Maritime Security Regimes and Impacts on Nigerian Seaports

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How to cite this paper: Onwuegbuchunam, D.E., Aponjolosun, M.O., Igboanusi, C. and Okeke, K.O. (2021) Maritime Security Regimes and Impacts on Nigerian Seaports. *Open Journal of Safety Science and Technology*, **11**, 158-170.
https://doi.org/10.4236/ojsst.2021.114011

Received: August 22, 2021
Accepted: October 5, 2021
Published: October 8, 2021

Abstract

Nigeria is a signatory to International Maritime Organization's (IMO) conventions and codes on safety and security relating to ports and other maritime facilities. The Federal Government through its relevant agencies has taken some steps to domesticate and implement the provisions therein. In spite of the measures implemented so far, maritime security related problems still beset the national ports and have impacted on their performance. The purpose of this paper was to assess the impacts of port security regimes on security incidents and performance of Nigerian ports. Copies of structured Likert scaled questionnaire were designed for this study. These were administered to randomly selected sample of port operators and port users operating in Tincan Island port and Apapa ports complex. Their opinion on observed security incidents at the ports was elicited using the instrument. The primary data so obtained were augmented with secondary data on cargo and vessel throughputs handled at these ports. To test the hypotheses governing the study, we applied the Partial Least Squares model to determine significant relationship between port security regimes (proxied by port security measures) and port security incidents and port performance. The results showed that implementation of appropriate security measures can engender significant reductions in port security incidents and improved port performance. The policy implications of study findings were discussed.

Keywords

Maritime Security, Regimes, Port Security, Port Security Incidents, Port Performance

1. Introduction

Maritime security is critical for sustainable growth of global commerce conducted

along ocean passages or maritime domain. About 90% of goods supporting the global economy are transported through the oceans. The ocean contains numerous resources that support livelihood of present and future generation (Randrianantenaina, [1]). A number of terrorist attacks and piracy have plagued the world ocean in recent history; notable among them include: attacks on the USS *Cole* in 2000 and the *M/V Limburg* in 2002, executed through the use of explosive-laden speedboats, attack at U.S controlled oil facilities at Basra by Iraqi insurgents resulting in deaths of three American service men in 2004, and in addition piracy around Southeast Asia waters by Jemaah Islamiah & Abu Sayyaf terrorist groups (Raymond & Morriën, [2]). The catastrophic events of 11th September 2001, when a sequence of synchronized terrorist attacks was made on the World Trade Center and Pentagon in the United States of America by the extremist Islamic group called Al-Qaeda became a watershed in global approach to maritime security policies formulation and administration. Specifically, more integrative and stringent security policies were introduced to prevent and suppress terror and other criminal acts around maritime infrastructure (seaports, terminals, jetties etc.), territorial waters and high seas. A number of security regimes spearheaded by IMO and USA, have been introduced at the local and international level to secure the oceans, ships, maritime trading routes and maritime trade. Notable examples of these include: International Ship and Port facility Security (ISPS) code, the Maritime Transportation Security Act of 2002 (MTSA), the Advance Manifest System (AMS/24 hour rule), the Container Security Initiative (CSI), the Technology Asset Protection Association (TAPA), Suppression of Unlawful Act against safety of Navigation (SUA), the U.S. Customs-Trade Partnership Against Terrorism (C-TPAT), and the Smart and Secure Trade-lane (SST) program. The introduction and administration of these instruments have defined security regimes at sea, in ports and associated transportation networks. It also provided a legal framework for further maritime security cooperation at regional and global level.

1.1. The Research Problem

Nigeria as a member state of IMO is signatory to a significant number of IMO conventions. As stated by Dakuku [3], Nigeria has ratified Forty (40) IMO conventions and the International Labour Organisation (ILO), covering maritime safety, labour and marine environment. Nineteen of the conventions have been domesticated by way of regulation, adoption or incorporation under the Merchant Shipping Act of 2007 (Dakuku, [3]). The Nigerian Maritime Administration stated that Nigerian government is working towards domesticating other conventions and Protocols relating to safety of Navigation [3]. For security of navigation, the Nigerian Navy has the statutory responsibility to provide Coastguard services to secure the maritime domain. At international level, the Federal government of Nigeria has initiated intergovernmental partnership in regional maritime security. It should also be stated that ISPS code for example, was implemented in Nigerian ports through NIMASA, the designated authority, in order

to eradicate all forms of unlawful and criminalities such as armed robbery, cargo pilferage/theft, stowaways and so on in the nation's seaports. In spite of these commitments, anecdotal evidence confirms the prevalence of pilferage, cargo theft, illegal importation of fire-arms, and armed robbery etc. in our port terminals.

