulk (break bulk and dry bulk), and containers. Liquid cargo, such as petroleum products and chemicals, are often transported via pipelines, and therefore, do not usually have mobile CHE associated with their operation. Break bulk cargo, such as lumber, steel, machinery, palletized material, and dry bulk cargo, such as cement, scrap metal, salt, sugar, sulfur, and petroleum coke, are handled using loaders, dozers, cranes, forklifts, and sweepers. Container cargo, which is the most common type of cargo at ports and intermodal rail yards, are handled using yard trucks, rubber-tired gantry (RTG) cranes, rail-mounted gantry cranes (RMGs), top picks, side picks, forklifts, and straddle carriers.

The most common type of cargo handling equipment at ports and intermodal rail yards is a yard truck. Yard trucks are also known as yard goats, utility tractor rigs (UTRs), hustlers, yard hostlers, and yard tractors. Yard trucks are very similar to heavy-duty on-road truck tractors, but historically, the majority has been equipped with off-road engines. Yard trucks are designed for moving cargo containers. They are used at container ports and intermodal rail yards as well as distribution centers and other intermodal facilities. Containers are loaded onto the yard trucks by other container handling equipment, such as rubber-tired gantry cranes, top picks, or side picks, and they are unloaded the same way. In addition to loading and unloading operations, yard trucks are used to move containers around a facility (yard) for stacking and storing purposes (Spasovic, 1999).

A number of conventional methods for handling cargo are available and are worth mentioning since they might be capable of providing at least a partial solution to the transfer problem. These methods include Burton, Housefall, Highline, helicopter, crane, and special purpose container crane. It should be emphasized that all of the above (except the Housefall method) have a common, basic disadvantage that once the cargo is even slightly lifted from the deck, it becomes pendulous and hence potentially dangerous. Thus, any improvement must provide some method of eliminating the unwanted free motion of the cargo - i.e., the same constraints which were originally supplied by the friction between the deck and the cargo must then be supplied by the transfer method once the cargo is free of the deck. Further, any method which does not use the ship as a reference (i.e. , not mounted on the ship) must also provide for some type of heave compensation (Sislian, Jaegler & Cariou, 2016).

Burton, Housefall, and highline methods are roughly similar in that a line is passed between ship and platform and suspended from some high point at each end. All have the advantage that the ship may undergo any motion during transfer, but the Burton and Highline methods still have the basic disadvantage discussed above (i.e., a pendulous cargo). One major advantage of the Housefall method is that the Housefall block may be raised and lowered. This permits a mini-mum pendulous length for the suspended cargo, and advanced versions of the Housefall block mechanism are under study at Hunters Point Naval Ship-yard. The Highline method has been adapted by the San Francisco Bay Naval Shipyard in developing a method for transferring cargo from ship to a beach head (Spasovic, 1999). The method was felt to be successful although no attempt was made to test it in heavy seas. A major disadvantage of all three methods is that a large percentage of the load carrying capacity of the line is used to keep the cargo up and out of the water, and the cargo is only a small percentage of the load capacity of the line. Typical maximum load capacities vary from 3,500 lb to 12,000 lb - the latter being of fair amount but still falling short of being able to support a 20 tonne container.

The Tractor-Trailer system

The Tractor-trailer system in which containers are both handled and stored on ‘’over the road’’ chassis or terminal trailers, and are moved around terminal by heavy duty tractor units. So far as **dry bulk cargoes** are concerned, handling facilities may be in the form of power-propelled conveyor belts, usually fed at the landward end by a hopper (a very large container on legs) or grabs, which may be magnetic for handling ores, fixed to a high capacity travel1ing crane or travel1ing gantries (Alderton,2008). These gantries move not only parallel to the quay, but also run back for considerable distances, and so cover a large stacking area, and are able to plumb the ship's hold. These two types of equipment are suitable for handling coal and ores. In the case of bulk sugar or when the grab is also used, the sugar would be discharged into a hopper, feeding by gravity a railway wagon or road vehicle (Rowbotham, 2008).

