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EFFECT OF INFORMATION TECHNOLOGY ON CARGO SERVICE QUALITY OF PORTS IN NIGER DELTA, NIGERIA

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ABSTRACT

This study examined the effect of information technology on cargo service quality of ports in Niger Delta, Nigeria. Information technology (independent variable) was examined with work automation, port infrastructure system, and communication devices. The dependent variable was measured with cargo service quality. The study was anchored on the use of Information Technology Theory. Cross-sectional survey research design was used for the study. The sources of data were mainly primary and secondary methods. The key research instrument for collection of primary data was structured questionnaire. The population of the study consisted of four (4) ports in Niger Delta. The study used descriptive and inferential statistical tools to analyze the data to achieve the research objectives and used Pearson Product Moment Correlation Co-efficient (r) to test the hypotheses with the help of SPSS 25.0. The reliability of the research instrument was validated with Cronbach Alpha threshold at 0 .70. The study found that Ports in Niger Delta are very skillful in work automation, which provides veritable opportunities to obtain effective operations that lead to effective port performance in Niger Delta. The study revealed the importance of work automation on cargo service quality satisfies ports' stakeholders. The study concluded that as ports in Niger Delta use work automation to operate digitally by adopting information technology in all areas of their works, their cargo service quality is significantly and positively improved, and sustained the protection of the ports' digital assets and information systems from cyber threats is positively and significantly assured. The study recommended that port authorities and stakeholders in Niger Delta should prioritize increased investment in information technology infrastructure. Ports should allocate budget resources and develop strategic plans that outline specific information technology projects aimed at bolstering operational efficiency.

Keywords: Information Technology, Work Automation, Port Infrastructure, Cargo Service Quality, Niger Delta.

1. INTRODUCTION

Effect of Information Technology on cargo service quality of ports in Niger Delta have been examined and become increasingly significant as it improves, efficiency, and competitiveness in the maritime and global trade. Niger Delta ports of Nigeria are among the key players in West Africa trade contributing to work automation systems in the process of port services to improve cargo service quality and seamless operation moving greater volume of goods along international trade network in Nigeria and beyond.

Apart from the fact that information technology have made greater achievement for reasonable output through efficient operations yet, Nigerian ports may not be ruled out from facing some challenges and impediments that could require urgent attention to ensure that adequate opportunities given can be maximized. Thiwanka, (2020).

It was accepted that stoppages are commonly cause by many factors such as resistance to changes in the maritime industry, lack of infrastructure, and lack of technical expertise with the use of information technology (IT) solution within the Nigerian ports' business environment. This situation engenders administrative delay on ports' clearance procedure resulting to snail-like cargo handling process that could cause demurrage and high expenses affecting many port stakeholders (users). So, information technology becomes germane for the improvement of cargo service quality in ports business operation in Nigeria. Seraji, (2020).

Recently, the use of digitalization unveiled its critical position in the area of port operation, displayed business continuity and adaptability for breaking unwanted stoppage at the time of COVID-19 pandemic. According to Oyewole et al (2019) states that pandemic has increased the use of distant working, electronic documentation and online transaction in moving port business forward. The authors further explicate the responsibilities of information technology in reducing risks and improving port operational efficiency on cargo quality.

This study targets the critical position of information Technology and its need for enforcement of cargo service delivery in Nigerian ports, which provides a wide range transformation for a successful business used as strong tools

in addressing the challenges that absolutely contribute to the benefits of digitalization for increased service quality for ports' cargo operation in Nigeria.

Looking at the study, it sought to contribute to the current exposition on information technology (IT) innovation on port infrastructure systems and performance of Nigerian ports. Ariene (2019).

Information technology in Nigerian ports relatively goes along way with basic fundamentals that facilitate port business operations for customers' satisfaction through effective communications in Nigeria. Therefore, information technology plays important roles in reshaping Nigerian maritime sector, highly supportive for efficient operations at different potentials with the target at meeting Nigerian ports' requirement in line with global standard.

