

Information & Communication Technology (ICT) Adoption in Nigerian Ports Terminal Operations

D. E. Onwuegbuchunam*, M. O. Aponjolosun, A. W. Ogunsakin

Department of Maritime Management Technology, Federal University of Technology, Owerri, Nigeria

Email: *don@futo.edu.ng

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Abstract

Most ports around the globe have adopted ICT in a bid to improve their operational performance and remain competitive in the industry. However, ports in developing economies still grapple with challenges associated with manual terminal operation. This paper evaluated the level of application and integration of Information and Communication Technologies (ICT) and factors limiting their use in terminal operations in Nigerian seaports. The data for the study were obtained from copies of structured Likert scaled questionnaire administered to a random sample of terminal operators, stevedores, shipping companies' agents, Customs licensed Clearing and Forwarding agents (C&F) operating in Apapa and Tincan Island ports in Nigeria. Specifically, opinion of these respondents was sought on extent of ICT application, integration and perceived constraints to ICT use in port terminal operations. Based on our findings using statistical model tests of proportion, the respondents stated that significant level of ICT procedures and processes have been adopted in port terminal operations. In terms of ICT applications, we found that electronic data and communication exchange applications were available in the terminals for use by the respondents. There are also in place ICT applications for warehouses and storage facilities management and e-payment systems. However, significant constraining factors were found to be: low ICT investment budgetary allocation, lack of e-skilled manpower and poor equipment maintenance culture. Other limiting factors were lack of integrated ICT facilities operated by other port stakeholders and absence of Port Community Systems network (PCS) linking all other relevant interests connected to terminal operations. Policy implications of our findings were discussed.

Keywords

ICT Adoption, Single Electronic Window, ICT Application and Integration,

1. Introduction

Ports have become a fundamental element of global supply chains and logistics (Mondragon, [1]) and contribute immensely to nations' economies. Increasingly, Information Communication Technology (ICT) has become an important component of the global maritime industries (Aung, [2]). Many seaports have adopted ICT in managing terminal operation to enhance their productivity (ITU, [3]) and operate in line with global standards. Since mid-1980's, ICT application has become part of the port sector which has been exploring options in governance, operational and technological implementation of strategies (Mondragon, [1]). The managements of most ports are investing more in ICT infrastructure to become more efficient not only in expectation of higher returns but to retain patronage of their clients who are often demanding better quality services (Ships and Ports, [4]).

1.1. Research Problem & Context

Ports around the globe have adopted ICT in a bid to improve their operational performance and remain competitive in the industry. However, ports in developing economies still grapple with challenges associated with manual port operation. Despite recent terminal concession reforms, Nigeria ports are still beset with slow documentation processes, delays in cargo clearance and container examination procedures (LCCI, [5]). Delays in cargo clearance and the resultant congestion at the ports have become source of concern to all port users (Rabaland *et al.*, [6], Daudi, [7], Kunaka *et al.*, [8]). To address concerns of port customers, the management of Nigerian ports introduced some ICT applications to improve port productivity, safety and security, reduce overhead costs and improve port customer satisfaction. Notable among these applications include Command, Control, Communication and Intelligence (CCCI) facility, electronic Ship Entry Notice (e-SEN), Revenue and Invoice Management System (RIMS), Corporate Website and Customer Portals. Yet, there are still concerns about the reach and integration of these ICT applications in port terminal operations, port user community and the national I.T infrastructure. As Temidayo [9] puts it: the inability of Nigeria ports' management to integrate the single electronic window in processes involving other relevant Federal agencies such as Nigerian Maritime & Safety Agency, Nigerian Shippers Council, Nigeria Customs Service, various terminal operators, shipping firms and other agencies at ports has hindered operational efficiency of the port and caused loss of revenue. It has therefore become imperative to examine the extent of ICT application and integration in port processes and identify areas for policy intervention. The problem of this paper is to establish the extent of ICT applications and integration as well as li-

miting factors to ICT use in port terminal operations.