1.2. Objectives of Study

The main objective of this study is to assess the impact of maritime security regimes on port performance and level of security incidents in Nigerian ports. However, the specific objectives are to determine:

1) Significant effect of port security measures on security incidents (proxied by cargo theft/pilferage, stowaways, attack on ships, armed robbery, human trafficking, missing of containerized cargo, drug trafficking, arms and ammunition and contraband items).

2) Significant effect of port security measures on port performance.

2. Literature Review

2.1. Maritime Security Regimes

The security of maritime domain has been a major concern to coastal states. Maritime security threats have manifested in the use of force (by non-state actors) against the territorial integrity of a state. These security threats include: acts of terrorism against shipping operations, offshore installations, piracy and sea robbery. Others include: smuggling of migrants, narcotic drugs and arms, illegal fishing, pollution of marine environment (AMSA, [4]; Bueger, [5]) and cyber-attacks against shipping/maritime infrastructure. Policy measures put in place by national governments and international regulatory bodies to counteract maritime security threats have found its basis on Regime theory. The Regime theory supports application of both formal and informal set of rules guiding government operations in discharging its responsibilities to the society and influence of these rules on the society (Ebaye, [6] and Levy *et al.*, [7]). Regime theory has also facilitated achievement of sustainable cooperation among sovereign nations (Neumayer, [8]) in resolving environmental, economic and financial issues. In the maritime sector, security regimes relate to the set of rules created and consented to by the concerned parties to establish security mechanisms that will enhance security of maritime operations and regulate operations of users of the seas within and beyond territorial boundary of a coastal state. It is significant to state that apart from ISPS code which was IMO's security initiative, the most significant maritime security regimes were introduced by The United States Government. These include: Container Security Initiative (CSI), Customs-Trade Partnership Against Terrorism (C-TPAT), 24-hour rule and The Proliferation Security Initiative (PSI) (UNCTAD, [9]).

2.2. Port Security and Security Incidents

Port security is an aspect of maritime security that is very essential in facilitating

safe and secure maritime transport. Port security measures are employed to safeguard seaports from terrorism and other criminal activities (Marine insight, [10]) and should be structured to provide effective and efficient landside operations, patrols of the harbours, anchorages and waterways of ports (U.S Department of Transportation, [11]). High rate of security incidents in ports threatens operations in port and hinders effective and efficient facilitation of trade domestically and internationally. To the authors knowledge, there have not been recorded cases of terrorists attack in any of the Nigerian ports. However, cases of armed robberies have occurred in port premises. In most cases, the sea robbers allegedly came through the waterfront in an outboard engine boat and launched attacks against ships in ports. Armed robbery attacks at ports pose a serious threat to trade. Prevention of criminal's, initial access to the ports and vessels and demonstration of consistency in responding effectively and rapidly to any security breach is the most effective countermeasure strategy that must be adopted (U.S Department of Transportation, [11]). Port security system must therefore be designed to have an anti-terrorist component to counter the possibility of terrorist attacks against facilities and vessels within the port. It should entail active cooperation of carriers (ocean, truck and rail) and other users of the port to proactively establish anti-terrorism response capabilities (U.S Department of transportation, [11]), with effective and efficient port security services. Thus, port security services should include the review of vulnerabilities as regards shipboard and terminal security plans and contingency response measures for both passenger and cargo trades (U.S Department of Transportation, [11]). Smuggling is one of the security incidents impacting Nigerian ports. Vulnerability of port security has often been exploited and hence our ports used for smuggling of narcotics, arms and ammunitions and other contrabands into Nigeria. Cargo theft is noted as one of the biggest risks facing cargo owners in Nigerian ports. Theft of imported cargo during custom's examination and clearing process in port has negatively impacted the image of the ports and caused severe losses to importers (Eromosele, [12]).

