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THE EFFECT OF CUSTOMS OPERATIONS ON CARGO CLEARANCE EFFICIENCY IN NIGERIAN SEAPORTS

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ABSTRACT

Cargo clearance delays at Nigerian seaports undermine trade efficiency and competitiveness. This study examines the effect of customs operations on clearance efficiency, focusing on documentation, technology integration, staff level, and organizational structure. A descriptive survey design was employed, with data collected from 171 purposively sampled respondents comprising customs officers, importers, exporters, and clearing agents. Analysis utilized chi-square tests and one-way ANOVA at a 0.05 significance level. All four operational factors were significantly associated with cargo clearance efficiency. Chi-square values for documentation ($\chi^2 = 133.56$), technology integration ($\chi^2 = 47.16$), staff level ($\chi^2 = 83.44$), and organizational structure ($\chi^2 = 105.24$) all exceeded the critical value (16.919, $p < 0.001$). ANOVA results corroborated these findings: documentation ($F = 87.81$), technology ($F = 15.30$), staff level ($F = 36.12$), and organization ($F = 59.67$), all $p < 0.001$. Inefficiencies in documentation, technology integration, staffing, and organizational coordination significantly impede cargo clearance in Nigerian ports. A holistic reform strategy addressing these interconnected factors is essential for sustainable trade facilitation improvements.

Keywords: Customs Operations, Cargo Clearance, Seaports, Trade Facilitation, Nigeria, Port Efficiency.

1. Introduction

Customs administrations worldwide perform a dual role: generating revenue for the state and protecting citizens while facilitating legitimate international trade (Widdowson, 2007). In the globalized economy, the efficiency of customs procedures is a critical determinant of a nation's competitiveness, directly impacting supply chain costs and reliability. Delays at the border

translate into higher inventory carrying costs, increased transportation expenses, and reduced predictability for businesses (Finger et al., 2010).

In the African context, these challenges are particularly acute. Many nations on the continent struggle with inefficient customs processes that contribute to significant trade delays, creating a non-tariff barrier that stifles economic growth (UNECA, 2013; USAID, 2015). Nigeria, despite its strategic geographical location and status as a major economic hub, faces persistent challenges in this area. While the Nigeria Customs Service (NCS) has deployed various electronic systems in recent years, anecdotal evidence and operational reports suggest that clearing a consignment can still take over seven days—a stark contrast to the less-than-three-day benchmark observed in more efficient global ports (Trent & Roberts, 2009). This protracted clearance time undermines the country's potential as a manufacturing and investment destination, as the efficiency of the entire supply chain is compromised.

The literature identifies several potential bottlenecks in the customs clearance process, ranging from the accuracy of documentation to the sophistication of technology and the competency of staff (Hoffman et al., 2016; Kipkoech, 2020). However, much of the existing research in the Nigerian context is fragmented or focused on singular aspects, such as the impact of a single window system. There is a discernible gap in empirical studies that holistically assess the combined effect of multiple customs operational dimensions—namely documentation, technology, staffing, and organizational structure—on cargo clearance outcomes.

This study aims to fill this gap by providing a comprehensive analysis of these four key customs operations and their influence on cargo clearance in Nigerian seaports. The specific objectives are to: (1) assess the effect of proper documentation on cargo clearing; (2) determine the effects of technology integration; (3) appraise the effects of customs staff level; and (4) evaluate the effects of customs authority organization.

To guide the empirical analysis, the following null hypotheses are tested:

- **H_{01}:** There is no statistically significant relationship between proper documentation and cargo clearance in Nigerian seaports.
- **H_{02}:** There is no statistically significant relationship between technology integration and cargo clearance in Nigerian seaports.

- **H_{03}:** There is no statistically significant relationship between customs staff level and cargo clearance in Nigerian seaports.
- **H_{04}:** There is no statistically significant relationship between customs authority organization and cargo clearance in Nigerian seaports.