1.2. Objectives of Study

The major aim of this paper is to evaluate the level of ICT use and its constraining factors in management of terminal operations in Nigerian ports. The specific objectives of the study are to determine significant:

- 1) ICT applications deployed in Nigeria port terminal operations;
- 2) ICT integration in terminal operations;
- 3) Factors limiting ICT use in ports operations.

2. Literature Review

According to UNESCO Institute for Statistics (UIS) [10], ICT is defined as set of technological resources such as computers, the internet, live broadcasting technologies (radio, television and webcasting), recorded broadcasting technologies (podcasting, audio and video players and storage devices) used to transmit, store, create, share or exchange information. ICT is similar to Information Technology (IT) but focuses primarily on communication technologies which include the internet, wireless networks, cell phones and other communication mediums (Christensson, [11]). Over time, ICT has proven to be very vital in restructuring and re-shaping business transactions and other activities. The challenges of using traditional paper based and manual data management systems in storing, retrieving, processing and transmitting information have been adequately addressed with the use of ICT through efficient management of information and physical flow. ICT facilitates management and timely processing of shipping documents. Electronic documents such as cargo stowage plan, manifest, bill of lading, booking instructions and customs declaration can be transmitted seamlessly among users via ICT platforms. Funds transfer, payments, tracking and tracing of cargoes and containers are now common forms of ICT applications (UNESCO, [12]). Other areas of ICT deployment include port gate management, marshalling yard management, terminal management and custom's procedures. The integration of ICT in these areas has improved processes (Rodrigue, [13]) with positive impacts on overall productivity of supply chains (Attia, [14]). ICT applications in trade and transport are more bound to grow and become even more important with globalisation and emergence of global supply chains and processes (UNCTAD, [15]). ICT usage could lead to decrease in shipping and trucking costs (Olugbode *et al.*, [16], Mithas & Rust [17], Carr, [18], Popa *et al.*, [19], Shahriari *et al.*, [20]), timely delivery of goods and services, perceived increase in trade volume and enhanced organizational logistics capability (Mlimbila, & Mbamba, [21]). ICT has become an important technological adoption in transport & logistics enabling partner firms to share information between them (Wong *et al.*, [22]). Thus, collaborative investment in information technologies among supply chain stakeholders has become a strategic thrust to achieve more transparent and efficient supply chains (Lee and Qualls, [23]). Indeed, seaports can benefit from ICT developments as many of them still experience congestion and are in

urgent need of procedures and technologies to increase cargo and ship throughputs and speed of goods handling (Nyquist, [24]). Seaports have grown in complexity due to the various types of cargoes handled, e.g. containers, bulks (wet and dry), RoRo, heavy-lift and out-of-gauge cargoes. Thus, investments in ICT infrastructure and facilities and integration in ports are needed to enhance their capacity to handle such diverse cargoes and thrive in such demanding transport markets. The present paper extends existing studies by seeking to evaluate the constraints to adoption and integration of ICT in ports operations.

3. Methodology

The most basic shipping activities in Nigerian ports involve some form of ICT application/use. Due to the international nature of shipping business, deployment of basic ICT facilities for operations has become commonplace among shipping and related firms in Nigeria's port sector. The study was carried out in Apapa and Tincan Island ports all situated in Lagos, Nigeria. These ports were purposively chosen due to their high terminal activity levels and prevalence of ICT deployment and use. In the first quarter of year 2019, Apapa and Tincan port accounted for 89.6% and 2.4% respectively of total export transactions in Nigeria seaports. In terms of imports, Apapa also remained the leading port of operation with transactions values put at N1.3trn while Tincan port accounted for N701.0bn (Dakuku, [25]).