Information technology revitalizes port logistics, supply chains and facilitates economic growth with increase on available cargo volume, it is believed that trading efficiently thrives in Nigerian ports. It shows that cargo handling process can be accomplished in a faster lane towards achieving the best result by promoting shipping business in Nigerian ports. Addo-Tenkorang, & Helo, (2016).

Ports as important distribution link in the value chain, control about 95% of the total goods in international trade dominantly moved by sea for various economic purposes, their concern with information technology become a great advantage for developing countries like Nigeria. Therefore, there is every need to invest on information technology to boost ports efficiencies in handling of cargo distribution within and outside the ports to enable affiliated traders and service providers take advantage of new business opportunities that would capture the market in order to become resilient and competitive with enhancement of digitalization (UNCTAD 2019).

Information technology is highly utilized in the global maritime industry in terms of cargo management such as the United States, Great Britain and Southern Korea, unlike the developing nations paying little or no attention on information technology infrastructure having long expectations for smart seaport in a shadow. Hence, this study investigated the effect of information technology on cargo service quality along with the challenges and ways of addressing them in the entire Niger Delta ports, Nigeria.

Statement of the Problem

In Nigeria, ports realized the critical position of information technology and its significance on cargo service quality as stakeholders' benefit greatly through huge investment on innovation placed to improve supply chain (supply, packaging, warehousing, distribution, logistics, and production) to which work automation becomes very helpful to cargo service quality process of all ports operation in Niger Delta. So, it has made tremendous achievement in revolutionizing cargo operational modeling to achieving a just-in-time pattern palatable to port stakeholders such as importers, exporters, terminal operators and other agencies in the Nigerian ports.

Work automation, port infrastructure and communication devices on cargo service quality orchestrate the use of digital equipment facilitating greater work efficiency for port customers' satisfaction and yet, Nigeria's ports still suffer plethora challenges associated with manual operations, undermining the recent port concession reform established that its implementation becomes far reaching because of conflicting interest generated by political reasons. They lack the quality of facilitating documentation processes, brewing incessant delay on container examination and cargo clearance policies (LCCI, 2018).The influence of operational comatose led to congestion in Nigerian ports that become area of concern to stakeholders and other port users.

This study therefore, focus on work automation owing to poor cargo service quality experienced by most ports in Nigerian maritime sector over some decades have recently attract emergence of modern technology on innovation of ship design for acclimatization of effective port operation in the world maritime sector.

Objectives of the Study

This study examined the following specific objectives:

1) To determine the extent to which work automation relate to cargo service quality of ports in Niger Delta, Nigeria.
2) To determine the extent to which port infrastructure relate to cargo service quality of ports in Niger Delta, Nigeria
3) To determine the extent to which communication devices relate to cargo service quality of ports in Niger Delta, Nigeria.

Research Questions

1) To what extent does work automation relate to cargo service quality of ports in Niger Delta, Nigeria?
2) To what extent does port infrastructure relate to cargo service quality of ports in Niger Delta, Nigeria?
3) To what extent does communication devices relate to cargo service quality of ports in Niger Delta, Nigeria?

Research Hypotheses

The research hypotheses of this study have been stated as follows:

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HO_1: Work automation does not significantly relate to cargo service quality of ports in Niger Delta, Nigeria.

HO_2: Port infrastructure does not significantly relate to cargo service quality of ports in Niger Delta, Nigeria.

HO_3**:** Communication devices do not significantly relate to cargo service of ports in Niger Delta, Nigeria.

2. LITERATURE REVIEW

Theoretical Review (Information Technology Theory)

This theory was established in the 20th century innovations associated with advance development of information technology. Ann and Park, (2021) use this theory to explain its application using Busan port in Korea as case study to explicate the economic feasibility of information technology on automated container terminal investment. Molavi et al., (2020) stated that using lexicographic goal programming in accordance to the theory will provide room to examine the advantages of microgrid integration enabling operations, environment, energy, safety and security

Gurzhiy et al, (2020) opined those cyber-physical systems (CPS) should be employed to automate equipment and infrastructure. These systems have the capacity to link physical devices with the virtual world to provide smart solutions on artificial intelligence (AI) perceived as essential elements of data-driven decision-making process in most modern ports globally, Liang and Liu, (2018) explained that Artificial Intelligence\e have drawn considerable attention in recent time through various research work undertaken.

