

OPERATIONAL CHALLENGES OF CARGO HANDLING EQUIPMENT AT TERMINALS OF LAGOS PORT COMPLEX, NIGERIA

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Abstract

The study aims at examining the operational challenges facing cargo handling equipment at privately owned terminals within the Lagos Port Complex (LPC), Nigeria. Primary data were collected through questionnaire survey randomly conducted on a total of 112 respondents who are staff of the private terminal operators at the port. The data collected were analysed using correlation and regression techniques of data analysis. The results of the regression analysis showed a high correlation value having $R^2 = 0.675$ with the dependent variable. It was further revealed that inadequate workshop facilities and misuse of equipment were the most significant challenges to the operation of cargo handling equipment at terminals of Lagos port complex. The study recommended that the strategies for successful operation of handling equipment should involve devising ways to compensate for a number of factors that, individually or in combination, act to reduce the efficiency of equipment.

Keywords –Terminals, Handling Equipment, Lagos Port Complex, Operational Challenges

1. Introduction

The various activities within the maritime sector of the 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 transshipment. Cargo transfer efficiency can be enhanced with the use of adequate cargo handling equipment. The efficiency of cargo terminals can also be influenced by adequacy of cargo handling equipment. This is in line with the study of Nyema (2014), which revealed that factors such as inadequate quay/gantry crane equipment, reducing berth times and delays of container ships, dwell time, container cargo and truck turnaround time, custom clearance, limited storage capacity, poor multi-modal connections to hinterland and infrastructure directly influence container terminal efficiency.

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 transshipment that will ensure Nigeria ports comply with the 48 hours cargo clearance rule of the International Maritime Organisation (IMO). However, Igbokwe (2013) suggests that there has been little improvement over time on the efficiency and productivity of Nigeria port management in meeting the IMO stipulation on cargo clearance. By the assessment of Somuyiwa and Akindele (2015) handling plants and equipment in Nigerian Ports are either

old, obsolete, malfunctioning, broken down or insufficient, with adverse effects on cargo handling operations. The previous studies were done before the private operators took over the operation of Lagos Port Complex (LPC). The situation however changed after the concession of the port operation, as latest cargo handling equipment with high lift capacity were procured at Tin Can port, Lagos in line with the port terminal concession policy (Somuyiwa and Akindele, 2015).

This study is aimed at examining the challenges facing the efficient operation of cargo handling equipment at terminals of LPC, Nigeria. This is an interesting research pursuit because the operation of modern cargo handling equipment will no doubt give rise to new challenges for operators who had been used to operating obsolete equipment that characterised the pre-concession era of Nigeria port operations.

2. Literature Review

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, Emagbara 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 out-dated 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 out-dated and obsolete equipment inherited from NPA as the results of their invested 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.

3. Methodology

The study relied on primary sources of data collection involving the survey of terminal operators in LPC through questionnaire administration. The study took a census of the staff of the private terminal operators with 112 respondents forming the sample size for the study since a population for the study could not be determined. The sample size for the study was found to be adequate going by Hair et al. (1995) cited by Williams et al. (2010) that sample

sizes should be 100 or greater. The study employed simple random sampling technique to collect data with the support of research assistants. Information in the questionnaire was presented such that respondents had to indicate the weight they attached to a series of factors capable of challenging the operation of handling equipment at the port.

The instrument was designed on a multiple-item measurement scale fashioned on the 5-point Likert scale to allow for a wide measurement of the degree of the respondents' consideration of the each operational challenge presented in the questionnaire. The six operational challenges measured are the following: inadequate equipment, misuse of equipment, poor maintenance, poor technical know-how, unavailability of spare parts, and inadequate workshop facilities. The variables were tabulated for the respondents to rank in order of significance from 1 – Not Significant to 5 – Highly Significant.

Correlation and multiple linear regression analyses were employed as techniques for data analysis. This is in the light of the need to determine the level of relationship between the variables, and measure the extent of the influence of the variables on the operation of handling equipment at terminals of the port. The model specification for the extent of relationship between the dependent variable and the independent variables takes the general form:

$$Y = a + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 \dots \beta_n X_n$$

Where; Y = Dependent Variable (Operational Challenges);

$\beta_1, \beta_2, \beta_3 \dots \beta_n$ = Coefficients; and

a = Constant, while

$X_1, X_2, X_3 \dots X_n$ are the independent variables.