The population of respondents in this study was drawn from registered list of terminal operators, shipping companies, stevedoring firms, and Clearing and Forwarding (C & F) firms operating in these ports. Terminal operators manage cargo terminals under concession arrangement with the Nigeria Port Authority (NPA). Specifically they provide ship and cargo handling services in port terminals and make use of their own ICT facilities as well as the ones provided in the ports by the authority (NPA). The stevedores or dockworkers have the statutory mandate to discharge and/or load cargoes onboard ship berthed at the terminals. They work in conjunction with the terminal operators. Shipping companies' agents in port represent interests of global shipping companies and husband vessels (berthed in port) on behalf of their principals. The C & F agents provide support services in form of cargo and ship document processing. They represent interests of cargo or consignment owners and most often arrange local transport on their behalf. These port users deploy ICT facilities in executing their respective operations. Sample frame of eighty-six (86) used for calculating our sample size for the study was drawn after delisting non-functional addresses of firms under study. A stratified random sample was therefore drawn from terminal operators, shipping company agents in ports, stevedores and Customs licensed C & F agents. Copies of structured Likert scaled questionnaire designed for the study featured sections A, B, C & D. Section A contained questions on profile of the respondents and section B contained closed ended questions relating to extent of ICT applications in use, C contained questions on ICT integration in port operations, while section D contained questions on limiting factors

to ICT deployment and use in port operations. The respondents were asked to provide rated responses to questions on ICT applications, extent of integration in terminal activities as well as limiting factors. Out of seventy (70) copies of questionnaires administered, 56 copies were returned completely filled. This number representing 80% response rate was considered representative for further analysis using statistical models. Hypotheses governing this study were tested using classical one sample test of proportion.

One Sample Test of Proportion

One sample proportion-test was employed to test for significant differences if any, in the proportion of respondents who agreed/disagreed on level of ICT applications, integration and factors affecting ICT adoption in port operations. For example, to test the null hypothesis in the study, we state thus: the proportion of respondents who agree is not significantly different from those who disagree on a limiting factor to ICT integration in port terminal operation. Mathematically; $H_0 : p = 0.5$. The alternative hypothesis $H_1 : p \neq 0.5$ implies that significant differences exist between the proportion of respondents who agree and those that disagree. To prepare the rating response data obtained for conducting tests for proportion, scores from 1 to 3 were recoded as zero. Similarly, scores from 4 to 5 were recoded as 1. The distribution of 1's and 0's allowed us to carry out the test for proportion of respondents who agree (represented by 1's) versus those who disagree (represented by 0's) according to questions in sections B, C & D of the questionnaire.

Mathematically, the Z-statistics for one sample population proportion test is calculated thus, see Aczel and Soundapandian [26]:

$$Z = \frac{\hat{p} - p}{\sqrt{pq/n}} \quad (1)$$

$p = 0.5$ is the hypothesized population proportion.

\hat{p} is calculated from sample and $q = 1 - p$.

Where n is sample size from population of respondents.

Critical region: $Z_{cal} > Z_{tab}$.

Decision rule: Reject H_0 if $Z_{cal} < -1.96$ or $Z_{cal} > 1.96$ Where 1.96 is the value of Z tabulated (Z_{tab}) statistic (for a two-tailed test).

The sample size ($n = 70$) calculated from population under study is taken to be representative of port users/operators in Nigeria's ports industry. Data analysis was carried out using STATA software for Windows, version 15.

4. Data Analysis Results and Discussion

The descriptive statistics of profile of respondents in this study are shown in the figures below. As stated before, the respondents comprised the Nigeria Custom's licensed Clearing and Forwarding agents, agents of shipping companies, stevedores and terminal operators. Clearing & Forwarding agents serve the interests of shipment owner or consignee while in ports, while agents of shipping companies represent the interests of shipowners or ship operators and are involved in

ship and cargo operations. Similarly, stevedores are directly involved in cargo handling activities which could be manually done or mechanized using ships' derrick or port provided facilities, while terminal operators manage terminals in the ports. These interests rely to an extent, on ICT facilities to undertake their operations in port terminals. Given, their numeric distribution represented in **Figure 1**, it can be taken that the respondents within the categories sampled were evenly represented.

The frequency distribution of years of experience of the respondents shown in **Figure 2**, indicates that majority in our study sample have work experience spanning over 10 years. This implies that only experienced persons were consulted for their opinion on ICT deployment and use in Nigerian seaports.