There have been several studies on port security, maritime security and implications of security measures on the performance of ports and shipping companies. For instance, Sadovaya and Thai [13] investigated the impacts of effective security management model on the shipping companies. The data for the study were collected from shipping ship management companies and analysed using Structural Equation Modeling (SEM) Technique. The result revealed that the security model has positive impacts on the organizational performance of the shipping companies in terms of business resilience, customer performance, time market performance and security related issues. Bichou [14] applied a stepwise Malmquist Data Envelopment Analysis approach to empirically assess the impact of procedural port security regulations on operational efficiency and productivity of container ports and terminals. The analysis revealed variations in productivity change by type of security regulations adopted across terminals but a general productivity gains were recorded. Also, empirical evidence pro-

vided by Onwuegbuchunam *et al.*, [15] revealed that compliance to the provisions of ISPS code had positive effects on operational performance of Nigerian seaports. Yeo *et al.*, [16] used System Dynamic methodology to analyse the relationship between seaport security levels in Korean ports and container volumes. The findings showed that significant economic benefits such as increased container throughput can be achieved by maintaining lower security level (ISPS code). Yang and Wei [17] empirically assessed how container shipping sector in Taiwan was impacted by supply chain security performance. Four crucial security dimensions were identified in the study; prevention of accident and procession; facility and cargo management; management of information; and partner relationship. Using factor analysis and multiple regression analysis models, he found that information management and partner relationship had positive significant impact on safety performance while customs clearance was positively impacted by partner relationship management. Also, Yang *et al.*, [18] in their quest for developing a generally acceptable methodology for port security assessment and risk analysis in quantitative manner used fuzzy evidential reasoning approach to facilitate port facility security assessment (PFSA). It is pertinent to note that, despite the existence of several studies on port security and shipping company performance, empirical study on the effect of port security measures on security incidents in ports is yet to be fully researched. Thus, this study will fill this gap.

3. Methodology

The population of this study comprised port users and port operators of Nigerian seaports namely: Tincan Island port and Apapa port complex, all located in Lagos State. Their opinion about impact of existing security regimes on port performance and security incidents observed in the ports was sought. These respondents were mainly ship-owners/operators/managers, port facility security officers, shippers, tug masters, shipping/port agents and other unclassified persons. To elicit their responses on relevant questions posed to them, a structured, Likert scaled questionnaire was designed as Google forms and administered electronically to the potential respondents. The questionnaire comprised two sections. Section A, contained questions on socioeconomic profile of the respondents. Section B focused on questions relating to observed port security incidents namely: cargo theft/pilferage, stowaways, armed robbery, attack on vessels in port and trafficking etc. These were Likert-scaled rating response questions. The primary data so obtained were augmented with secondary data on cargo throughputs (tonnes) and Vessel traffic throughputs (count). These variables were considered as manifest variables for the latent endogenous variable: port performance. Partial Least Square (PLS) structural equation modeling technique (using SmartPLS software) was applied to statistically analyse the data obtained for the study.

The main objective of PLS SEM is to estimate the latent variable score that maximizes the explanatory variance of the endogenous latent structure (*i.e.*, de-

pendent) in the path model. According to Golob [19], Structural Equation modeling (SEM) is a modeling technique that can handle a large number of endogenous and exogenous variables as well as latent (unobserved) variables specified as linear combinations (weighted averages) of the observed variables. SEM technique captures the causal influences (regression effects) of the exogenous variables on the endogenous variables and the causal influences of endogenous variables upon one another. Division of Statistics and Scientific Computation Inc. [20] stated that manifest or observed variables are directly measured by the researchers, while latent or unobserved variables are not directly measured but are inferred by the relationship or correlations among measured variables in the analysis. In this study, we postulate that port security regimes (proxied by port security measures) impact on port security incidences and port performance. Conceptually, the path diagram in **Figure 1**, illustrates the relationship between the port security regime (exogenous variable), port security measures (endogenous variable) and port performance variable (endogenous variables). Port security incidents were captured by the manifest variables shown in the figure, while port performance variables were captured by manifest variables: volume of cargo throughputs and vessel traffic. The description of all the endogenous, exogenous and manifest variables is listed in **Table 1**.

