



Influence of Private Port on Efficiency of Ports in Nigeria

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ABSTRACT

This study examined the relationship between private port and efficiency of ports in Nigeria. The predictor variable is private port, and the criterion variable (efficiency of ports) was measured with berth occupancy rate, vessel turnaround time and cargo dwell time. The theories that underpinned the study included: Queuing theory and stakeholder theory. Cross-sectional/survey design was used for the study. Data for the study were obtained by using primary and secondary sources and a structured survey questionnaire was used as the research instrument to elicit data from the respondents. The target population of the study consisted of all the six ports in Nigeria. The sample elements of the study consisted of 23 Managers/Officers/Supervisors from each of the six ports totaling 138 staff. A sample of 138 copies of questionnaire were distributed to the respondents from the six ports in Nigeria, and 114 copies of questionnaire were retrieved from them. After editing them, 112 copies of questionnaire representing 81% response rate were found useful for the study analysis. Specifically, Pearson Products Moment Correlation Coefficient (r) was used to test the hypotheses with the aid of SPSS 25.0. The reliability of the research instrument was tested using the Cronbach Alpha. The study revealed that private port influences port administration leading to port efficiency and that high berth occupancy is a sign of congestion (>70%) and hence decline of services, while low berth occupancy signifies underutilization of resources (<50%). The study concluded that: Private port significant relates with berth occupancy rate ($r = 0.718$), vessel turnaround time ($r = 0.646$) and cargo dwell time ($r = 0.529$) of ports in Nigeria. This study, therefore, recommended that as private port management model elicits port performance, including profitability, efficiency and effectiveness, the port authority control should be through an internal organization of the port itself and not by government supervision.

Keywords: Private Port, Efficiency of Ports, Berth Occupancy Rate, Vessel Turnaround Time, Cargo Dwell Time

INTRODUCTION

In most developing countries, port management efforts have been hampered by lack of public finance and managerial resources (Rodrigue, 2020). These challenges have been exacerbated in the environment of globalization, production, distribution, technological changes in ship design, and cargo handling methods, which have induced considerable demand on port resources (Sorgenfrei, 2018). Thus, to provide funding and management philosophy needed to reposition ports in line with the new challenges, the port administration of most countries opted for reforms in the port sector. The focus of these reforms was on identification of optimal financing and managerial models for public ports based on national peculiarities and reform objectives (Akinyemi, 2016). There are five main port management models based on the respective responsibility of the public and private sectors. They include the public service port, the tool port, the landlord port, the corporatized port, and the private service port (Zhang *et al.*, 2019).

Effective port management, similarly, enhances sea trade, especially loading and unloading of cargoes (Eniola, 2014). The efficiency of terminal operations is important for cargo transshipment that ensures Nigeria ports comply with the 48 hours' cargo clearance rule of the International Maritime Organisation (IMO). However, Yusuf (2017) submits that there has been little improvement over time on the efficiency and productivity of Nigeria ports management in meeting the IMO stipulation on cargo clearance. By the submission of Akinyemi (2016) the Federal government of Nigeria, adopted the landlord port model which brought about concessioning of port terminals to private operators. Despite high investments in terminal facilities by the private terminal operators, there are still complaints about level of service offered to port users. The contribution of port management in port efficiency has been inadequately researched and documented. However, the little knowledge which is available suggests the needs to undertake the study of this kind. Nigerian ports are said to be performing better than it were before the reform. However, comparatively, it is still obvious that there is no competitiveness among the ports because of poor management. Therefore, this research focuses on the examination of the relationship between port management models and efficiency of ports in Nigeria.

However, comparatively, it is still obvious that there is no competitiveness among the ports in Nigeria. Some ports are still performing below expectation in spite of the concession of the ports. Administration and implementation of the rules and regulations among strategic port components and stakeholders have not yielded the required results (Yusuf, 2017). The formation of policies, plans and procedures, setting up of goals and objectives, enforcing rules and regulations which are the functions of administration could be perfected through any of the port management models. However, the attainment of

operational efficiency in ports through private port) being examined has remained a critical and puzzling issue. Hence, the study seeks to assess the relationship between private port and efficiency of ports in Nigeria.

Objectives of the Study

The main purpose of this study was to empirically examine the relationship between private port and efficiency of ports in Nigeria. In line with this, the study seeks to achieve the following specific objectives:

- i. Assess the extent to which private port relates to berth occupancy rate of ports in Nigeria.
- ii. Examine how private port relates to vessel turnaround time of ports in Nigeria.
- iii. Ascertain the extent to which private port relates to cargo dwell time of ports in Nigeria.

Research Questions

The following research questions was answered in this study:

- i. To what extent does private port relate to berth occupancy rate of ports in Nigeria?
- ii. To what extent does private port relate to vessel turnaround time of ports in Nigeria?
- iii. To what extent does private port relate to cargo dwell time of ports in Nigeria?

Research Hypotheses

This study investigated the relationship between landlord port and port efficiency in Nigeria. Accordingly, the following hypotheses relating to the purpose and problems of the study have been formulated for investigation:

- Ho₁: There is no significant relationship between private port and berth occupancy rate of ports in Nigeria.
- Ho₂: There is no significant relationship between private port and vessel turnaround time of ports in Nigeria.
- Ho₃: There is no significant relationship between private port and cargo dwell time of ports in Nigeria.

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 stakeholders' theory of port management. Also, the literature review has captured concepts like- landlord port, port efficiency, berth occupancy rate, vessel turnaround time, cargo dwell time and empirical studies.

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

In the context of queuing theory (Hillier & Gerald, 2014; Sundarapandian, 2009), 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 (Enyioko, 2016). 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 Helix (2013) 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 ($n = 0, 1, 2, \dots$).

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

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. This birth-and-death process illustration as shown in the figure 1 leads directly to the formulae that measure the performance of this queuing system.