In terms of educational qualification, see **Figure 3**, thirty (30) of the respondents possess Bachelor's degree or its equivalent. However, ten (10) of them

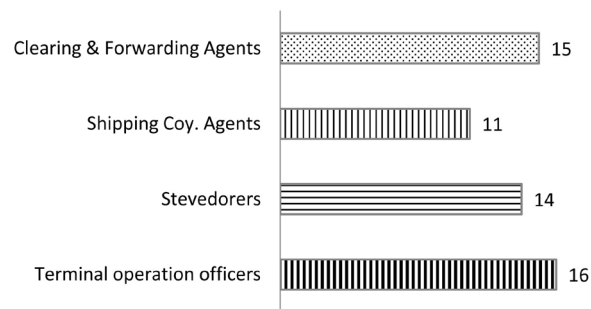


Figure 1. Distribution of respondents according to type of business.

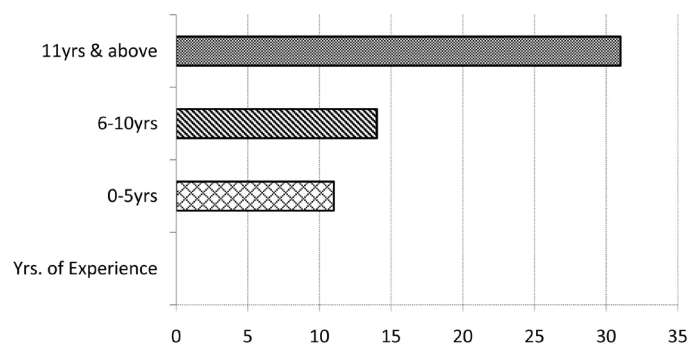


Figure 2. Distribution of years of experience of respondents.

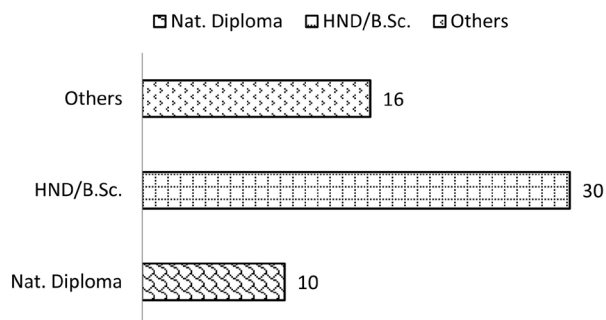


Figure 3. Distribution of educational qualification of respondents.

possess National Diploma (ND) certificates while the others have some form of professional qualifications. Thus, it is evident that these port users and service providers interviewed had sufficient job experience, requisite academic background and amply distributed according to relevant functional areas of our interest. Therefore, their responses were considered informed enough for purposes of this research.

In **Table 1**, we present the descriptive statistics (mean & standard deviation of scores) obtained from the rating responses from the sampled persons. The alphanumeric labels represent sub-questions in each section of the questionnaire administered. For example, b1 represents question one (1) on section B of the questionnaire. Distribution of minimum and maximum scores observed from respondents' rating are as shown in the table. Total number of observations in each case is fifty six (56). This implies that each respondent addressed all questions posed in the questionnaire.

To be able to apply statistical tests, certain assumptions of normality in data have to be met. Therefore, to ensure we have a normal distribution of scores and hence stable test results, tests for skewness and kurtosis were carried out and the results shown in **Table 2**. The Chi-Square and p-values of joint test results show that our data set is to a large extent, normally distributed and can be subjected to tests for proportion. These scores were then used to determine the proportion of respondents who agreed versus those who disagreed according to the questionnaire items or constructs. To test important hypotheses that govern this study, we applied tests for proportion which results were presented in the subsequent sections.

Table 3 shows respondents' opinion on ICT applications deployed in the management of port by Nigerian Port Authority. They acknowledged that the standard operating procedure in Nigerian ports is ICT-enabled. According to them, ship arrival notification, berth reservation, booking for pilots can be carried out through Port Management Information System in place. Other e-services applications available include container yard management system, e-request for tugs assistance, mooring and stevedoring services. There is also Vehicle Booking Systems (VBS) for control of vehicle and truck movements at port gates. For accelerated cargo processing, a single electronic window application has been provided by the Nigeria Customs Service. Although, the respondents stated that there is a port collaborative decision system for terminal operators, shipping companies and the port authority however, a National Single Maritime Window linking the maritime community is lacking.