Figure 2.1: Trailer-Tractor Equipment

Source: Air Resource Board (2015). Technology assessment: Mobile cargo handling equipment. *California environmental protection agency publication*, 1-

A **tractor** is an engineering vehicle specifically designed to deliver a high tractive effort (or torque) at slow speeds, for the purposes of hauling a trailer or machinery used in agriculture or construction. Most commonly, the term is used to describe a farm vehicle that provides the power and traction to mechanize agricultural tasks, especially (and originally) tillage, but nowadays a great variety of tasks. Agricultural implements may be towed behind or mounted on the tractor, and the tractor may also provide a source of power if the implement is mechanized (Rowbotham, 2008).

The word *tractor* was taken from Latin, being the agent noun of *trahere* "to pull (Talley, 1994). The first recorded use of the word meaning "an engine or vehicle for pulling wagons or ploughs" occurred in 1896, from the earlier term "traction engine" (1859) there are many types of tractors. But the main types are crawler and rubber wheeled tractors (Alderton, 2008).

In parallel with the early portable engine development, many engineers attempted to make them self-propelled – the fore-runners of the traction engine. In most cases this was achieved by fitting a sprocket on the end of the crankshaft, and running a chain from this to a larger sprocket on the rear axle. These experiments met with mixed success (Talley, 1994). The first proper traction engine, in the form recognisable today, was developed in 1859 when British engineer Thomas Aveling modified a Clayton & Shuttleworth portable engine, which had to be hauled from job to job by horses, into a self-propelled one. The alteration was made by fitting a long driving chain between the crankshaft and the rear axle (Rowbotham, 2008).

Heavy Duty Forklift System

Heavy duty Forklift or front-end loader system**,** in which heavy duty forklift trucks are used to perform quay transfer and yard operation, called direct system or in combination with other equipment called relay system.

A forklift (also called lift truck, jitney, fork truck, fork hoist, and forklift truck) is a powered industrial truck used to lift and move materials over short distances. The forklift was developed in the early 20th century by various companies, including Clark, which made transmissions, and Yale & Towne Manufacturing, which made hoists. Since World War II, the use and development of the forklift truck have greatly expanded worldwide. Forklifts have become an indispensable piece of equipment in manufacturing and warehousing. In 2013, the top 20 manufacturers worldwide posted sales of $30.4 billion, with 944,405 machines sold (Itsuro, 2003).

Forklifts are rated for loads at a specified maximum weight and a specified forward center of gravity. This information is located on a nameplate provided by the manufacturer, and loads must not exceed these specifications. In many jurisdictions, it is illegal to alter or remove the nameplate without the permission of the forklift manufacturer. An important aspect of forklift operation is that it must have rear-wheel steering. While this increases maneuverability in tight cornering situations, it differs from a driver’s traditional experience with other wheeled vehicles. While steering, as there is no caster action, it is unnecessary to apply steering force to maintain a constant rate of turn.

Another critical characteristic of the forklift is its instability. The forklift and load must be considered a unit with a continually varying center of gravity with every movement of the load. A forklift must never negotiate a turn at speed with a raised load, where centrifugal and gravitational forces may combine to cause a disastrous tip-over accident. The forklift is designed with a load limit for the forks which is decreased with fork elevation and undercutting of the load (i.e., when a load does not butt against the fork "L"). A loading plate for loading reference is usually located on the forklift. A forklift should not be used as a personnel lift without the fitting of specific safety equipment, such as a "cherry picker" or "cage" (Jose & Tongzon, 2007).

Figure 2.2: Forklift

Source: Air Resource Board (2015). Technology assessment: Mobile cargo handling equipment.

California environmental protection agency publication, 1-8

Forklifts are a critical element of warehouses and distribution centers. It's imperative that these structures be designed to accommodate their efficient and safe movement. In the case of Drive-In/Drive-Thru Racking, a forklift needs to travel inside a storage bay that is multiple pallet positions deep to place or retrieve a pallet. Often, forklift drivers are guided into the bay through guide rails on the floor and the pallet is placed on cantilevered arms or rails. These maneuvers require well-trained operators. Since every pallet requires the truck to enter the storage structure, damage is more common than with other types of storage. In designing a drive-in system, dimensions of the fork truck, including overall width and mast width, must be carefully considered (Air Resource Board, 2015).