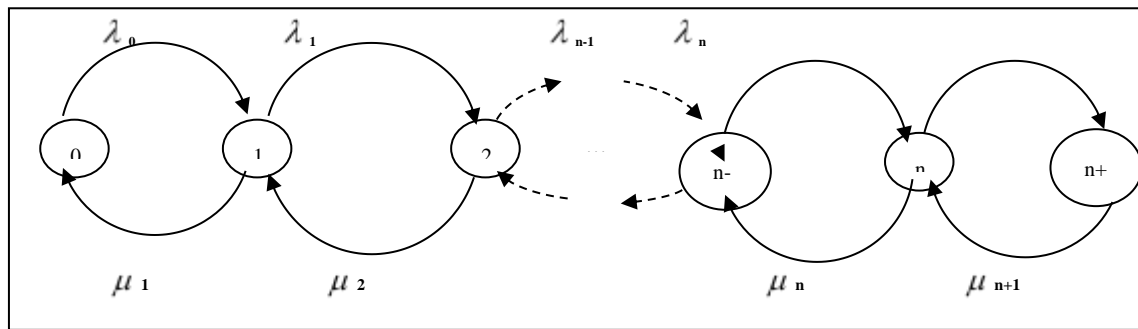


Figure 1: Rate Diagram for the Birth-and-Death Process

Source: Sundarapandian, V. (2009). Queueing Theory: Probability, Statistics and Queueing

Theory. *PHI Learning*, 33(5) 519-527

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 (Enyioko, 2016). The approach is based on the rate-equality principle (Medhi, 2005) 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. 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 ($n = 0, 1, 2, \dots$), and mean entering rate = mean leaving rate (Schwartz, 2015).

Sundarapandian (2009) pointed out the application of Queuing theory to curb port congestion problem at Tin Can Island Port in Nigeria, Hillier and Gerald (2014) 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 handle 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.

Stakeholder Theory in Port Management

Stakeholder theory's popularity in port management studies has been very profound (Ha *et al.*, 2017; Zhang *et al.*, (2018).; Dooms, 2018). These studies include a wide variety of internal stakeholders, for example, those actors who are directly part of the port administration organisation, shareholders, managers, employees, unions, and external stakeholders. The latter group includes actors ranging from economic players directly investing in the port area (for example, concessionaries, freight forwarders, carriers and port service providers) to firms or institutions located in the foreland or hinterland (for example, shippers and multimodal transport operators), cruise and ferry passengers, public policy stakeholders and regulators, as well as local community and societal groups of interest.

Port stakeholders constitute groups and individuals interested in the activities and outcomes of a port as an organisation and on whom the port relies for achieving its objectives. For example, customers of the various actors in the complex port value chain constitute one group of stakeholders, for example, they have an economic stake. Suppliers and employees are examples of other stakeholders with an economic stake in ports. Stakeholders might also have an equity stake in the firm, including the port authorities and the two large multinational companies, such as MPS consortium shareholders. In addition, stakeholders may simply be interested in what the firm does because it influences them somehow, even if it is not a direct market effect (Cong *et al.*, 2020).

Special interest groups, for instance, try to influence firm decisions in conformance with their agendas. Stakeholder coalitions often form around particular issues because stakeholder interests tend to be interconnected. Various stakeholder groups receive any organisational action favourably or unfavourably. The influencer stakeholder highlights a critical point: just because a stakeholder is interested in the organisation does not necessarily mean that the organisation is particularly interested in that stakeholder. In other words, there is no universally accepted definition of who merits classification as a legitimate stakeholder from the organisation's perspective (Zaucha & Kreiner, 2021).

Another way to determine which stakeholders should receive primary attention is the principle of fairness. This principle suggests that the organisation's legitimate stakeholders should include voluntarily accepted resources. Acheampong *et al.* (2022), reported the primary stakeholders' legitimacy, including employees, customers, financiers, suppliers and local communities. Their integral link to the value-creating processes of the organisation makes them primary. Secondary stakeholders can dramatically influence an organisation but typically are not a part of the firm's operating core. Examples of secondary stakeholders include the government, the media, special interest groups, consumer advocate groups and competitors.

Stakeholder theory received criticism early in its development from people, who claimed that it advances the position that all stakeholders should have equal standing with the firm. While it may be true that stakeholder theory advocates moral and just treatment of all a firm's stakeholders, it does not argue that all stakeholders are equal. This is especially pertinent concerning the resources an organisation devotes to serving particular stakeholders and the value it allocates to returns. Fairness would suggest that more value and attention should be allocated to stakeholders central to the organisation's objectives and who contribute the most to the firm's value-creation processes (Notteboom & Winkelmans, 2002).

Therefore, indiscriminately disclosing information to other stakeholders, or even worse, the public, on 'sensitive' matters such as cost breakdowns, things that no commercial entity would ever disclose even to its shareholders, might be counterproductive to the long-term well-being of the port. In an increasing number of ports worldwide, the most significant part of the documentation produced by the port authority is, by law, uploaded to the organisation's website (Geerts & Dooms, 2017). Such documentation, among other information, includes executive decisions and tenders, qualified suppliers, concessions and authorisations, maintenance plans, technical department designs, budgets and much more (Notteboom & Haralambides, 2020).

Conceptual Review

This section reviews such concepts as private port, port efficiency, berth occupancy rate, vessel turnaround time, and cargo dwell time.

Conceptual Framework

This study is interested in intellectualizing landlord port as the umbrella for the conceptual framework of the study. This conceptualization has been adopted from the earlier works of Acheampong *et al.*, (2022), Ma *et al.*, (2021) and Brooks *et al.*, (2020) as depicted in Figure 2.