To understand the extent in which ICT has been integrated into the terminal operations of Nigerian ports, the respondents were asked to give answers to a series of questions on the extent of integration of ICT facilities, softwares and processes in terminal operations. In **Table 4**, we present tests for proportion results on ICT integration according to respondents. Based on **Table 4**, significant proportion of the port users and service providers stated that: there is electronic interface for exchange of data between shipowners and terminal operators. In

Table 1. Distribution of descriptive statistics of rating response scores.

Item No	Constructs by Clusters	Descriptive Statistics			
		Mean	Std. Dev.	Min	Max
	ICT applications in port operations				
b1	There is in place Port Management Information System (PMIS) for ship arrival pre-notification, berth reservation, order for pilots, tugs, mooring and stevedoring services.	3.875	1.192	1	5
b2	Vehicle Booking System (VBS) is in place for digital processing of loaded trucks, to ensure security at port gate entrance and exit.	3.714	1.232	1	5
b3	There is a Container Yard Traffic Management System for storage, tracking and tracing of containers.	2.393	1.039	1	5
b4	There is in place Port Collaborative Decision Making System (PCDMS) for joint consultative meetings involving terminal operators, shipping companies and the port authority.	3.696	1.111	2	5
b5	The Nigeria Customs Service deploys single electronic window for facilitated cargo document submission, processing and clearance at port terminals.	3.750	1.049	1	5
b6	There is a National Maritime Single Window linking all maritime stakeholders (government and private) for data exchange and communication.	3.589	1.108	1	5
	ICT Integration in Port Operations				
c1	The exchange of data between shipowners, port authority and your organization is done using an electronic data interface system.	3.571	1.438	1	5
c2	Payment or receipt of port charges, container fees, custom duties and other statutory levies from other agencies can now be handled electronically by your organization.	3.411	1.276	1	5
c3	There is established electronic communication medium between your office, government parastatals and other relevant private agencies.	2.446	1.025	1	4
c4	There is a central database that enables all ship and cargo interests to monitor the progress of ship operation and cargo handling in port terminals.	3.393	1.317	1	5
c5	Transit sheds, stacking areas, warehouses and other storage facilities are operated with facility management software applications.	3.786	1.411	1	5
	Limiting Factors to ICT Adoption				
d1	Low budgetary allocation for acquisition of ICT facilities and infrastructure in the ports.	3.321	1.350	1	5
d2	Lack of adequate technical knowledge among port officials has affected the level of adoption of ICT in ports.	3.589	1.247	1	5
d3	Poor maintenance of existing IT facilities in the port has affected ICT adoption.	3.625	1.153	1	5
d4	Absence of requisite national I.T Infrastructure has affected the reach of port ICT applications.	3.232	1.321	1	5
d5	Lack of integration of ICT facilities operated by different port operators and users.	3.518	1.307	1	5

Source: Authors, data analysis, No. of Observations: 56.

Table 2. Skewness/Kurtosis tests for Normality.

Variable	Pr (Skewness)	Pr (Kurtosis)	Joint Test	
			adj chi2 (2)	Prob > chi2
b1	0.014	0.721	5.830	0.054
b2	0.045	0.445	4.640	0.098
b3	0.034	0.962	4.550	0.103
b4	0.000	0.040	14.660	0.001
b5	0.165	0.001	10.790	0.005
b6	0.165	0.001	10.790	0.005
c1	0.036	0.023	8.290	0.016
c2	0.081	0.086	5.690	0.058
c3	0.625	0.003	7.980	0.019
c4	0.010	0.410	6.750	0.034
c5	0.003	0.749	7.690	0.021
d1	0.074	0.003	10.100	0.006
d2	0.007	0.909	6.610	0.037
d3	0.004	0.459	7.690	0.021
d4	0.117	0.011	7.810	0.020
d5	0.045	0.138	5.860	0.053

Source: Authors, data analysis.