The study made use of Statistical Package for Social Sciences (SPSS version 21) to analyse the data collected using regression techniques. Data collected using Likert scale are suited to parametric analysis; for as Norman (2010) found using real scale data, parametric tests such as Pearson correlation and regression analysis can be used with Likert data without fear of "coming to the wrong conclusion" as Jamieson (2004) puts it.

4. Results and Discussion

The issues of inadequate equipment at terminals of seaports in Nigeria was one of the reasons the government decided in 2006 to involve private participation in the services of port operations through concession of berths to private investors. This is mainly for acquisition of more up to date equipment capable of handling the demand for cargo traffic at the port. This goal had been achieved by 2015, for Shomuyiwa and Ogundele (2015) report that state-of-the-art cargo handling equipment with high lift capacity had been procured at Tin Can port, Lagos. Table 1 presents the list of terminal operators and their allocated berths at the LPC.

Table 1: Berths operated by terminal operators in LPC

Berth	Operator's name
1 – 5	Apapa Bulk Terminal Ltd (ABTL)
6 – 14	ENL Consurtium (ENL)
15 – 18	AP Moller (APMT)
19 – 20	Greenview Development Nig Ltd. (GDNL)

NPA, LPC Annual Report

The probable challenges facing efficient operation of cargo equipment at terminals of LPC were examined in this study and found that they are naturally related to each other through correlation analysis.

Table 2: Correlation Results of Operational Challenges of Cargo handling Equipment

		Inadequate Equipment	Misuse of Equipment	Poor Maintenance	Poor Technical Know-How	Unavailability of Spare Parts	Inadequate Workshop
Inadequate Equipment	Correlation Coefficient	1.000	.545**	.553**	.122	-.356**	-.031
	Sig. (2-tailed)		.000	.000	.201	.000	.746
	N	112	112	112	112	112	112
Misuse of Equipment	Correlation Coefficient		1.000	.653**	-.188*	-.014	-.394**
	Sig. (2-tailed)		.	.000	.047	.883	.000
	N		112	112	112	112	112
Poor Maintenance	Correlation Coefficient			1.000	-.097	-.449**	-.208*
	Sig. (2-tailed)			.	.309	.000	.028
	N			112	112	112	112
Poor Technical Know-How	Correlation Coefficient				1.000	-.275**	-.318**
	Sig. (2-tailed)				.	.003	.001
	N				112	112	112
Unavailability of Spare Parts	Correlation Coefficient					1.000	.469**
	Sig. (2-tailed)					.	.000
	N						112
Inadequate Workshop	Correlation Coefficient						1.000
	Sig. (2-tailed)						.
	N						112

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

* . Correlation is significant at the 0.05 level (2-tailed).

Table 2 shows that the variables are correlated with a mix of positive and negative relationships.

The relationship between inadequate equipment and misuse of equipment ($r = .545$) indicates that when handling equipment are in gross inadequacy for handling cargo types, available ones will have to be used, even if the equipment is not designed to handle such type of goods it is being used for. This invariably will result into misuse of equipment as a result of inadequate equipment.

The significance of the relationship between inadequate equipment and poor maintenance ($r = .554$) suggests that poor maintenance may lead to deterioration of a number of equipment till they no longer adequate for cargo handling. Misuse of equipment has a significant relationship with poor maintenance ($r = .653$) and inadequate workshop ($r = .394$),

suggesting that inadequacy of workshop facilities can affect the maintenance of equipment. At same time, poor level of equipment maintenance will reduce the availability of spare parts (See Table 2).

The study took a step further in the analysis of the operational challenges of cargo handling equipment at terminal of Lagos Port complex by subjecting the variables to multiple linear regression analysis. Table 3 presents the model summary of the multiple linear regression analysis in order to assess the strength of the relationship between the independent variables and the dependent variable. It further shows the model correlation coefficients, R, its square, R², and an adjusted version of this coefficient as summary measures of model fit. The multiple correlation coefficient R = 0.82 predicts a strong correlation in the relationships between and within the dependent and independent variables.