Jovi´c et al., (2019). Stated that the adoption of modern digital technologies improves cargo service quality of ports business partnerships/strategies swift operations and efficiencies. However, increasingly crisscrossed networks function to make all port activities sustainable, far reaching and efficient, thereby making the dream of technology evolution comes to reality to smart port (De la et al., 2021).

Conceptual Review

Information Technology

It is clearly stated that information technology advances as the day goes by. So, the dynamic change in development, and people meeting various situation in their different work places, facilitate the interest of many scientists to work tirelessly for the development of different level of technologies that met the need of people in this contemporary world more especially, in the production of goods and services in most palatable manner to customers. Relatively, Lai, (2016) posit that there are many good number of researchers that indicate interest in addressing the problems involved in the process of adopting modern Technologies. Basically, the current port operation pattern on technology adoption considered a smart response to the consciousness of economics of globalization and emergence on death of distance.

Work Automation

Chen, (2017) posits that automation on ports generally generate cloud-based software to support in providing efficient operational flows that assist the port function without hitch. Presently, most of the ports around the globe are characterized with technology integrated system to promote the actualization of complete efficiency for complete port total quality management of port operation. Port of Hamburg, Germany, and Sweden is one such smart port that uses cloud-based solutions for managing energy resources, traffic control, infrastructure facilities, and port property for efficient port operation.

Port Infrastructure

The development of port infrastructure is seen as a good facilitator to improvement of economic growth at the local, and regional levels. Numerous scholars made various contributions in their studies to evaluate the influences of developing port infrastructure in convenience transportation and the economic condition emerging from the quantity of investment and the output realized.

Communication Devices

Communication devices consist of digital system refer to as cluster of applications of big data from Automatic Identification System (AIS) use in maritime or port operation, (Wang Wan and Zhang, 2016). They claimed in their publication, that proper visualization on maritime traffic could improve the safety of port and entire maritime operation.

Cargo Service Quality

About 39 years, records had it that cargo service quality produced a reasonable output estimating 14,467,024 metric tons. But from the year 2006 to 2012, moving average volume of 67,240,231.86 metric tons of cargo, indicating that quality of were able to actualize 67,240,231.86 metric tons of cargo from the year 2006 to 2012 greater than the annual average of 14,467,024 metric tons of cargo from the year 1956 to 2005. This record shown there is great improvement on quality service that were set to deliver increase volume of cargo by 456.69%. Invariably, shows a progressive trend

generated from the port new governance model established at the period of new government policies on concessionaire.

Thinwaka et al., (2020) assessed quality service on cargo in various information technology systems relating to cloud-based storage system. They proposed several optimization models to facilitate their performance in the port environment. They emphatically state that, applying optimization of data transfer techniques, and increasing the potential of network bandwidth, will absolutely enhance the cargo throughput system of ports. Sharma et al., (2019) investigated quality service on cargo throughput information of terms (IOT) networks, and prepare a novel designed for efficient data transfer and processing. The scholars demonstrated that novel can significantly improve cargo quality service in port maritime business operations.

Empirical Review

This review will examines recent works assessing the extent work automation impact on cargo service quality. Studies on work automation focuses on the operation of container terminals. Notteboom and Rodrigue, (2018) experiment to understand the extent to which work automation improves on cargo service quality for performance optimization in the entire global ports such as stacking cranes and automated guided vehicles designed for transformation of container terminals in promoting the level of port performance.

Gap in Knowledge

The literature review of previous works in this area to a very large extent show that the subject of this work does not absolutely contain the exhaustive information required concerning the variables and the place of the study, hence the gap in these critical domains as far as ports in Niger Delta of Nigeria are concerned.

3. METHODOLOGY

This research adopted cross sectional survey design. The target population of the study consisted of the staff in the four Niger Delta ports in Nigeria. Therefore, the population of the study was 1,396 staff and questionnaire were distributed.