Table 3. ICT application in port management operation by the Nigerian port authority.

ICT applications in port operations	Proportion	Std. Err	Z. calc.	Remark: Reject H_0
There is in place Port Management Information System (PMIS) for ship arrival pre-notification, berth reservation, order for pilots, tugs, mooring and stevedoring services.	0.732	0.059	3.474*	Yes
Vehicle Booking System (VBS) is in place for digital processing of loaded trucks, to ensure security at port's gate entrance and exit.	0.679	0.062	2.673*	Yes
There is a Container Yard Traffic Management System for storage, tracking and tracing of cargo containers.	0.661	0.063	2.401*	Yes
There is in place Port Collaborative Decision Making System (PCDMS) for joint consultative meetings involving terminal operators, shipping companies and the port authority.	0.107	0.0413	-5.88*	Yes
The Nigeria Customs Service deploys single electronic window for facilitated cargo document submission, processing and clearance at port terminals.	0.804	0.053	4.543*	Yes
There is a National Maritime Single Window linking all maritime stakeholders (government and private) for data exchange and communication.	0.625	0.0647	1.871*	No

Source: Authors computations. *: Significant ($Z_{cal} > Z_{tab}$), Z tabulated: 1.96 ($\alpha = 0.05$).

addition, electronic payment systems are in place for financial transactions in the ports. There is also a yard management system for integrated management of transit sheds, storage areas and warehouses within the terminals. However, the respondents stated that there is no system connecting the activities of the entire port community and that no central database exists for tracking ship and cargo operations in the terminals.

Deployment of some ICT applications in port operations in Nigerian ports is however beset with some constraints according to the findings of this research. According to results presented in **Table 5**; certain significant factors were found

Table 4. Establishing the level of integration of ICT in port terminal operations.

ICT Integration in Port Operations	Proportion	Std. Err	Z. calc.	Remark: Reject H_0
The exchange of data between shipowners, port authority and your organization is done via an electronic data interface system.	0.643	0.064	2.138*	Yes
Payment or receipt of port charges, container fees, custom duties and other statutory levies from other agencies can now be handled electronically by your organization.	0.661	0.063	2.405*	Yes
There is established electronic communication medium between your office, government parastatals and other relevant private agencies.	0.196	0.0531	-4.543*	Yes
There is a central database that enables all ship and cargo interests to monitor the progress of ship and cargo handling operations in port terminals.	0.589	0.0657	1.336	No
Transit sheds, stacking areas, warehouses and other storage facilities are operated with facility management software applications.	0.714	0.604	3.207*	Yes

Source: Authors computations. *: Significant ($Z_{cal} > Z_{tab}$), Z tabulated: 1.96 ($\alpha = 0.05$).

Table 5. Factors limiting the use of ICT in Nigerian ports.

Limiting Factors to ICT Adoption	Proportion	Std. Err	Z. calc.	Remark: Reject H_0
Low budgetary allocation for acquisition of ICT facilities and infrastructure in the ports.	0.643	0.064	2.138*	Yes
Lack of adequate technical knowledge among ports workers has affected the level of adoption of ICT in ports.	0.696	0.0614	2.939*	Yes
Poor maintenance of existing IT facilities in the port has affected ICT adoption.	0.679	0.0624	2.673*	Yes
Absence of requisite national I.T Infrastructure has affected the reach of port's ICT applications.	0.554	0.0664	0.802	No
Lack of integration of ICT facilities operated by different port operators and users.	0.429	0.0661	-1.069*	Yes

Source: Authors computations. *: Significant ($Z_{cal} > Z_{tab}$), where Z tabulated: 1.96 ($\alpha = 0.05$).

to limit adoption of ICT in Nigerian ports. These factors include low budgetary allocation-which would likely impact negatively on ICT facility and infrastructure procurement; inadequate number of ICT skilled personnel and poor ICT maintenance culture. Other constraining factor to ICT adoption includes lack of integration of ICT facilities operated by other port stakeholders.