Table 3: Model Summary of Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.821 ^a	.675	.656	.255
a. Predictors: (Constant), Inadequate Workshop, Poor Maintenance, Poor Technical Know-How, Unavailability of Spare Parts, Inadequate Equipment, Misuse of Equipment				

The R² value of 0.656 indicates that the variables can explain 67.5% of the variance in the operational challenges facing cargo handling equipment at LPC. In other words, 67.5% of the variance in the operational challenges of cargo handling equipment can be explained as the influence of inadequate workshop, poor maintenance, poor technical know-how, unavailability of spare parts, inadequate equipment and misuse of equipment. Since by definition, R² will increase when further terms are added to the model, even if this does not explain variability in the population, the adjusted R² is an attempt at improving the estimation of R² in the population. The index is adjusted down to compensate for the chance increase in R², with bigger adjustments for larger sets of explanatory variables. The use of this adjusted measure leads to a revised estimate that 65.6% of the variability of the independent variables can be used to explain the dependent variable.

Table 4 represents an ANOVA result providing an F-Test equal to 36.314 when the explanatory variables are set at zero. The result shows $F(6,105) = 36, p < 0.001$, which can lead to the conclusion that the independent variables significantly influence the operation of handling equipment at the port.

Table 4: ANOVA result of Equipment Operational Challenges

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	14.171	6	2.362	36.314	.000 ^b
	Residual	6.829	105	.065		
	Total	21.000	111			
a. Dependent Variable: Operational Challenges						
b. Predictors: (Constant), Inadequate Workshop, Poor Maintenance, Poor Technical Know-How, Unavailability of Spare Parts, Inadequate Equipment, Misuse of Equipment						

The coefficient of equipment operational challenges presented in Table 5 provides the estimates of the regression coefficient, standard errors of the estimates, t-tests that a

coefficient takes the value zero, and confidence intervals. The estimated coefficients are given under the heading ‘Unstandardized Coefficients B’; these give, for each of the explanatory variables, the predicted change in the dependent variable when the explanatory variables is increased by one unit conditional upon all the other variables in the model remaining constant. It therefore shows that identified challenges facing the operation of handling equipment tends to be increasing by 2.8%, 16.5%, 9.7%, and 2.8% for every additional score on inadequate equipment, misuse of equipment, poor maintenance, and technical know-how respectively. At the same time, operational challenges of handling equipment at the port tends to be decreasing by 3.8% and 7.3% for unavailability of spare parts and inadequate workshop respectively (See Table 5). This implies that the independent variables are the major factors contributing to the operational challenges faced in handling equipment at LPC terminals.

Table 5: Coefficient of Operational Challenges of Handling Equipment

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	
	B	Std. Error	Beta			
1	(Constant)	1.265	.165		7.650	.000
	Inadequate Equipment	.028	.026	.078	1.085	.280
	Misuse of Equipment	.165	.054	.402	3.076	.003
	Poor Maintenance	.097	.033	.392	2.896	.005
	Poor Technical Know-How	.028	.019	.095	1.448	.151
	Unavailability of Spare Parts	-.038	.035	-.088	-1.081	.282
	Inadequate Workshop	-.073	.022	-.274	-3.327	.001

a. Dependent Variable: Operational Challenges

The definition of the model specification for the extent of relationship between the dependent variable and the independent variables takes the form:

$$\text{Equipment Operational Challenges} = 1.265 + .028(\text{Inadequate Equipment}) + .165(\text{Misuse of Equipment}) + .097(\text{Poor Maintenance}) + .028(\text{Technical Know-How}) - .038(\text{Unavailability of Spare Parts}) - .073 (\text{Inadequate Workshop})$$

A further examination of Table 5 shows that inadequate workshop facilities, misuse of equipment and poor maintenance form the most significant issues constituting challenges to efficient operation of cargo handling equipment at private terminals of the Lagos Port Complex.

5. Policy Recommendation and Conclusion

An understanding of the variability in the operation of various handling equipment for handling different cargo types is crucial for efficient cargo management at the terminals of any port. Cargo management cannot be efficient without minimising the challenges faced when operating cargo handling equipment. For terminal operators, the strategy for successful operation of handling equipment 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. While it is imperative for the terminal operators to give attention to the need for increased cargo traffic through efficient handling equipment; it is also important that terminal operators 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. The management under the supervision of the NPA should ensure regulations guiding the provision and operation of equipment by terminal operators are enforced.

The study subjected six variables believed to be adversely affecting the efficient operation of cargo handling equipment at terminals of LPC to correlation and regression analyses. Therefore, the study concludes that inadequate workshop and misuse of equipment were the most significant problems confronting the efficient operation of handling equipment at the terminals of the Lagos Port Complex. Poor maintenance is also a significant challenge. Further study is required to determine the impact of the provision of workshop facilities and proper maintenance of equipment in the operation of cargo handling equipment at the terminals of the port.

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