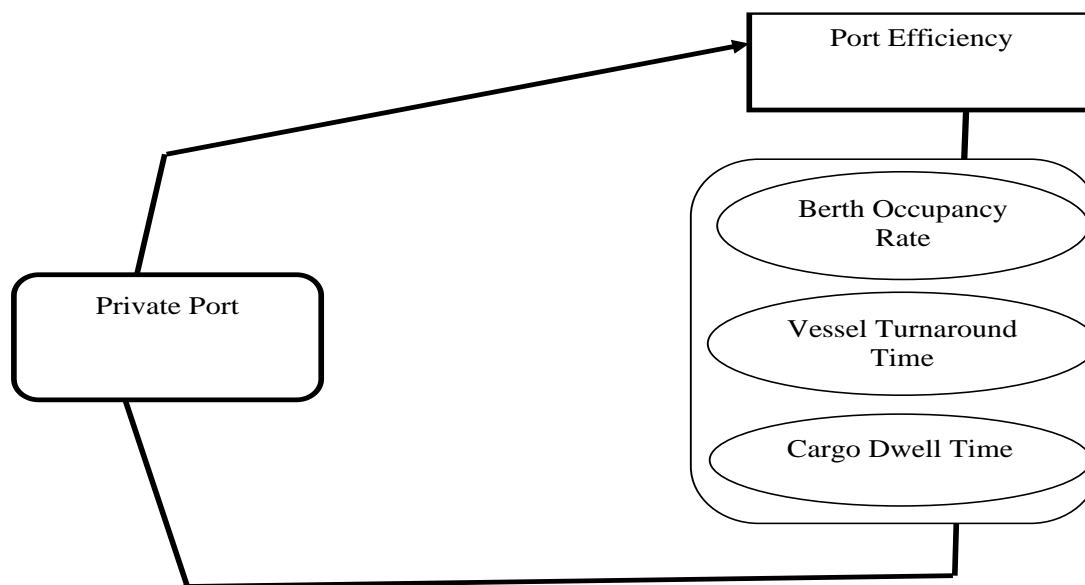


Figure 2: Conceptual Framework of the Relationship between Private Port and Port Efficiency in Nigeria

Sources: Acheampong *et al.* (2022). Stakeholder legitimacy and efficiency: The case of innovation at the Port of Tema, Ghana. *International Journal of Business and Global Trade* 30(1),92–110.

Ma *et al.* (2021). Port integration and regional economic development: lessons from China. *Transport Policy* 110:430–439.

Researcher's Review of Relevant Literature, (2023).

Private Port

When choosing the best form to introduce private participation in the organization of Port services there are several alternatives depending on Port size, initial condition and the type of services considered among the different possibilities, the following can be mentioned (Burns, 2015): i. Selling the seaport as a whole (full privatization). Using this form all assets and liabilities are transferred to the private sector, which can be justified by serious focal needs from the public sector. ii. Transferring to the private sector part of the seaport for their development by the private operators (build operate) and own, (BOO). Short - term financial needs justify the use of this form of privatization. iii. Introducing private participation in the Ports in order to build or renovate facilities required for services provision (Build/ Rehabilitate, Operate and Transfer, (BOX) or (ROT).

In this case, the public sector does not lose ownership of the Port infrastructure, and even those new facilities built by the private firms are transferred to the public sector after a specified period of time, this is the case of classical concessions. iv. Creating a new independent port, from the combinations of efforts of two or more firms, joint ventures. This type of agreement arises when two parties with common interest join forces. Thus, for example, in some cases a firm can supply technology and know-how, between Port authorities and private firms, as in the cases of Shanghai China), Kelany (Manaysia), and other Asian Ports with large investment projects, where Port authorities have formed many joint ventures to develop and operate new terminals. In other cases, collaboration may be found between several public firms, as in the example of the Singapore Ports Authority with the authority of Dalian,

you develop and operate a container terminal in the Port of rent Port of Dayaowo (China) (Burns, 2015). v. Leasing: In some cases, Port authorities simply rent Port assets to be used by private operators during a fixed period, and thus they obtain income from contract fees, contrary to concession contracts, in this case private firms are usually not required to make investments; therefore, they only assure commercial risks. Some Ports facilities such as storage buildings or cranes are rented by operators under this scheme. vi. Licensing: In this case the Port authority allows operators to provide some services which only require relatively simple equipment, and these assets are generally owned by private operators. Infrastructure is provided for these operators to use it, generally for some specified fee, and in some cases, they may use some superstructure element owned by the Port authority stevedoring companies, pilots, tug operators or consignees can work under this type of agreement. A simple form of introducing private participation in a port is by contracting out the port management.

In this situation, the Port authority is the owner of infrastructure and Port facilities, but decisions on its running are taken by a private firm which can provide a more commercial risk are in this case faced by the public sector, such management do not invest their own capital in the Port (Acheampong *et al.*, 2022). In Port of British (U.K) is an example of this type of contract, where facilities are owned by the local government, but the Port is managed privately. When choosing among the options in the list above to determine which is the best alternative for a particular Port, the Port objectives must be considered. The type of service may determine the possible degree of private participation. A basis determinant would be to consider whether the services require the exclusive use of a Port fixed assets (Burns, 2015).

Under this model, too often the fully privatized port takes the form of a private service port. Unlike other management systems or port models, port land including superstructures and infrastructures is fully owned by the private sector or company. In this type of model, one of the key highlights is the complete transfer of land ownership from the public sector/government to the private sector. Additionally, some governments may turn the regulatory authority over to the private sector (World Bank, 2019).

Fully privatized ports are few and seldom found around the world in port settings today. For example, countries like the United Kingdom (U.K.) and New Zealand are the best and most modern examples of the fully privatized port model. Many scholars and reformers have referred to this model as the extreme form of port reform (World Bank, 2019). The Fully Privatized model signifies that the government or state does not have at least any interest port management. Unlike the other port models, in a fully privatized port, the land is owned by a private company. The danger under this arrangement is that port land sold to private companies or firms may be of major national security concern (Burns, 2015).

Port Efficiency

Port efficiency is a multi-dimensional concept that refers to operational performance, particularly the maximization of the produced output or the production of a given output with limited possible resources. It has expanded to include additional dimensions of port performance. Ancor *et al.*, (2016) define efficiency as the ability to achieve an end goal with little to no waste, effort, or energy. Being efficient means, achieving results by putting the resources available in the best way possible. Several careful literature reviews have disclosed numerous aspects that occupy port research involving efficiency evaluation (Al-Eraqi *et al.*, 2008; Demirel, *et al.*, 2012).

Efficiency can be broken down further in terms of its technical and allocative nature. Port efficiency (PE) analyses the ability of a port to obtain the maximum output under a given number of inputs. Therefore, gains in efficiency represent an improvement in performance closer to optima (Suarez-Aleman *et al.*, 2016). PE is a keen component of port performance (Notteboom *et al.*, 2021). Several authors studied the effects of PE on transportation cost, trade, port competition, and socio-economic issues.

Port performance indicators (PPIs) is simply defined as a measured aspect of a port's operation to maximize berth occupancy rate and economic objectives (UNCTAD 2016). Hence a cost-effective port must achieve optimum and technical efficient (TE) throughput to meet its goals (Shetty and Dwarakish 2018; Talley 2006). A port performance measurement depends on several PPIs that affect regional competitiveness and optimum throughput. These factors may vary depending on the port location and region; however, the essential Port performance indicators (PPIs) are berthing capacity, storing capacity, loading/unloading equipment, floor size, and the number of gates lanes (Melalla *et al.*, 2016). Nevertheless, the standard measurement of port performance is related to several factors such as vessel dwell time (DT), loading/unloading the cargo, quality storage, and inland transport (Shetty and Dwarakish 2018).