Methods of Data Collection

The study used a structured questionnaire (research instrument) to collect the primary data. The secondary sources were gotten from existing data obtained from relevant materials such; books, journals, magazines and so on an unpublished work of others as well as valuable documents available to the researcher.

Data Analysis Techniques

In this study, percentages, ratios, frequency distribution, scaling, ranking and other statistical tools were used to analyse and the achieve research objectives. Specifically, Pearson's Product Moment Correlation Co-efficient was used to achieve objectives 1, 2, 3 and as well test the hypotheses formulated in the study with the help of SPSS 25.0.

4. RESULTS

Table 1: Descriptive Statistics Analysis of Work Automation as a Dimension of Information technology

Questionnaire Items	SA	A	D	SD	Mean	Std. Dev.
Work automation allows organizations to consolidate infrastructure from multiple systems, databases, and applications into a single location, making it easier to access and perform effectively and efficiently in the port	123 (43.9%)	111 (39.6%)	26 (9.3%)	20 (7.1%)	3.20	1.21
Automation on ports generally generate cloud based software to support in providing efficient operational flows that assist the port function without hitch	117 (41.8%)	106 (37.9%)	32 (11.4%)	25 (8.9%)	3.12	0.80
There are great range and various automation levels that differ from port to port, hinging on the potential and capacity of the port, their geographical position, the volume of cargo they accommodate, and their economic values.	106 (37.9%)	106 (37.9%)	36 (12.9%)	32 (11.4%)	3.02	0.62

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Work automation enables job efficiency, standardization, and enrichment, ensuring that the outcome is accurate, consistent, and reliable for optimized port operations	118 (46.4%)	115 (41.1%)	15 (5.4%)	20 (7.1%)	3.27	1.22
Automated equipment digitalized are used in the carriage of containers of various tonnage in port terminals fulfilling customers' service deliveries in the port business environment with the support either unmanned horizontal transportation or unmanned yard cranes.	119 (42.5%)	104 (37.1%)	37 (9.1%)	20 (7.1%)	3.15	0.79

Source: Field Survey (2024).

Key: SA = Strongly Agree, A = Agree, D = Disagree, SD = Strongly Disagree

Table 1 presents the univariate analysis of response rates on work automation as measured on a five- item instrument and scaled on a four-point modified Likert scale. The results on the table showed that greater number and percentages of the respondents agreed/ strongly agreed with all the questionnaire items on work automation. In other words, the questionnaire items on work automation have the weighted mean ratings of 3.20, 3.12, 3.02. 3.27 and 3.15 which are above criterion mean of 2.5 and are therefore accepted. This means that there is sufficient statistical evidence to infer that the respondents are in agreement with the questionnaire items on work automation.

Table 2: Descriptive Statistics Analysis of Port Infrastructure System as a Dimension of Information technology

Questionnaire Items	SA (%)	A (%)	D (%)	SD (%)	Mean	Std. Dev.
Port service is mostly achieved when the infrastructure system is automated and this enhances port performance	277 (46.4%)	100 (35.7%)	25 (8.9%)	25 (8.9%)	3.20	1.19
Port infrastructure system provides a significant and positive nexus between provincial economics and value-added activities at ports	109 (38.9%)	109 (38.9%)	39 (13.9%)	23 (8.2%)	3.09	.079
Port infrastructure system contributes greatly to effectiveness and efficiency of operations, giving room for effective ship calls time bound at ports	87 (31.1%)	141 (50.4%)	26 (9.3%)	26 (9.3%)	3.03	0.57
Port infrastructure system improves economic growth as strategies of port influences the expansion of assets in which influence the economic benefits of cities and towns in the area of employment, production, and high standard of living.	91 (32.5%)	135 (48.2%)	30 (10.7%)	24 (8.6%)	3.05	1.19
Variation in port infrastructure development is a clear indication of improved productivity, customers' and stakeholders' new status, and port governance	100 (35.7%)	118 (42.1%)	32 (11.4%)	30 (10.7%)	3.03	0.79

Source: Field Survey (2024).