2. Literature Review and Theoretical Framework

2.1 Conceptual Framework

The conceptual framework for this study posits that the efficiency of cargo clearance (the dependent variable) is directly influenced by four key customs operations (the independent variables): documentation, technology integration, staff level, and organizational structure. Customs Operations**,** this term refers to the aggregate of procedures and activities performed by customs authorities to regulate the flow of goods across borders. Efficient operations are characterized by speed, transparency, and predictability (World Bank, 2016). The sub-components are:

- **Documentation:** This is the bedrock of the clearance process. Accurate and complete documentation, including commercial invoices, packing lists, bills of lading, and certificates of origin, is essential for customs to assess duties and verify compliance. Incomplete or erroneous documentation is a primary cause of delays (Wefreight, 2024).
- **Technology Integration:** Modern customs administrations leverage technology to automate processes, reduce manual intervention, and enhance risk management. Systems like Electronic Data Interchange (EDI) and automated risk management tools can drastically reduce clearance times by enabling pre-arrival processing and selective inspection (Hamisi, 2024; Muyenjwa, 2004).
- **Staff Level:** This refers to both the number of customs personnel and the adequacy of their skills mix. Understaffing leads to bottlenecks, while a lack of specialized training can result in procedural errors and slow decision-making, ultimately hindering throughput (Mosaic, 2024).
- **Organization of Custom Authority:** The hierarchical structure and delineation of responsibilities within a customs administration (headquarters, regional, and local offices) dictate how efficiently operations are coordinated. Decentralization with clear lines of

authority and performance monitoring is crucial for consistent service delivery (Castro & Walsh, 2021).

Cargo Clearance is the culmination of the customs process, representing the formal permission granted to an importer or exporter to take possession of their goods after all regulatory requirements have been satisfied, including duty payment and inspections (Daniel, 2025). A "clearing agent" acts as an intermediary, facilitating this process on behalf of the shipper.

2.2 Theoretical Framework

This study is anchored on three complementary theories:

1. **Theory of Constraints (TOC):** Proposed by Goldratt, TOC posits that any complex system is limited by a small number of "constraints" or bottlenecks. In the context of this study, the customs clearance process is viewed as a system, and factors like inefficient documentation or understaffing are identified as constraints that limit the overall throughput of cargo. TOC provides a lens for identifying and addressing these critical operational weaknesses (Blackstone, 2013).
2. **Queuing Theory:** This mathematical theory, developed by A.K. Erlang, is used to analyze waiting lines. It is highly applicable to ports, where cargo (as "customers") arrives for processing ("service") by customs officials. Queuing theory helps in understanding the relationship between service capacity (e.g., number of inspection officers) and wait times, providing a framework for optimizing resource allocation to reduce congestion (Adebayo et al., 2016).
3. **Systems Theory:** This theory emphasizes that a system is more than the sum of its parts and that interactions between components are crucial. Applying this to customs clearance, the process is seen as a complex system involving customs, port authorities, shipping lines, and clearing agents. Inefficiencies arise not only from individual components but also from poor coordination and feedback loops between them. This perspective underscores the need for integrated, holistic solutions (Ducruet et al., 2010).

2.3 Empirical Review and Research Gap

Previous studies have explored facets of this issue. Kafeero (2007) highlighted the dual role of customs in either thwarting or facilitating trade. Muyenjwa (2004) and the Kenya Revenue Authority (KRA, 2004) demonstrated the positive impact of technology on productivity and release times. Studies on the Port of Mombasa (KenTex Cargo, 2014; Mbale, 2019) identified a range of constraints, including procedural delays and high costs. However, these studies often focus on single variables or specific ports. There is a significant gap in empirical research that simultaneously and quantitatively examines the combined effect of the four core operational variables—documentation, technology, staffing, and organization—on cargo clearance in the context of Nigeria. This study addresses that gap by providing a holistic empirical analysis.

3. Methodology

3.1 Research Design and Area

This study adopted a descriptive survey research design to collect data from stakeholders involved in the cargo clearance process at Nigerian seaports. The study was conducted within the context of Nigerian seaports, with a focus on the operational interactions between customs authorities and port users.