Figure 2.3: Dedicated container forklift of the HMNZS Canterbury vessel of the New Zealand Navy

Source: Air Resource Board (2015). Technology assessment: Mobile cargo handling equipment. *California environmental protection agency publication*, 1-8

Forklift hydraulics are controlled either with levers directly manipulating the hydraulic valves or by electrically controlled actuators, using smaller "finger" levers for control. The latter allows forklift designers more freedom in ergonomic design. Forklift trucks are available in many variations and load capacities. In a typical warehouse setting, most forklifts have load capacities between one and five tons. Larger machines, up to 50 tons lift capacity, are used for lifting heavier loads, including loaded shipping containers (Branch, 2007).

In addition to a control to raise and lower the forks (also known as blades or tines), the operator can tilt the mast to compensate for a load's tendency to angle the blades toward the ground and risk slipping off the forks. Tilt also provides a limited ability to operate on non-level ground. Skilled forklift operators annually compete in obstacle and timed challenges at regional forklift rodeos.

The following is a list, in no particular order, of the more common lift truck types (Jose & Tongzon, 2007): Hand pallet truck – no onboard power system of any kind; the operator's muscle power is used to jack-up and move loads. Walkie low lift truck – powered pallet truck, usually electrically powered, Rider low lift truck- usually electrically powered, Towing tractor – may be internal combustion engine or electrically powered, Walkie stacker – usually electrically powered, Rider stacker – usually electrically powered, Reach truck – variant on a Rider Stacker forklift, designed for small aisles, usually Electrically Powered, named because the forks can extend to reach the load. There are two variants, moving carriage, which is common in North America, and moving mast which is common in the rest of the world, and generally regarded as safer (Itsuro, 2003).

A lot of terminal or port cargo handling equipment is provided to facilitate movement of the cargo to and from the ship's side and the transit shed, warehouse, barge, railway wagon or road vehicle. These include two-wheeled hand barrows and four-wheeled trucks either manually or mechanica1ly propelled, and mechanically or electrica1ly propelled tractors for hauling four- wheeled trailers. Ro-ro trailers are moved by tug-masters or ro-ro tractors. There are also belt conveyors mechanically or electrically operated, or rollers, all perhaps extending from the quayside to the transit shed, warehouse, railway wagon or road vehicle. Containers are loaded and unloaded by means of the quayside container cranes, i.e. container gantries also called shiptainers (Air Resource Board, 2015).

Empirical Studies

A search for literature has shown that several attempts had been made by scholars to contribute knowledge to the development of the maritime industry in Nigeria. Several studies had also been undertaken by erudite researchers across different maritime economies of the world. Past studies were extensive in that they covered both port and shipping operations of different maritime nations of the world. Olaogbebikan, Njoku, Faniran and Okoko (2014) carried out an evaluation of the performance of Nigerian ports before and after concession policy of the year 2006. The study found that cargo throughput has continued to increase from 2006 probably as a result of the concession policy.

Ndikom's (2013) evaluation of the challenges and opportunities for shipping lines services in Nigeria concluded that a significant relationship existed between government policies and shipping operations; the activities of pirates and the profitability of shipping lines; and that adequate cargo handling machines led to faster turn-round time of vessels at seaports. The focus of the study of Stephens and Ukpere (2011) was to establish the relationship between land transport systems in the country of destination and the turn-around time, capacity utilisation of port infrastructure, facilities and cargo-handling equipment and general port performance. Using Apapa Port Complex as a case study, Emaghara and Ndikom (2012) linked delays at seaports in Nigeria to inadequate functional cargo handling equipment as the most critical factor causing delays at the port. The researchers concluded as follows: "though the private operators have invested resources in the procurement of cargo handling equipment in both quantity and quality, the result is not yet significant because private terminal operators still rely mostly on the outdated and obsolete equipment inherited from Nigerian ports authority (NPA) during the concession arrangement". It is evident that private terminal operators no longer depend on the outdated and obsolete equipment inherited from NPA as the results of their investment has yielded into equipment with new technologies that requires special technical know-how. The high technical demand of the new equipment is throwing a lot of challenges at efficient operation of cargo handling equipment at the port's terminals (Gidado, 2015).