Berth Occupancy Rate

Occupancy ratio plays an important role in port planning and port master plan design. The number of berths should be established based on operational requirements, driven primarily by berth occupancy considerations (Gani, 2017). The optimum berth occupancy depends on throughput requirements and site constraints. The assessment of the berth occupancy is based on the consideration of vessel arrival and departure times, time at berth or vessel turnaround time, downtime caused by maintenance, and severe environmental conditions (stopping of loading and/or vessel leaving the berth) (Figueiredo De Oliveira & Cariou, 2015). This parameter is obtained as the function of berth occupancy, number of births, number of containers, waiting and service times and berthing and unberthing times (CEPAL 2019).

Various methods and approaches are presented in references and standards for definition of berth occupancy ratio. For example, this ratio is presented in PIANC mainly in term of yearly working times that results an average value of occupancy ratio in a year (Clark *et al.*, 2004).

Çelebi (2017) defines berth occupancy rate in term of weekly working and service hours which may results various values for seasons and every month in a year. In addition to design stage and port planning, occupancy ratio is used to evaluate in service port performance in order to planning and performance optimization purpose. Berth occupancy studies help the designers to plan a terminal in optimum throughput, traffic condition and ship

waiting time. Low value of berth occupancy ratio is not acceptable to the port authority from economically point of view, while the high value leads to traffic congestion and increase of ship waiting time. The optimum range of 30-90 and 40-70 percent are given in terms of number of berth and cargo type (container, bulk and liquid bulk) in the related standards (Jung, 2011). Berth occupancy is the ratio of time the berth is occupied by a vessel to the total time available in that period. High berth occupancy is a sign of congestion (>70%) and hence decline of services, while low berth occupancy signifies underutilization of resources (<50%) (Talley, 2017).

Vessel Turnaround Time

Turnaround times directly impacts port container performance from both economic and operational point of view (Sarriera, 2015). 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 (Pérez *et al.*, 2016).

The vessel turnaround time can vary depending on many factors: ships' particulars such as size, and type, and speed of service being provided to ship operators. The larger the vessel, the longer the ship-turn round time tends to be. Similarly, a general cargo vessel with many small consignments and different packaging requires a longer services time and thus longer turnaround time compared to a Ro/Ro vessel with only one type of cargo, mainly vehicles. On the other hand, it is obvious that the faster the service provided to the ship operator, the shorter the vessel turnaround time will be. Therefore, it is more logical to present the average turn round time of each type of ship (Talley, 2017).

Turnaround times directly impacts port container performance from both economic and operational point of view (Kraemer, 2021). 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 (Bhadury, 2016). Based on statistics provided by CEPAL (2020) for a certain period, ships' turn-around time is equivalent to the ships' service time at berth as there is 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 (Çetin *et al.*, 2017). 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. Gani (2017) submits that vessel turnaround time is the average time the unit (vessel) spends in the system.

Cargo Dwell Time

Cargo dwell time (CDT) is the amount of time a cargo or ship spends within a port (Rodrigue & Notteboom 2021). It is also an indication of the efficiency levels of a seaport (Notteboom *et al.*, 2021). DT impacts port productivity and efficiency; thus, reducing DT will improve port productivity. Port productivity is used frequently to measure and compare the performance of a firm's ratio of output over input, while PE analyses the ability of a port to obtain the maximum result under a given amount of input (Suarez-Aleman *et al.*, 2016; Talley 2017). Several authors studied the relationship between DT and port productivity. Shetty and Dwarakish (2018) reviewed the relationship between performance parameters and the port's productivity. PPI's data was retrieved from the new Mangalore port from 1990 to 2015. Results revealed a strong negative correlation between idling time at berth, turnaround time of a vessel, and idle time at berth to the port's productivity.

Aminatou *et al.* (2018) studied the impact of long cargo Cargo dwell time (CDT) on port performance. A shipment level analysis was conducted using original and extensive data on container imports in the Port of Douala, Cameroon. They investigated why containers stay an average exceeding two weeks at berth. Their findings revealed that internal factors such as the logistics performance of consignees, port operations, and the efficiency of customs clearance operations and external factors such as customs procedures, shippers, and shipping lines were the main contributors to long Cargo dwell time (CDT). Hassan *et al.*, (2017) analyze the Cargo dwell time (CDT) of containers at container terminals in Indonesia. Root Cause Analysis and Problem Tree framework analyzed operational data and interviews. The results from the simulation revealed that container handling equipment had a significant impact on DT. Finding also revealed that most DT was contributed by a prolonged time of containers stay at the terminal yard (Aigner *et al.*, 1977).

The assertion that the cargo dwell time of ports is largely influenced by a national and/or regional situation was confirmed by the positive influence of GDP per capita and of the number of calls on cargo dwell time. However, three composite indices about logistics performance, port infrastructure quality, and global connectedness, did not play a statistically significant role on cargo dwell time (Ndikom, 2013).

Empirical (Private Port and Port Efficiency)

The conservative port authority focuses on managing and implementing actions passively and mechanistically. The 'facilitating' port authority assumes itself as mediator and partner between economic and social interests, seeking to become involved in strategic regional partnerships. The 'business' port authority combines features of facilitator with the attitude of an investor, service provider and consultant (Pardali & Michalopoulos, 2008; Kalgora *et al.*, 2019). The intra-port competition regulation is an important characteristic of the port governance model and can be more oriented to (a) liberalization of port services; (b) limitation of port service providers; or (c) to monopoly on port services (World Bank 2019). The Port Managers/Harbour Managers/Officers' selection process is an important factor and can influence port performance. The managers can be appointed by national politicians, local politicians, recurring to a technical tender or appointed by the port community (Kraemer, 2021).