Table 1. Description of variables used in port security assessment.

Initial	Variable name	Variable description
PSM	Port security measures	Latent exogenous variable
PP	Port performance	Latent endogenous variable
PSI	Port security incidents	Latent endogenous variable
PSM1	There are adequate security measures in ports	Manifest variable
PSM2	Ports/Terminal complied to ISPS code Implementation	Manifest variable
PSM3	There are measures in place to ensure compliance to ISPS code	Manifest variable
PS1	Human Trafficking	Manifest variable
PS2	Drug trafficking	Manifest variable
PS3	Arms and Ammunition	Manifest variable
PS4	Contraband items	Manifest variable
PS5	Cargo theft	Manifest variable
PS6	Armed robbery	Manifest variable
PS7	Attack on vessels	Manifest variable
PS8	Missing of containerized cargoes	Manifest variable
PS9	Stowaways	Manifest variable
PP1	Cargo throughput	Manifest variable
PP2	Vessel traffic	Manifest variable

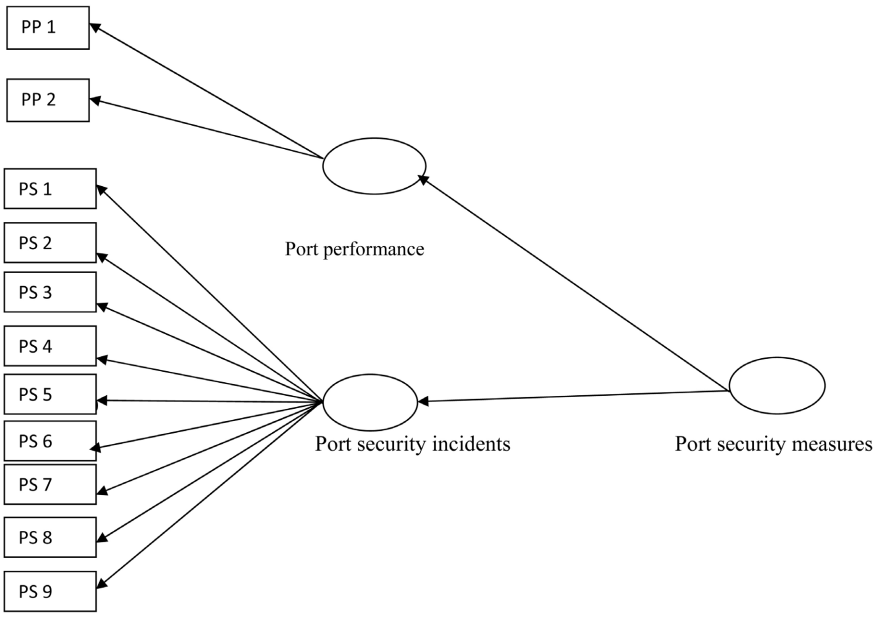

Figure 1. Path diagram: Conceptual research model.

4. Data Presentation, Results and Analysis

4.1. The Demographic Characteristics of the Survey Respondents

Table 2 presents the socio-economic characteristics of respondents in the study. It could be seen from the table that more than 90% of the respondents in the study are males. In terms of job experience, about 60% of the respondents have been on the job for at least 10 years. Similarly a significant percentage (>70%) respondents possesses at least a Diploma certificate. The sample population comprised more of port users (cargo and ship owners, shippers, shipping & port agents) than port authority personnel. Given this distribution, it can be taken that the respondents are knowledgeable about their activities, experienced and were in a better position to have given informed response on copies of questionnaires administered to them.

4.2. Descriptive Statistics of Manifest Variables

Results of the descriptive analysis as depicted in Table 3 shows that manifest variables: contra-band and stowaway items represented the highest and lowest security incidents in port respectively.