Key: SA = Strongly Agree, A = Agree, D = Disagree, SD = Strongly Disagree

Table 2 presents the univariate analysis of response rates on port infrastructure system as measured on a five- item instrument and scaled on a four point modified Likert scale. The results on the table showed that greater number and percentages of the respondents agreed/ strongly agreed with all the questionnaire items on port infrastructure system. In other words, the questionnaire items on port infrastructure system have the weighted mean ratings of 3.20, 3.09, 3.03. 3.05 and 3.03 which ae above criterion mean of 2.5 and are therefore accepted. This means that there is sufficient

statistical evidence to infer that the respondents are in agreement with the questionnaire items on port infrastructure system.

Table 3: Descriptive Statistics Analysis of Communication Devices as a Dimension of Information technology

Questionnaire Items	SA (%)	A (%)	D (%)	SD (%)	Mean	Std. Dev.
Communication devices prevent unauthorized access, eavesdropping, or communication breaches, thereby safeguarding sensitive information.	122 (43.6%)	102 (36.4%)	23 (8.2%)	33 (11.8%)	3.12	0.68
Implementing communication devices can enhance an organization's trustworthiness and reputation.	108 (38.6%)	104 (37.1%)	30 (10.7%)	38 (13.6%)	3.01	0.68
By using effective communication devices digital signatures or certificates, it becomes difficult for malicious actors to forge or tamper with them, enhancing trust and port computerization processes.	97 (34.6%)	278 (46.8%)	29 (10.4%)	23 (8.2%)	3.08	0.55
Complex communication devices, excessive port computerization requirements, or frequent key management tasks can negatively impact user acceptance and adoption.	101 (36.1%)	110 (39.3%)	39 (13.9%)	30 (10.7%)	3.01	1.28
Communication devices are made up of digital system popularly known as cluster of applications of big data from Automatic Identification System (AIS) use in maritime or port operation	119 (42.5%)	99 (35.4%)	31 (11.1%)	31 (11.1%)	3.09	0.73

Source: Field Survey (2024).

Key: SA = Strongly Agree, A = Agree, D = Disagree, SD = Strongly Disagree

Table 3 presents the univariate analysis of response rates on communication devices as measured on a five- item instrument and scaled on a four point modified Likert scale. The results on the table showed that greater number and percentages of the respondents agreed/ strongly agreed with all the questionnaire items on communication devices. In other words, the questionnaire items on port infrastructure system have the weighted mean ratings of 3.12, 3.01, 3.08. 3.01 and 3.09 which ae above criterion mean of 2.5 and are therefore accepted. This means that there is sufficient statistical evidence to infer that the respondents are in agreement with the questionnaire items on communication devices.

Table 6 presents the univariate analysis of response rates on port infrastructure system as measured on a five- item instrument and scaled on a four point modified Likert scale. The results on the table showed that greater number and percentages of the respondents agreed/ strongly agreed with all the questionnaire items on work automation. In other words, the questionnaire items on port infrastructure system have the weighted mean ratings of 3.20, 3.09, 3.03. 3.05 and 3.03 which ae above criterion mean of 2.5 and are therefore accepted. This means that there is sufficient statistical evidence to infer that the respondents are in agreement with the questionnaire items on port infrastructure system.

Table 4: Descriptive Statistics Analysis of Cargo Service Quality as a Measure or Proxy of Performance optimization of Ports in Niger Delta

Questionnaire Items	SA	A	D	SD	Mean	Std. Dev.
Cargo service quality requires a holistic approach that combines technical safeguards, robust policies and procedures, regular audits and assessments, and a security-conscious organizational performance.	123 (43.9%)	103 (36.8%)	23 (8.2%)	31 (11.1%)	3.14	1.21
Applying optimization of data transfer techniques, and increasing the potential of network band witch, will absolutely enhance the cargo service quality of ports.	108 (38.6%)	104 (37.1%)	30 (10.7%)	38 (13.6%)	3.01	0.91
Cargo service quality can be compromised by insiders like employees, contractors, or	120 (42.9%)	99 (35.4%)	30 (10.7%)	31 (11.1%)	3.10	0.74

partners who have legitimate access to sensitive information.						
Quality service on cargo in various information technology systems relating to cloud-based storage system amplify several optimization models to facilitate efficient performance in the port environment.	277 (46.4%)	115 (41.1%)	15 (5.4%)	20 (7.1%)	3.27	1.23
The use of information technology devices and effective digitalized service system can offer convenience and scalability but they can introduce additional challenges in maintaining information cargo service quality.	95 (33.9%)	127 (45.4%)	29 (10.4%)	29 (10.4%)	3.03	0.95

Source: Field Survey (2024).