Kraemer (2021) observed that fully privatized ports (which often take the form of a private service port) are few in number and can be found mainly in the United Kingdom (U.K.) and New Zealand. Full privatization is considered by many as an extreme form of port reform. It suggests that the state no longer has any meaningful involvement or public policy interest in the port sector. In fully privatized ports, port land is privately owned, unlike the situation in other port management models. This requires the transfer of ownership of such land from the public to the private sector. In addition, along with the sale of port land to private interests, some governments may simultaneously transfer the regulatory functions to private successor companies. In the absence of a port regulator in the U.K., for example, privatized ports are essentially self-regulating. The risk in this type of arrangement is that port land can be sold or resold for non-port activities, thereby making it impossible to reclaim for its original maritime use. Moreover, there is also the possibility of land speculation, especially when port land is in or near a major city. Furthermore, sale of land to private ports may also sometimes raise a national security issue (Pagano *et al.*, 2012).

Ugboma, *et al.* (2007) analyzed service quality in two Nigerian ports. They collected data on ports using a questionnaire, which was given to port users and was developed from focus groups and the literature. Finally, Rugman and Verbeke (1993) applied Porter's diamond to the port industry, concluding that the port's position in the market is determined by six main factors: (a) factor conditions; (b) demand conditions; (c) related and supporting industries; (d) the strategy of competitors; (e) chance; and (f) government. Also, Park and De (2004) examined an alternative approach to efficiency measurement of seaports and found strong and significant relationship between privatized port and port efficiency in Panama.

Kalgora (2019) conducted a study on strategic container ports competitiveness analysis in West Africa using data envelopment analysis (DEA) model, revealed that when Port Managers/Harbour Managers/Officers, or other port positions, are chosen on friendship basis or political closeness, good results cannot be expected and over staffing can influence performance. It is possible to distinguish the type of Management Control exercised over the port authority: (a) internal control, (b) financial and investment control, government control, (c) management KPIs, monitored monthly or quarterly by government, and (d) Total control and decision dependence of the central government or another entity (Zaucha & Kreiner, 2021).

Burns (2015) maintained that governments create control mechanisms that reduce ports independence, but they should instead create autonomous bodies of supervision hence the need for port privatization. Based on these empirical studies, this thesis hypothesizes that: Ho₁: There is no significant relationship between private port and berth occupancy rate of ports in Nigeria. Ho₂: There is no significant relationship between private port and vessel turnaround time of ports in Nigeria. Ho₃: There is no significant relationship between private port and cargo dwell time of ports in Nigeria.

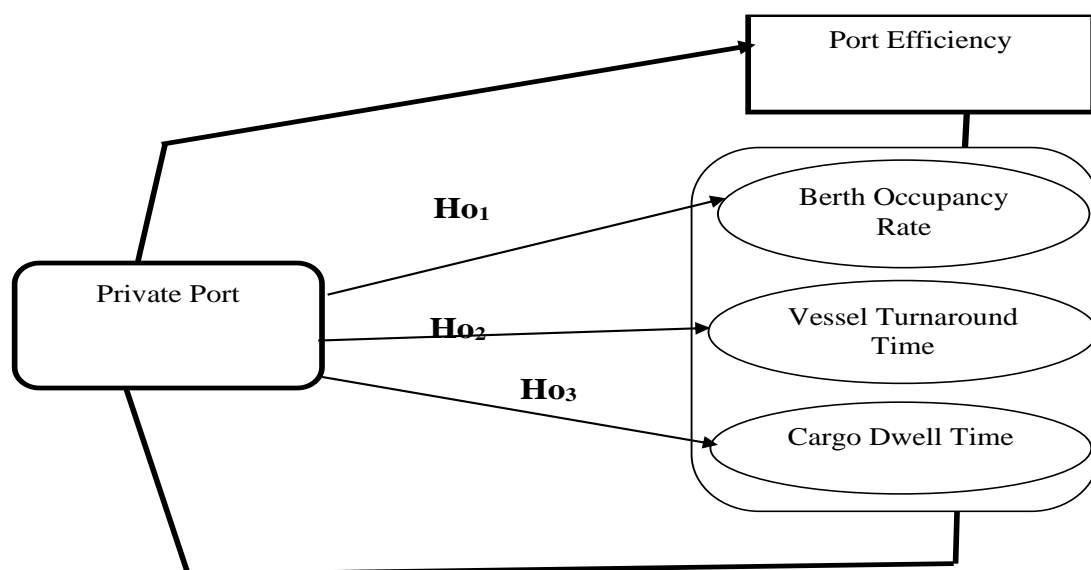


Figure 2: Conceptual Framework of the Relationship between Private Port and Port Efficiency in Nigeria

Sources: Acheampong *et al.* (2022) and Ma *et al.* (2021). Researcher's Review of Relevant Literature, (2023).

METHODOLOGY

The research design to be applied in this study is the cross-sectional survey design. The cross-sectional survey design method emphasizes quantitative analysis whereby data are collected through questionnaire, interviews, or from existing documents for example. The population of the study consisted of 6 ports in Nigeria, namely Lagos Port Complex, Tincan Port, Warri Port, Calabar Port, Port Harcourt Port and Onne Port. Considering that the population of the study was not large 23 Managers/ Officers/ Supervisors were selected in each of the six ports and that brought the total to 138 staff. There was no need to involve the study in random sampling. Rather the researcher conducted a census study. The sampling technique used in this study was the purposive sample distribution. The choice of this method is predicated on the fact that the sample distribution has the characteristics needed to execute

the study. The sample elements of the study were drawn from the Port Managers/Harbour Managers/Officers, Port Servicem Officer, Chief Port Accountants/Accountants/Officers, Port Human Resources Managers/Officers, Traffic Managers/Officers, Port Legal Officers and others who are directly involved in the port managerial activities. In this study, the reliability was verified by conducting a confirmatory test of internal consistency on the instrument with the sample using the Cronbach alpha. The Cronbach alpha that indicated the only result of 0.7 and above were considered as reliable while any result below 0.7 were painstaking taken as unreliable. All the analyses in this study were done with descriptive and inferential statistical tools. Correlation analyses were used to test the extent of the relationship between individual and collective variable(s) on the other. Also, Pearson's Product Moment Correlation Coefficient (r) was used to test the hypotheses formulated in the study as they tested relationships. The formula for Pearson's Product Moment Correlation Co-efficient is given as follows:

$$r = \frac{n(\sum x y) - (\sum x)(\sum y)}{\sqrt{[n(\sum x^2) - (\sum x)^2][n(\sum y^2) - (\sum y)^2]}}$$

For 't' we have:

$$t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$$

Where;

- r = correlation coefficient
- n = number of observations
- x = predictor variable
- y = criterion variable

RESULTS AND DISCUSSION

In this section, the study presents the univariate data analysis on the examined constructs. The univariate analysis on each of the operationalized variables is presented. In generating the data on the operationalized variables, the study used a 4-point Likert scale instrument. Based on this scale; options, responses and associated rating points, the mean, standard deviation, variances, and responses to issues raised in the research are presented below, using the SPSS software package window output, Version 25.0. The analysis is commenced with the table on private port.