4.3. Reliability and Validity

Cronbach's Alpha and Composite reliability (CR) were used in testing the reliability of the variables. All the factor loadings were above 0.6 which make them usable for this study without having to discarding any. Table 4 shows the result for reliability and validity of factor loadings. The average variance extracted for each constructs was higher than 0.5 thresholds suggested by Hamid *et al.*, [21]. The inner VIF for the inner model/structural model for the

Table 2. Socio-economic characteristics of the respondents.

Gender	Percentage (%)
Male	93.9
Female	6.1
Experience	
0 - 5 yrs	35.0
6 - 10 yrs	18.4
11 - 15 yrs	22.4
16 - 20 yrs	16.3
21 yrs & above	8.16
Education Qualification	
SSCE/O level holders,	14.30
National Diploma (ND)	28.60
BSc/HND	40.80
MSc	8.20
Others	8.20
Work Position	
Cargo Owners,	20.4
Ship-Owners/Operators/Managers	12.2
Port Facility Security Officers,	16.3
Shippers,	16.3
Tug Masters,	6.1
Shipping/Port Agents	24.5
Others.	4.2

Source: Author own elaboration based on survey data.

Table 3. Descriptive statistics.

Items	Mean	Standard deviation
PSM1	3.306	1.358
PSM2	3.653	1.254
PSM3	4.184	1.082
PSI-1	1.469	0.883
PSI-2	1.939	0.793
PSI-3	2.102	0.909
PSI-4	2.449	0.672
PSI-5	1.939	0.818

Continued

PSI-6	1.531	0.971
PSI-7	1.816	0.941
PSI-8	1.592	0.946
PSI-9	1.143	0.969
PP-1	4.245	1.134
PP-2	4.041	1.309

Source: Author, Data Analysis.

Table 4. Loadings, reliability and validity.

Constructs	Indicators	Outer loadings	Composite reliability	Cronbach's Alpha	Average Variance Extracted (AVE)
Port security measures	PSM1	0.969	0.969	0.952	0.912
	PSM2	0.961			
	PSM3	0.935			
Port security incidents	PS1	0.929	0.985	0.983	0.882
	PS2	0.94			
	PS3	0.935			
	PS4	0.913			
	PS5	0.942			
	PS6	0.959			
	PS7	0.956			
	PS8	0.962			
	PS9	0.913			
Port performance	PP1	0.989	0.989	0.977	0.978
	PP2	0.989			

Source: Author, data analysis.

assessment of collinearity among the constructs is 1. However, the VIF for the measurement model for this study was not considered because they are reflective indicators.

The discriminant validity is as shown in Table 5. In this table, all the factor loadings are greater than or equal to the cross loading. This comparison satisfies discriminant validity requirement.

4.4. Structural Model Result Output and Hypotheses Testing

Figure 2 depicts the path diagram of the structural equation model in which the latent exogenous variables (port security incidents) and port performance va-

riables are predicted by endogenous variable port security measures. The latent variables were measured by sets of observed or manifest variables. The hypotheses were tested by assessing the correlations between the endogenous variable and the exogenous variables. As regard predictive power of the model for port security measures, R^2 adjusted values for port performance and port security incidents indicate that the model explained 92% and 95% of the variance in port security measures.

However, analysis of the hypothesized relationship between the latent endogenous variable (port security measures) and latent exogenous variables (port security incidents and port performance) is presented in detail in Table 6. The findings as shown in Table 6 revealed that significant statistical evidence exists to accept the research hypotheses. This is evident in the large *t*-statistic values of 208.18 and 72.551 and their corresponding *p*-values all significant at 1%. Therefore the stated research hypotheses are accepted.

Table 5. Cross loadings.

Items	Port performance	Port security incidents	Port security measures
PSM1	0.893	0.97	0.969
PSM2	0.887	0.945	0.961
PSM3	0.941	0.879	0.935
PS1	0.778	0.929	0.875
PS2	0.786	0.94	0.908
PS3	0.896	0.935	0.936
PS4	0.914	0.913	0.920
PS5	0.824	0.942	0.924
PS6	0.824	0.959	0.921
PS7	0.876	0.956	0.958
PS8	0.854	0.962	0.931
PS9	0.775	0.913	0.866
PP1	0.989	0.876	0.937
PP2	0.989	0.899	0.941

Source: data analysis.