Key: SA = Strongly Agree, A = Agree, D = Disagree, SD = Strongly Disagree

Table 4 presents the univariate analysis of response rates on cargo service quality as measured on a five-item instrument and scaled on a four-point modified Likert scale. The results in the table showed that greater number and percentages of the respondents agreed/strongly agreed with all the questionnaire items on cargo service quality. In order words, the questionnaire items on cargo service quality have the weighted mean ratings of 3.14, 3.01, 3.10, 3.27 and 3.03 which are above the criterion mean of 2.5 and are therefore accepted. This means that there is sufficient statistical evidence to infer that the respondents are in agreement with the five questionnaire items on cargo service quality.

Interpretation and Discussion of Findings

The findings of this study were drawn from the analyses of the results in the previous chapter. In this chapter, the study attempts to discuss the findings in order to draw the conclusions therefrom. However, the study interprets and discusses the findings in four compartments according to the basic dimensions of the study's predictor variables against the criterion variables. This chapter is therefore divided into four sections. It deals with the relationship between information technology involving work automation, port, port infrastructure system, communication devices and cargo service quality of ports performance.

Positive and Significant Relationship between Information Technology and Cargo Service Quality

The findings of the study connected to the relationship between information technology and cargo service quality revealed that Ports in Niger Delta use work automation to conduct their information technology and that this elicits port performance. A critical appraisal of the finding reveals that a strong positive and significant relationship exists between work automation and cargo service quality (r=0.734);, and a strong positive and significant relationship exists between port infrastructure system as a dimension of information technology and cargo service quality (r=0.600); there is a strong positive relationship between communication devices and cargo service quality (r=0.707); as a measure of port performance. In all, there is strong positive and significant relationship between work automation, port infrastructure system, communication devices on cargo service quality. The full fact of this finding is that Ports in Niger Delta use work automation software that provides a variety of technological features, including comments, work automation, port infrastructure, communication devices on cargo service quality that make it possible for improvement of ports performance (Moody, 2019). Work automation, port infrastructure, communication devices on cargo service quality make great hubs for port's other information technology efforts, as they can be integrated with nearly every other digital tool or platform to elicit cargo service quality. Every port with a digital objective tries to have a work automation that speaks to its current and potential stakeholders as real people. Every time ports in Nigeria introduce new product and services, they endeavor to engage in the use of work automation, port computerization, communication devices and port infrastructure and by so doing they promote their products and services and mobilize customers and stakeholders that would end up improving performance.

5. CONCLUSION

The study investigated the effect of information technology on cargo service quality of ports performance in Niger Delta, Nigeria. Information technology refers to the process of accepting or using a new technology or product.

6. RECOMMENDATIONS

Based on the findings and conclusion of this study, the following recommendations have been made:

1. Port authorities and stakeholders in Niger Delta should prioritize increased investment on information technology infrastructure. This includes work automation, robust port infrastructure systems, communication devices and cargo service quality. By upgrading these technologies, ports can improve cargo service quality, leading to enhanced overall port performance. It is crucial to allocate budget resources and develop strategic plans that outline specific information technology projects aimed at bolstering operational efficiency.
2. To maximize the benefits of information technology, port authorities should establish continuous training and capacity-building programs for employees. These programmes should focus on the effective use of new technologies and data management.
3. Government and the Port Authorities should ensure that staff are well-trained which will not only facilitate smoother transitions to new systems but also promote a proactive approach to utilizing information technology in improving operational processes. Partnerships with educational institutions for certification programs in information technology could further enhance the skill set of the workforce.

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