Table 1: Responses on Private port

	Question Items on Private port	Mean	STD
1	Private port is considered to be the most efficient port management model which influences port efficiency in Nigeria	3.062	0.571
2	Private port is adequate in meeting the containerization need of customers in port efficiency in Nigeria	3.981	0.757
3	Private port influences port administration leading to port efficiency in Nigeria	3.552	0.634
4	Ports have the facilities, equipment and personnel to perform maximally for efficiency in vessel turnaround time of the port	3.112	0.930
5	Private port provides customers with motivational incentives to enhance customer attraction and optimize port efficiency in Nigeria	3.333	0.734
Valid N listwise		112	

Source: Survey Data, 2023, and SPSS Window Output, Version 25.0 (appendix c)

Table 1 shows the rate at which private port as a dimension of port management models relate with port efficiency. The results from the five question items on the 5 points scale show a distribution that reflects affirmation to the inquiries. The 1st question item on the Table has the mean and standard deviation scores of 3.062±0.571, showing that the respondents generally agreed that private port is considered to be the most efficient port management model which influences port efficiency in Nigeria.

The 2nd question item on the Table sought to know whether private port is adequate in meeting the containerization need of customers in port efficiency in Nigeria, the results indicate that private port is adequate in meeting the containerization need of customers in port efficiency in Nigeria; this was shown by the mean and standard deviation scores of 3.981±0.757. For the 3rd question item, sought to ascertain if private port influences port administration leading to port efficiency in Nigeria. The respondents were also more inclined to the agree range with the mean and standard deviation scores of 3.552±0.634. This descriptively revealed that private port influences port administration leading to port efficiency in Nigeria. In the case of the 4th question item, the mean and standard deviation scores of 3.112±0.930, implies that respondents were more favorable to the agree option that ports have the facilities, equipment and personnel to perform maximally for efficiency in vessel turnaround time of the port. The 5th question item on private port is

to know how private port provides customers with motivational incentives to enhance customer attraction and optimize port efficiency in Nigeria. The mean and standard deviation scores of 3.333 ± 0.734 , indicate that private port provides customers with motivational incentives to enhance customer attraction and optimize port efficiency in Nigeria.

Table 2: Responses on Berth Occupancy Rate

	Question Items on Berth Occupancy Rate	Mean	STD
1	Ports value giving satisfactory and accurate information to the stakeholders to achieve lower berth occupancy rate	3.848	0.373
2	Ports engage in activities that encourage efficiency and berth occupancy as berth occupancy studies help the designers to plan a terminal in optimum throughput, traffic condition and ship waiting time	3.190	0.588
3	Ports allow for the management staff to engage other staff in robust and critical issues pertaining to their efficient performance with reference to berth occupancy rate	3.352	0.770
4	Lower berth occupancy rate is the target all stakeholders aim to achieve because a higher productivity and rippling effect on the supply chain and can even lead to less cost incurred in the chain that ultimately leads to port efficiency.	3.281	0.808
5	Berth occupancy rate in term of weekly working and service hours which may results various values for seasons and every month in a year at ports.	3.214	0.576
	Valid N listwise	112	

Source: Survey Data, 2023, and SPSS Window Output, Version 25.0(Appendix E)

Table 2 shows descriptive results on berth occupancy rate which is measured with five question items on the 4-point scale. The first question item which sought to know whether ports value giving satisfactory and accurate information to the stakeholders to achieve lower berth occupancy rate had the mean and standard deviation scores of 3.848 ± 0.373 meaning that the respondents agreed that ports value giving satisfactory and accurate information to the stakeholders to achieve lower berth occupancy rate.

The 2nd question sought to determine whether ports engage in activities that encourage efficiency and berth occupancy as berth occupancy studies help the designers to plan a terminal in optimum throughput, traffic condition and ship waiting time and the mean and standard deviation scores of 3.190 ± 0.588 indicate positive agreement from the respondents. In the case of the 3rd The mean and standard deviation scores of 3.352 ± 0.770 revealed that the respondents agreed that ports allow for the management staff to engage other staff in robust and critical issues pertaining to their efficient performance with reference to berth occupancy rate. Also, the 4th question items which sought to determine whether lower berth occupancy rate is the target all stakeholders aim to achieve because a higher productivity and rippling effect on the supply chain and can even lead to less cost incurred in the chain that ultimately leads to port efficiency had the mean and standard deviation scores of 3.281 ± 0.808 as agreed by the respondents. The 5th question determined whether berth occupancy rate in term of weekly working and service hours which may results various values for seasons and every month in a year at ports. The item has the mean and standard deviation scores of 3.214 ± 0.576 which reflects that the respondents agreed that berth occupancy rate in term of weekly working and service hours which may results various values for seasons and every month in a year at ports.

Table 3: Responses on Vessel Turnaround Time

	Question Items on Vessel turnaround time	Mean	STD
1	Port satisfactory services to clients and shipping firms lead to effective vessel turnaround time	3.338	0.709
2	Vessel turnaround time is often used as a key performance indicator (KPI) to review the effectiveness and efficiency in your port	3.933	0.872
3	Port allows rooms for staff to engage customers in discussions on how to improve the port's vessel turnaround time	3.295	0.823
4	Port allows clients to make variety of choices through appropriate service engagements that elicit vessel turnaround time	3.262	0.832
5	Ports have the facilities, equipment and personnel to perform maximally for efficiency in vessel turnaround time of the port.	3.757	0.556
	Valid N listwise	112	

Source: Survey Data, 2023, and SPSS Window Output, Version 25.0(Appendix F)

Vessel turnaround time as a measure of port efficiency was examined and empirically expressed in Table 3, in the studied six ports and 5 question items were raised. For the first question item, the result indicated that ports give satisfactory services to clients and shipping firms that lead to effective vessel turnaround time. The mean and standard deviation scores of 3.338 ± 0.709 prove that. The second question item with the mean and standard deviation scores of 3.933 ± 0.872 is an indication that the respondents agreed that vessel turnaround time is often used as a key performance indicator (KPI) to review the effectiveness and efficiency in your port. The third question item has the mean and standard deviation scores of 3.295 ± 0.823 revealed that the respondents agreed that port allows rooms for staff to engage customers in discussions on how to improve the port's vessel turnaround time. The 4th question item also sought to know whether port allows clients to make variety of choices through appropriate service engagements that elicit vessel turnaround time.