Alderton (2013) has studied the role of cargo handling equipment to port performance. Their main concern was why cargo spends weeks in Sub-Saharan African ports. Their findings suggest that there is a problem of cargo handling equipment in many of the African ports. In fact, their findings influence the will to undertake the study of this kind as they noted that; the case of cargo dwell times is an illustration of a more general problem in African port developments. Most, if not all, the binding constraints to grow such infrastructure are the result of an equilibrium in which certain actors cause of problem. One of the resulting problems is the delay in cargo clearance and delivery.

According to them, the process of cargo clearance in its international standards should take three to four days. But this is not in case of African port where the processes take 15 days to three weak. Their assumption is dwell time and clearance time is a major commercial instrument used to attract cargo and revenues. There has major concern worldwide about the role of cargo handling equipment to port performance. In so doing several researchers, author and organization have attempted to research about this topic. One among them is Rigout (2012), in his study on the effect of container terminal concessions on port performance; analyzed the way cargo handling equipment contributes to port performance. In a similar manner Du, Wang, Tripathi and Lam (2016), explain that the backbone of ports is cargo handling equipment. His study continues to note that the port performance indicators that focus on the cargo-handling product are very important to analyze. The study provides three possible indicators concerning cargo-handling products. However, it is noted that Port throughput is the most widely used in the port industry since it can be measured uniformly. Also, port throughput, to a large extent, is a determinant for the other port performance indicators. For example, the size of logistics space depends on port throughput volumes. If a port has higher throughput volumes, the logistics capacity has to increase with the throughput volumes.

According to him, this also applies for the value added generated in the ports and the port related employment. Other potential indicators can be found in Chung's division of indicators Denis (2014) states that to evaluate the operational performance, the ship turn-around time is a good indicator. However, the ship turn-around time does, in its basic form, not mean much. The vessels‟ length of stay depends on the volume of the cargo, the available facilities and the composition of the cargo (Chung, 1993). Tonnage handled per ship day or ship hour is obtained by dividing the port throughput measured in tonnages by the total number of hours that the vessels are in the port. Chung furthermore states that the asset performance is influenced by the total port throughput: generally, this is measured as total throughput divided by the meters of quay or number of berths. To make the financial performances comparable with other ports, they are stated relatively, meaning in ratio to the port throughput. In general, the other port indicators are (indirectly) determined by port throughput.

Likewise, the literature by Talley (2007) provides important information about cargo handling equipment to port performance worldwide. The study assumes that performance indicators are choice variables for optimizing the port's economic objective. As noted by Tongzon (1995) using port throughput as port performance is based on the assumption that ports try to maximize throughput. Traditionally the performance of ports has been evaluated by comparing the actual throughput with its optimum throughput (Talley, 2007). However, " if performance indicator standards are unknown, a port's performance can be evaluated just by knowing the actual values of its performance indicators".

UNCTAD (2012) have also discussed about cargo handling equipment to port performance worldwide. Their assumption is cargo handling equipment plays a key role in the port performance and subsequently in economy and development. The study continues to note worldwide large percent of trade is handled in ports. This implies that cargo handling equipment through port is the most efficient way in logistics and transportation.

In a similar manner Song and Allen (2013) have also studied about the factors influences port performance. The findings of his study suggest that berth utilization, frequency with which shipping lines call at a port, geographical location of a port and economic activities of a port hinterlands influences performance of a port. Though this study agrees with him on the above outlined factors, his analysis has not considered the importance or contribution of cargo handling equipment factors to port performance. The assumption is business environment around ports have changed rapidly competition among port has become intense. In this case, this study aimed at analyzing the contribution of cargo handling equipment to port performance because.

Therefore, the summary derived from above empirical literature review worldwide shows that cargo handling equipment is the backbone of port. Hence, its performance indicators is determined by the following performance indicators such as the size of logistics space on port throughput volumes, the port related employment, the operational performance and the ship turn-around time is a good indicator. Others include vessels‟ length of stay, the available facilities and the composition of the cargo and the tonnage handled per ship day or ship hour is obtained.