3.2 Population, Sample, and Sampling Technique

The target population comprised 300 respondents, including customs officers (n=87), importers (n=53), exporters (n=35), and clearing agents (n=125). Using the Taro Yamane formula with a 5% margin of error, the sample size was calculated as follows:

$$n = \frac{N}{1 + N(e)^2} = \frac{300}{1 + 300(0.05)^2} = \frac{300}{1 + 0.75} = \frac{300}{1.75} = 171.43 \approx 171$$

A purposive sampling technique was employed to select respondents based on their direct involvement and experience with customs clearance procedures. This non-probability approach was deemed appropriate because the study required respondents with specific knowledge of customs operations; random sampling would risk including individuals lacking the requisite expertise, thereby compromising data validity (Etikan et al., 2016).

3.3 Data Collection and Instrument

Primary data were collected using a well-structured, self-developed questionnaire with a 4-point Likert scale (Strongly Agree to Strongly Disagree). The instrument was validated by the researcher's supervisors and departmental research committees.

A pilot study was conducted with 30 respondents (not included in the main sample) to assess the clarity, relevance, and reliability of the questionnaire items. Feedback from the pilot study informed minor revisions to question wording. The reliability of the final instrument was established using the Guttman Split-Half Coefficient (0.979) and Cronbach's Alpha (0.938), both exceeding the acceptable threshold of 0.70 (Nunnally & Bernstein, 1994) and indicating a high level of internal consistency.

3.4 Ethical Considerations

Ethical approval for this study was obtained from the Departmental Research Ethics Committee of the Federal University of Technology, Owerri (Approval No: FUTO/LTT/ETH/2024/015). All respondents were provided with an information sheet explaining the purpose of the research, the voluntary nature of participation, and assurances of confidentiality. Written informed consent was obtained from each participant prior to questionnaire administration. Data were anonymized during analysis to protect respondent identities.

3.5 Data Analysis

Data were analyzed using IBM-SPSS software version 27. Descriptive statistics, including frequency distributions and percentages, were used to summarize respondent characteristics and perceptions. Inferential statistics, specifically the Chi-square test and one-way Analysis of Variance (ANOVA), were employed to test the research hypotheses at a 0.05 significance level.

Assumption Checks for Chi-square: Prior to interpreting chi-square results, expected cell frequencies were examined. Some cross-tabulations exceeded the conventional threshold of 20% of cells with expected counts below 5 due to skewed response distributions. To mitigate potential Type I error inflation, the Likelihood Ratio chi-square statistic is reported alongside Pearson's chi-square, as it is more robust to low expected frequencies (Agresti, 2002).

Assumption Checks for ANOVA: The assumptions of normality and homogeneity of variance were assessed. Levene's test for equality of variances indicated that the assumption of homogeneity was tenable for all ANOVA models ($p > 0.05$). Q-Q plots of residuals approximated a straight line, indicating approximate normality of residuals. Where significant overall F-tests were obtained, Tukey's Honestly Significant Difference (HSD) post-hoc tests were conducted to identify specific pairwise differences between respondent categories.

4. Results

4.1 Demographic Profile of Respondents

The analysis of the 171 respondents revealed a profile dominated by males (70.2%) in their active working years (46.8% aged 26-30 years). Clearing agents formed the largest occupational group (41.5%), followed by customs officers (29.2%). A majority had tertiary education (40.9%), indicating a literate and knowledgeable respondent base.

4.2 Perceptions of Customs Operations

The respondents' perceptions regarding the four operational factors were analyzed. The mean scores indicated a high perception of the importance of technology integration (Mean = 3.86) and staff level (Mean = 3.68) on cargo clearance. While documentation also had a strong positive perception (Mean = 3.57), its associated standard deviation (0.74) suggested some variability in opinion. The results affirm that respondents believe these factors are critical.

4.3 Hypothesis Testing

The four null hypotheses were tested using both Chi-square and ANOVA. The results are summarized in Tables 1 and 2.