The mean and standard deviation scores of 3.262 ± 0.832 indicate that port allows clients to make variety of choices through appropriate service engagements that elicit vessel turnaround time. The 5th question item also sought to know if ports have the facilities, equipment and personnel to perform maximally for efficiency in vessel turnaround time of the port. The mean and standard deviation scores of 3.757 ± 0.556 indicate that ports have the facilities, equipment and personnel to perform maximally for efficiency in vessel turnaround time of the port.

Table 4: Responses Cargo Dwell Time

	Question Items on Cargo dwell time	Mean	STD
1	Effective cargo handling equipment boosts the cargo dwell time in Nigerian Ports	3.605	0.765
2	Ports are always involved in the activities that can improve cargo dwell time in Nigerian Ports	3.605	0.699
3	Ports consider the opinion of workers before making important decision that affects cargo dwell time	3.457	0.771
4	Ports deliberate on issues concerning the increase of cargo dwell time in your port	3.576	0.495
5	Cargo dwell time is often used as a key performance indicator (KPI) to review the effectiveness and efficiency in port	3.957	1.159
	Valid N listwise	112	

Source: Survey Data, 2023, and SPSS Window Output, Version 25.0(Appendix G)

Cargo dwell time as a measure of port efficiency was examined and empirically expressed in Table 3 in the studied ports; 5 question items were raised on it. For the 1st question item, the result indicated that effective cargo handling equipment boosts the cargo dwell time in Nigerian ports. The mean and standard deviation scores of 3.605 ± 0.765 were the evidence that effective cargo handling equipment boosts the cargo dwell time in Nigerian Ports. The 2nd question item with the mean and standard deviation scores of 3.605 ± 0.699 indicate that the respondents agreed that ports are always involved in the activities that can improve cargo dwell time in Nigerian ports. The 3rd question item has the mean and standard deviation scores of 3.457 ± 0.771 indicating that the respondents favour the statement that ports consider the opinion of workers before making important decision that affects cargo dwell time. The 4th question item also sought to know if ports deliberate on issues concerning the increase of cargo dwell time. The mean and standard deviation scores of 3.576 ± 0.495 indicate that ports deliberate on issues concerning the increase of cargo dwell time. The 5th question item also sought to know whether cargo dwell time is often used as a key performance indicator (KPI) to review the effectiveness and efficiency in port, the mean and standard deviation scores of 3.957 ± 1.159 authenticate that.

Test of Hypotheses

In order to examine the relationships that exist between private port and port efficiency the following hypotheses were formulated:

H₀₇: There is no significant relationship between private port and berth occupancy rate.

H₀₈: There is no significant relationship between private port and vessel turnaround time.

H₀₉: There is no significant relationship between private port and cargo dwell time.

Table 5: Test Result of Private Port and Port Efficiency

Statistics	PP (BOR)	PP (VTT)	PP (CDT)
Pearson correlation	0.718**	0.646**	0.529**
Sig(2-tailed)	.000	.000	.000
N	112	112	112

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

Source: Survey Data, 2023, and SPSS Window Output, Version 25.0

Table 5 shows the inferential test results on the relationships between private port as a measure of port management models and the measures of port efficiency which include berth occupancy rate, vessel turnaround time and cargo dwell time. These are also expressed in the research hypotheses F₀₁, H₀₂ and H₀₃. In the case of H₀₁, the r- value of 0.718@ p0.000 < 0.01 shows that a strong positive and significant relationship exists between private port and berth occupancy rate. This means that the null hypothesis has been rejected and alternate hypothesis 1 accepted.

In the case of H_{02} which examined the relationship between private port and vessel turnaround time, it shows a strong positive and significant relationship. This is indicated with the r -value of 0.646@ $p < 0.000 < 0.01$. The null hypothesis stated is also rejected in that instance. For H_{03} , the r -value of 0.529@ $p < 0.000 < 0.01$ shows a moderate but significant relationship between private port as a dimension of port management models and cargo dwell time as a measure of port efficiency. The null hypothesis stated is also rejected. The inferential results are indicative of the nature of the relationship, thus:

1. Private port has a positive and significant relationship with berth occupancy rate as a measure of port efficiency.
2. Private port has a strong positive and significant relationship with vessel turnaround time as a measure of port efficiency.
3. Private port has moderate and significant relationship with cargo dwell time as a measure of port efficiency.

From the foregoing, there is a strong positive and significant relationship between private port and berth occupancy rate, vessel turnaround time, and cargo dwell time of ports in Nigeria.

The next step is to look at the influence of legal framework on port management models and port efficiency. To do this, the study formulated the following hypothesis:

H_{010} : Legal framework does not significantly influence the relationship between employee's port management models and efficiency of ports in Nigeria.