5. Conclusion

Existing literature has established that positive correlation exists between ICT application in port terminal operations and terminal efficiency. Many ports have therefore invested in and adopted ICT to improve their operations and hence key into global standards expected of modern ports. The findings from this study showed that Nigeria ports have in the same vein, adopted some level of ICT procedures and processes in their operations and transactions. In terms of ICT applications, the following were found operational in the ports: Port Management Information System (PMIS) for harbour services, vehicle movement at the gates, container yard management and berthing meetings. There is also a single electronic window platform for expedited document submission and processing. The areas of integration include ICT-enabled terminal management operations involving storage facilities, transit sheds and warehouses. Electronic data interface in place connects terminal operators, shipping agents and the port authority. Payment systems have become ICT-enabled for electronic transfers/receipts. However, the respondents stated that there is absence of national I.T infrastructure and lack of integration of ICT facilities operated by different port users. Presently, the national I.T infrastructure is more voice-driven than data. The existing broadband operated by Global System for Mobile (GSM) service providers is too narrow and may limit deployment of cutting edge ICT platforms in the ports. As a result of this limitation, Port Community Systems (PCS) networks expected to connect the port community with the relevant government agencies for improved and better performance has yet to be adopted. This is consistent with Temidayo [9] who argue that absence of functional trade platform such as national electronic single window is affecting productivity of the ports and causing revenue losses to Nigeria. Lastly, findings also indicated that there were funding constraints (low budgetary allocation), lack of e-skills on the part of personnel and poor maintenance of ICT facilities.

6. Recommendations

The paper recommends suitable intervention policies to ensure full adoption and integration of ICT in port operations. Specifically, more personnel within the port community should be trained by their employers on requisite ICT skills. Ship to Shore communication platforms and Port Community Network Systems are critical for improved port operations and should be provided. The present paper focused on ICT users in port terminal operations as its unit of analysis. It did not address ICT exposure of firms involved in other transport and logistics

chain activities besides terminal operations. Neither did it address questions on firms' characteristics and impact on ICT adoption etc. While these may be recognised as limitations, future studies should expand the scope of the present paper to cover ICT adoption by firms in Nigeria's maritime sector.

Conflicts of Interest

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

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Appendix

Some unedited outputs of Test of Proportion

```
. *ICT application in Port Management Operation by the Nigerian Port Authority
.*
. prtest B1 == 0.5
```

One-sample test of proportion B1: Number of obs = 56

Variable	Mean	Std. Err.	[95% Conf. Interval]	
B1	.7321429	.0591774	.6161574	.8481283

p = proportion(B1) z = 3.4744
 Ho: p = 0.5

Ha: p < 0.5 Ha: p != 0.5 Ha: p > 0.5
 Pr(Z < z) = 0.9997 Pr(|Z| > |z|) = 0.0005 Pr(Z > z) = 0.0003

```
. *The level of integration of ICT in terminal operations of Nigerian ports
.*
. prtest C1 == 0.5
```

One-sample test of proportion C1: Number of obs = 56

Variable	Mean	Std. Err.	[95% Conf. Interval]	
C1	.6428571	.0640301	.5173604	.7683538

p = proportion(C1) z = 2.1381
 Ho: p = 0.5

Ha: p < 0.5 Ha: p != 0.5 Ha: p > 0.5
 Pr(Z < z) = 0.9837 Pr(|Z| > |z|) = 0.0325 Pr(Z > z) = 0.0163

```
. *Factors Limiting the use of ICT in Nigerian ports
.*
. prtest D1 == 0.5
```

One-sample test of proportion D1: Number of obs = 56

Variable	Mean	Std. Err.	[95% Conf. Interval]	
D1	.6428571	.0640301	.5173604	.7683538

p = proportion(D1) z = 2.1381
 Ho: p = 0.5

Ha: p < 0.5 Ha: p != 0.5 Ha: p > 0.5
 Pr(Z < z) = 0.9837 Pr(|Z| > |z|) = 0.0325 Pr(Z > z) = 0.0163