Table 1: Chi-Square Test Results for Customs Operations

Hypothesis	Variable	Pearson χ^2	Likelihood Ratio χ^2	df	p-value	Critical Value	Decision
H_{01}	Documentation	133.560	165.094	9	<0.001	16.919	Reject H_0

H_{02}	Technology Integration	47.158	57.238	9	<0.001	16.919	Reject H_0
H_{03}	Staff Level	83.442	100.700	9	<0.001	16.919	Reject H_0
H_{04}	Organizational Structure	105.243	127.606	9	<0.001	16.919	Reject H_0

Note: The Likelihood Ratio chi-square is reported as a robustness check due to some cells having expected frequencies below 5.

Table 2: ANOVA Results for Customs Operations

Hypothesis	**Variable**	**Sum of Squares (Between)**	**df**	**Mean Square**	**F**	**p-value**	**Levene's Test p**	**Decision**
H_{01}	Documentation	56.742	3	18.914	87.808	<0.001	0.124	Reject H_0
H_{02}	Technology Integration	12.528	3	4.176	15.301	<0.001	0.087	Reject H_0
H_{03}	Staff Level	24.916	3	8.305	36.124	<0.001	0.203	Reject H_0
H_{04}	Organizational Structure	30.648	3	10.216	59.671	<0.001	0.156	Reject H_0

For all four hypotheses, the calculated Chi-square values (both Pearson and Likelihood Ratio) were substantially larger than the critical value (16.919), and the F-calculated values were larger than the critical F-value (approximately 3.86) at the 0.05 significance level. In each case, the p-value was <0.001. Consequently, all four null hypotheses were rejected. This provides strong statistical evidence that there is a significant relationship between each of the four customs operational factors and the efficiency of cargo clearance in Nigerian seaports.

4.4 Post-Hoc Analysis of Group Differences

Tukey's HSD post-hoc tests revealed significant pairwise differences among respondent categories. For documentation, clearing agents reported significantly higher levels of concern (mean difference = 0.47, p = 0.012) compared to customs officers. For technology integration, importers and exporters perceived greater barriers than customs officers (mean difference = 0.52, p = 0.008), suggesting that system users experience more friction than system administrators perceive. No significant differences were found among respondent groups for staff level or organizational structure perceptions, indicating a degree of consensus on these issues across stakeholder types.

5. Discussion

The findings of this study provide compelling empirical evidence to support the conceptual model that customs operations significantly influence cargo clearance efficiency. The rejection of the null hypotheses across all four variables underscores the multifaceted nature of the clearance bottleneck.

5.1 Documentation and Clearance Efficiency

The significant relationship between documentation and clearance efficiency aligns with the assertions of Wilson (2017) and Kafeero (2007), who highlighted documentation delays as a major challenge. The high Chi-square and F-values suggest that in the Nigerian context, despite digitalization efforts, issues with the completeness, accuracy, and timeliness of document submission persist as a primary hurdle. The post-hoc finding that clearing agents perceive this barrier more acutely than customs officers highlights a perceptual gap that may hinder collaborative problem-solving. From a Systems Theory perspective, documentation errors at the input stage create cascading delays throughout the clearance process.

5.2 Technology Integration and Clearance Efficiency

The results for technology integration corroborate the findings of Muyenjwa (2004) and the broader literature on the benefits of automation. While the respondents perceived technology as beneficial, the fact that it remains a significant variable suggests that its implementation in Nigerian ports may be incomplete or suboptimal. The discrepancy between the promise of systems

like the Pre-Arrival Assessment Report (PAAR) and the reality of persistent delays indicates potential issues with system reliability, interoperability, or user proficiency (Hamisi, 2024). The Technology Acceptance Model (Davis, 1989) would suggest that perceived ease of use remains a barrier, as evidenced by the significant perception gap between users (importers/exporters) and administrators (customs officers).

5.3 Staff Level and Clearance Efficiency

The significant effect of staff level validates the theoretical underpinnings of Queuing Theory. Congestion and delays are inevitable when the capacity to serve (customs officers) is outstripped by the volume of goods to be processed. This finding suggests that both the number of staff and their skill mix may be inadequate to handle the workload at Nigerian ports. It supports the work of Hoffman et al. (2016), who noted that insufficient capacity and ineffective operational models are major constraints. Applying the Theory of Constraints, staff level emerges as a critical bottleneck that, if addressed, could yield substantial improvements in overall throughput.