The study, the study by Kiwanuka (2013) shows that, despite the fact that Dar es Salaam port favored with geographical location and other services relevant to port operation, yet, recently, several countries and customers shifted to Mombasa. However, the study suggests for improving efficiency in cargo handling equipment as a necessary condition in improving the port performance. Therefore, similar to the role of cargo handling equipment to port performance worldwide, it seems also the backbone of port in Africa is cargo handling. Another study by African Development Bank (2010) explained about the contribution of cargo handling equipment to port performance. The study suggests that approximately 80 percent of world merchandise trade carried by ships, maritime transport remains by far the most common mode of international freight transport.

Resulting from the empirical studies, the following hypotheses are hereby stated to be tested:

Ho_1: There is no significant relationship between tractor-trailer system and efficient cargo delivery in Nigerian Ports.

Ho_2: There is no significant relationship between heavy duty forklift system and cargo turnaround time in Nigerian Ports.

METHODOLOGY

The study adopted the cross-sectional survey in its investigation of the variables. Primary source of data was generated through self- administered questionnaire. The population of the study was 2,416 employees of six ports in Nigeria including Abuja office. The sample size of 344 was determined using the Taro Yamane's formula for sample size determination. The reliability of the instrument was achieved by the use of the Cronbach Alpha coefficient with all the items scoring above 0.70. Data generated were analyzed and presented using both descriptive and inferential statistical techniques. The hypotheses were tested using the Spearman's Rank Order Correlation Statistics. The tests were carried out at a 95% confidence interval and a 0.05 level of significance.

DATA ANALYSIS AND RESULTS

The level of significance 0.05 was adopted as a criterion for the probability of accepting the null hypothesis in ($p > 0.05$) or rejecting the null hypothesis in ($p < 0.05$).

Table 1 Correlation matrix for Tractor-Trailer System and efficient cargo delivery

			Tractor-Trailer System	Efficient Cargo Delivery
Spearman's rho	Tractor-Trailer System	Correlation Coefficient	1.000	.740**
		Sig. (2-tailed)	.	.000
		N	325	325
	Efficient Cargo Delivery	Correlation Coefficient	.740**	1.000
		Sig. (2-tailed)	.000	.
		N	325	325

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Research Data 2019, (SPSS output version 23.0)

Ho$_{1:}$ There is no significant relationship between tractor-trailer system and efficient cargo delivery in Nigerian Ports.

Table 1 shows the result of correlation matrix obtained for tractor-trailer system and efficient cargo delivery. Similarly displayed in the table is the statistical test of significance (p - value), which makes possible the generalization of our findings to the study population. From the result obtained in table 1 above, the correlation coefficient (rho) showed that there is a significant relationship between tractor-trailer system and efficient cargo delivery. The correlation coefficient of 0.740 confirms the extent and strength of this relationship and it is significant at p 0.000<0.01. The coefficient represents a strong correlation between the variables. Therefore, based on empirical findings the null hypothesis earlier stated is hereby rejected and the alternate upheld. Thus, there is a significant relationship between tractor-trailer system and efficient cargo delivery in Nigerian Ports.

Table 2 Correlation for Heavy Duty Forklift System and measures of efficient cargo delivery

			Heavy Duty Forklift	Efficient Cargo Delivery
Spearman's rho	Heavy Duty Forklift	Correlation Coefficient	1.000	.818**
		Sig. (2-tailed)	.	.000
		N	325	325
	Efficient Cargo Delivery	Correlation Coefficient	.818**	1.000
		Sig. (2-tailed)	.000	.
		N	325	325

**. Correlation is significant at the 0.01 level (2-tailed).

Source: Research Data 2019, (SPSS output version 23.0)

Ho$_{2:}$ There is no significant relationship between heavy duty forklift and efficient cargo delivery in Nigerian Ports.