Table 6: Summary of the Results on Test of the Research Hypotheses

Research Hypotheses	r - value	Result	Decision
H_{01} : There is no significant relationship between private port and berth occupancy rate	0.718	Positive and Significant	Reject
H_{02} : There is no significant relationship between private port and vessel turnaround time.	0.646	Positive and Significant	Reject
H_{03} : There is no significant relationship between private port and cargo dwell time.	0.529	Positive and Significant	Reject

Source: Survey Data, 2023, and SPSS Window Output, Version 25.0

H_{i7} : There is significant relationship between private port and berth occupancy rate;

H_{i8} : There is significant relationship between private port and vessel turnaround time;

H_{i9} : There is significant relationship between private port and cargo dwell time and

DISCUSSION

Relationship between private port and Efficiency of Ports in Nigeria

The result associated with the relationship between private port and efficiency of ports, points to the fact that, when individuals feel they have been mistreated, retaliation is a deliberate and rational response, and this action is always to the disadvantage of the port efficiency. Private port is as a result of organizational decisions and managerial actions that are deemed unfair or unjust as perceived by the employees. Once employees feel that they have been treated unjustly they steal from the organization, or they cause harm to the organization even though they will not benefit from the action. A closer examination of the finding reveals that a strong, positive, and significant relationship exists between private port and cargo dwell time as a measure of efficiency of ports in Nigeria with r -value of 0.718. This finding agrees with the works of Cong *et al.* (2020). that private port enhances performance due to a more diverse pool of skills and knowledge that leads to complementary and mutual learning. For example, due to complementarities and learning opportunities, ethnically diverse teams are associated with more creativity and innovative leading to berth occupancy rate. Burns (2015) has contended that private port has a positive effect on port efficiency as it creates a pool of skills sets and learning opportunities that the port can tap into for positive performance. The point is that private port allows or permits the port to match individuals from different administrative backcross tasks and assignments in which they are most competent (Dooms, 2018).

According to Hassan *et al.*, (2017) private port also has a similar impact on port efficiency. This view is supported by Ibrahim (2022) who found that private port increases creativity and innovativeness in the firm by expanding the perspectives and viewpoints in the port. Some studies have found that a more ethnically diverse port management model exhibits more creativity, innovativeness than a more ethnically homogenous port management model and berth occupancy rate (Kraemer, 2021). This is probably because of the learning opportunities, perspectives and complementarities that private port brings to the firm's performance. Ibrahim (2022) observe that private port implies in language, religions, races and cultures. They revealed that there has been an increase in multicultural port management model in organizations for utilizing greater participation and synergy to improve and increase both employee satisfaction and business performance.

A Fully Privatized Port can be said to be the direct opposite of public service port. While the latter is owned and managed by government with the interest and the collective good of the public as its abiding belief, the former is normally under the control and management of private parties including the land itself and same is allowed to be exploited for private gains

World Bank (2007) and other experts have described this form of port governance model as an extreme form among the rest. They are to be found mainly in the United Kingdom and New Zealand. This model subtly suggests that state has relinquished all its rights to port operation and is no longer interested in the formulation of public policy to guide its operations. It involves the transfer of ownership of public lands to the private sector. The reason why this is seen to be extreme is the fact that, even regulatory functions are left with the private operators to decide making the involvement of government in the running of the ports non-existent. The United Kingdom is a classic case where government-backed or public regulator is absent. The ports themselves regulate their activities.

A critical analysis of the finding reveals that a strong, positive, and significant relationship exists between private port and vessel turnaround time as a measure of efficiency of ports in Nigeria with r -value of 0.646. On the other hand, the costs associated with more private port would be related to more difficult communication and coordination (Baek, Han & Ryu, 2019). All in all, private port is an influential source of heterogeneity. Ethnically diverse teams working in relatively homogenous organizations experienced performance deficits relative to the more homogeneous teams (Liao, 2012). Mohammad's (2017) study posits that ethnicity can be used as a proxy for cultural background and diversity in ethnicity can be expected to be positive for innovative performance, since it broadens the viewpoints and perspective in the firm (Baek, Han & Ryu, 2019).

The results point out that the government plays an important role in defining and achieving port policy goals, since it owns the port authority, although more control must be carried out by internal bodies as advocated by De Langen and Van de Lugt (2017). The results also point out that the port authorities should not focus only on their core business, but must give more attention to local customers, logistics chains and to their region/city, that should participate on the port's management (minimized regionalization), corroborating only partially what Notteboom and Rodrigue (2005) or Villa (2017) have referred.

A critical analysis of the finding reveals that a moderate, positive, and significant relationship exists between private port and cargo dwell time as a measure of efficiency of ports in Nigeria with r -value of 0.529. The results agreed with Subhash and Archana (2017) who found that private port enhances the cargo dwell time of ports. Aminatou *et al.*, (2018) maintain that while the port authority usually prepares the structures, the private port operators provide and maintain their own superstructure including buildings.

Kraemer (2021) observed that fully privatized ports (which often take the form of a private service port) are few in number and can be found mainly in the United Kingdom (U.K.) and New Zealand. Full privatization is considered by many as an extreme form of port reform. It suggests that the state no longer has any meaningful involvement or public policy interest in the port sector. In fully privatized ports, port land is privately owned, unlike the situation in other port management models. This requires the transfer of ownership of such land from the public to the private sector. In addition, along with the sale of port land to private interests, some governments may simultaneously transfer the regulatory functions to private successor companies. In the absence of a port regulator in the U.K., for example, privatized ports are essentially self-regulating. The risk in this type of arrangement is that port land can be sold or resold for non-port activities, thereby making it impossible to reclaim for its original maritime use. Moreover, there is also the possibility of land speculation, especially when port land is in or near a major city. Furthermore, sale of land to private ports may also sometimes raise a national security issue (Pagano *et al.*, 2012).

Conclusion

The conclusion of this study provides holistic outcomes of the study. The values possessed by private port management model in many countries, and it tends to achieve better performance. Thus, ineffective use of port private management model most likely impedes corporate functioning and leads to port inefficiency. Conclusively, it is evident that: The relationships between private port and port efficiency are positive and significant because strong positive and significant relationship exists between: Private port and berth occupancy rate ($r = 0.718 @ p0.000 < 0.01$); private port and vessel turnaround time ($r = 0.646 @ p0.000 < 0.01$); private port and cargo dwell time in Nigeria ($r = 0.529 @ p0.000 < 0.01$).

Recommendations

Based on the findings of the study and conclusions reached the following recommendations have been made:

1. Government should consider making all ports in the country independent of each other instead of the current administrative guide where one single port authority oversees all policy, regulatory and sometimes operational needs of all the ports in the country.
2. Although the port authority does not do much operational work, its staff strength is much higher than the private partner. This is obviously putting a lot of financial stress on the authority which monies could have been used to improve on the efficiency of the ports, therefore, there should be staff rationalization to make sure that staff who are employed are actually needed.
3. The port authority should concentrate on being the regulatory arm of government to ensure a fair playing field for all parties involved in the operational chain of the ports in Nigeria.
4. As private port management model elicits port performance, including profitability, efficiency and effectiveness, the port authority control should be through an internal organization of the port itself and not by government supervision

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