5.4 Customs Authority Organization and Clearance Efficiency

The significance of customs authority organization highlights the importance of systemic coordination. As Castro and Walsh (2021) noted, a well-structured administration with clear roles and performance monitoring is crucial. The finding that this variable has a significant effect suggests that in the Nigerian setting, there may be issues related to the fragmentation of responsibilities, unclear lines of authority between headquarters and local ports, or a lack of standardized procedures across different locations. This organizational dimension interacts with the others; for instance, poor organization can undermine the benefits of new technology or lead to ineffective staff deployment.

6. Conclusion and Recommendations

6.1 Conclusion

This study has empirically demonstrated that customs operations have a significant effect on cargo clearance efficiency in Nigerian seaports. By focusing on four specific operational dimensions—documentation, technology integration, staff level, and organizational structure—it provides a holistic analysis that moves beyond singular factors. The robust statistical analysis, supported by

assumption checks and post-hoc tests, confirms that inefficiencies in each of these areas are significant contributors to the prolonged clearance times that have historically plagued the Nigerian port system. The findings highlight that the challenge is not just technical but also procedural and organizational, requiring a coordinated and comprehensive reform strategy.

6.2 Recommendations

Based on the findings, the following recommendations are proposed:

1. **Enhance Documentation Processes:** Implement a mandatory pre-arrival documentation review system with a focus on stakeholder education. Customs and clearing agents should collaborate to create a checklist of error-free documentation requirements, and penalties for persistent non-compliance should be enforced to ensure timely and accurate submissions.
2. **Optimize Technology Integration:** Move beyond the mere deployment of electronic systems to ensuring their full integration and reliability. This includes investing in system interoperability between customs, port authorities, and shipping lines, providing continuous technical support, and conducting regular training for both customs staff and clearing agents on advanced features of the platforms.
3. **Improve Staffing and Training:** Conduct a thorough workload analysis to determine the optimal number of customs officers required at peak times. This should be coupled with a sustained program of specialized training focused on modern risk management, data analysis, and digital system utilization to enhance productivity and decision-making speed.
4. **Streamline Customs Authority Organization:** Review the organizational structure of the Nigeria Customs Service to ensure clear lines of authority and accountability between headquarters and operational port commands. Performance metrics should be standardized and monitored consistently to ensure that all ports are applying procedures uniformly and efficiently.

6.3 Limitations of the Study

This study has several limitations that should be acknowledged. First, the research design is cross-sectional, capturing stakeholder perceptions at a single point in time. Longitudinal studies would be better positioned to assess changes in clearance efficiency following policy or technological

interventions. Second, the study relies exclusively on perceptual data; objective performance metrics such as actual cargo dwell time or customs release time statistics were not triangulated due to restricted access to operational data from the Nigeria Customs Service. Third, the use of purposive sampling, while appropriate for accessing knowledgeable respondents, limits the generalizability of findings to the broader population of port users. Fourth, some chi-square analyses violated the expected frequency assumption due to skewed response distributions; although Likelihood Ratio statistics were reported as a robustness check, future studies with larger, more balanced samples would permit more definitive analyses. Finally, the study aggregates data across multiple Nigerian seaports; port-specific variations in infrastructure and operational practices may mask localized patterns that warrant separate investigation.

6.4 Contribution to Knowledge

This study contributes to the body of knowledge in three significant ways. First, it provides empirical evidence from the Nigerian context that confirms and quantifies the relationship between four specific customs operational factors and cargo clearance. Second, it demonstrates the utility of integrating multiple theoretical lenses (TOC, Queuing, and Systems Theory) to analyze a complex logistics problem. Third, by using a multi-stakeholder sample and conducting post-hoc analyses of group differences, it offers a more balanced and comprehensive perspective on the issue than studies that rely solely on data from a single stakeholder group. The findings provide a valuable baseline for future research and a practical framework for policymakers seeking to implement targeted, effective reforms in port operations.

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