Table 2 shows the result of correlation matrix obtained for tractor-trailer system and efficient cargo delivery. Similarly displayed in the table is the statistical test of significance (p - value), which makes possible the generalization of our findings to the study population. From the result obtained in table 1 above, the correlation coefficient (rho) showed that there is a significant relationship between tractor-trailer system and efficient cargo delivery. The correlation coefficient of 0.818 confirms the extent and strength of this relationship and it is significant at p 0.000<0.01. The coefficient represents a strong correlation between the variables. Therefore, based on empirical findings the null hypothesis earlier stated is hereby rejected and the alternate upheld. Thus, there is a significant relationship between tractor-trailer system and efficient cargo delivery in Nigerian Ports.

DISCUSSION OF FINDINGS

Discussion of Findings

The findings of the study revealed that there is a significant relationship between cargo handling equipment and efficient cargo delivery in Nigerian Ports using the Spearman Rank Order Correlation tool and at a 95% confidence interval. The findings of this study confirmed the views of Olaogbebikan, Njoku, Faniran and Okoko (2014) carried out an evaluation of the performance of Nigerian ports before and after concession policy of the year 2006. The study found that cargo throughput has continued to increase from 2006 probably as a result of the concession policy.

Also, the current finding is in line with Ndikom's (2013) evaluation of the challenges and opportunities for shipping lines services in Nigeria concluded that a significant relationship existed between government policies and shipping operations; the activities of pirates and the profitability of shipping lines; and that adequate cargo handling machines led to faster turn-round time of vessels at seaports. The focus of the study of Stephens and Ukpere (2011) was to establish the relationship between land transport systems in the country of destination and the turn-around time, capacity utilisation of port infrastructure, facilities and cargo-handling equipment and general port performance. Using Apapa Port Complex as a case study, Emaghara and Ndikom (2012) linked delays at seaports in Nigeria to inadequate functional cargo handling equipment as the most critical factor causing delays at the port. The researchers concluded as follows: "though the private operators have invested resources in the procurement of cargo handling equipment in both quantity and quality, the result is not yet significant because private terminal operators still rely mostly on the outdated and obsolete equipment inherited from Nigerian ports authority (NPA) during the concession arrangement". It is evident that private terminal operators no longer depend on the outdated and obsolete equipment inherited from NPA as the results of their investment has yielded into equipment with new technologies that requires special technical know-how. The high technical demand of the new equipment is throwing a lot of challenges at efficient operation of cargo handling equipment at the port's terminals (Usman, 2015).

Kiwanuka (2013) used a case study approach to analyze the effects of cargo handling equipment to port performance. His findings showed that there is a problem in cargo handling equipment especially in the port of Dares Salaam. Among the greatest problem identified are cargo clearances. The study continues to note that in the port of Dar es Salaam it takes between ten to fifteen days for one to clear the cargo. He identified that several countries which were served their cargo to Dares Salaam port were now shifted to Mombasa. This is different from port in Western countries, as noted by UNCTAD (2012) that at international standard cargo clearance should take between two to three days.

CONCLUSION

Cargo handling equipment enhances such as aspects of port operation as schedule of arriving vessels, allocation of wharf space and quay crane resources to service the vessels. They similarly enhance ship operations, especially loading and unloading of cargoes (Somuyiwa and Akindele, 2015). The efficiency of terminal operations is important for cargo transhipment that will ensure Nigeria ports comply with the 48 hours cargo clearance rule of the International Maritime Organisation (IMO). Cargo handling equipment is important at the port because the pieces determine the operations at the quay and moreover in the sheds. In the port, the equipment used includes mobile cranes, forklifts and betotti. These, though still in use in ports of the world they need to be supplemented in the port with modern equipment to be efficient. Modern ships require modern equipment for operations because of their design. Based on the findings, this study concludes that cargo handling equipment significantly influences efficient cargo delivery in Nigerian Ports.

RECOMMENDATIONS

i. Management of ports in Nigeria should devise strategies for successful operation of handling equipment which should involve devising ways to compensate for a number of factors that, individually or in combination, act to reduce the efficiency of their equipment. This should be done with a view to avoiding misuse of equipment, while adequate workshops and spare parts are provided.

ii. Management of ports in Nigeria should provide the technical know-how for efficient operation of equipment through training and retraining of staff. This should be complemented by the provision of workshop facilities and spare parts capable of bringing about servicing and maintenance of equipment.

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