Table 6. Summary of hypotheses testing.

Path	Beta coefficient	*t*-value	*p*-value
Port security measures → port security incidents	0.976	208.148	0.000
Port security measures → port performance	0.950	72.551	0.000

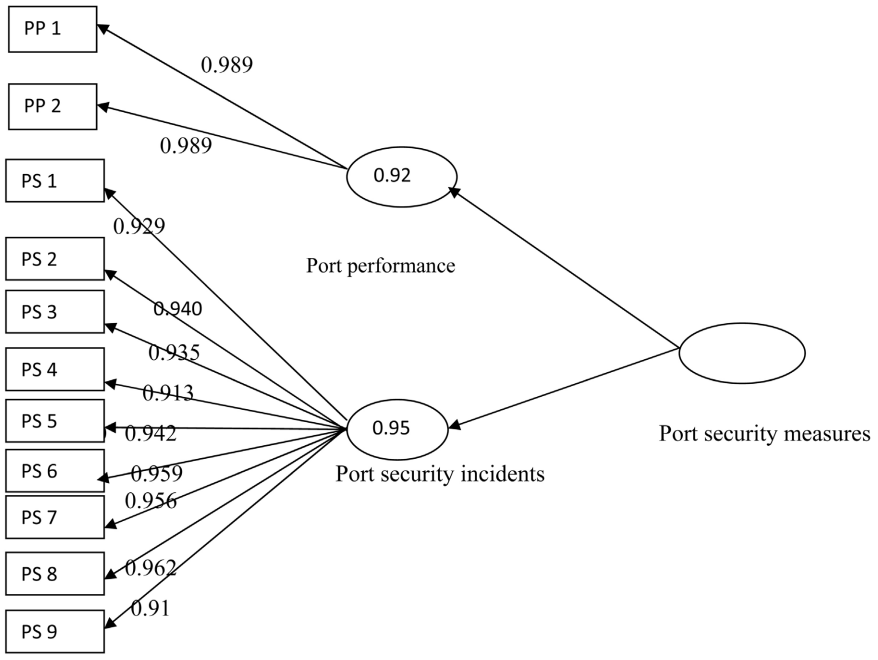

Figure 2. Path diagram.

The F-statistic values of 9.199 and 19.748 for port performance and port security incidents respectively are considered sufficiently high and represent large effects which imply a significant contribution to the exogenous variable (port security measures).

5. Discussion of Results

Frequent occurrence of port security incidents (such as cargo theft, armed robbery, stowaways and so on) is an impediment to the growth and economic viability of a port. Thus, there is need for improved port security measures in order to facilitate effective and efficient operation which will ultimately improve port performance. This study established the existence of significant relationship between port security measures and the other variables namely: port security incidents and port performance in Lagos ports. The findings suggest that significant improvement in the level of port security measures could lead to improved port performance and reduction in security incidences. This is consistent with findings from previous studies: Onwuegbuchunam *et al.*, [15]; Sadovaya and Thai, [13]; Bichou [14]; Yeo *et al.*, [16]; Yang and Wei, [17] establishing that port security measures contribute to improved port performance.

6. Conclusion and Recommendations

The result from this study established that significant relationship exists between security measures (or regimes) adopted in a port and likelihood of port security incidents occurrence. The security regimes variables also correlate significantly with port performance level observed in the ports. In Nigeria, the Federal government and private terminal operators are aware of their role to put necessary

security measures in place for safe and efficient operations in the port. However, there is need for sustained and further improvement in security architecture of the port for better performance. This can be achieved through strict implementation of all relevant security measures and continuous compliance of terminal operators to the provisions of ISPS code. Other measures include improved collaborative efforts with other stakeholders in maritime sector and enhanced synergy among security agencies in ports. The study did not cover ports in the southern region of Nigeria and this may affect generalizability of the research findings. While this is taken as limitation, further studies on maritime security regimes should be focused on impacts of security regimes on offshore platforms.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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