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Human Resource Capacity as a Moderator of the Relationship Between Infrastructure and Cargo Clearance Efficiency at One Stop Border Posts in Kenya

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Abstract

The objective of the study was to evaluate the effect of Infrastructure on cargo clearance efficiency at Namanga and Lungalunga one-stop border posts in Kenya. The study also sought to examine the moderating effect of human resource capacity on the relationship between Infrastructure and cargo clearance efficiency at Namanga and Lungalunga one-stop border posts in Kenya. The study used a quantitative research design and structured questionnaires to collect data from 222 respondents, including clearing agents, customs officials, freight forwarders, and port health officers. The determined sample size was 222. Because the population had a variety of traits that fit into several strata, the study used stratified sampling when determining the sample size. The study used descriptive and inferential statistics to analyze the gathered data in SPSS Version 27. Descriptive statistics (mean, standard deviation, and frequencies) summarized respondent demographics and variable trends. Inferential statistics included hierarchical regression analysis to evaluate the study's hypotheses, such as the moderating effect of human resource capability, and Pearson's correlation analysis to investigate associations. Tables, charts, and graphs displayed the data. The study found that infrastructure has a statistically significant effect on cargo clearance efficiency at Namanga and Lungalunga one-stop border posts in Kenya. Recommendations include the need for continued investments by the Government of Kenya through its border management agencies in border infrastructure through expansion of office spaces, introduction of more cargo scanning machines and weighbridges, internet connectivity and supply of electricity. Maintenance of existing infrastructure should also be emphasized to ensure smooth customs procedures and improve cargo clearance efficiency.

Keywords: *Infrastructure, human resource capacity, cargo clearance efficiency*

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1. Introduction

The Coordinated Border Management program enables national and international regulatory organizations to manage the flow of services, people, goods and animals crossing borders through border control actions. CBM is a strategic reform framework that improves the efficiency of travel and trade flows while safeguarding security and compliance (WCO, 2014).

It rationalizes the principle of harmonization of procedures, delivery of results and programs through adoption and implementation of concepts such as One Stop Border Posts (OSBPs). There are several agencies involved in border management that include customs, health, immigration, security, trade, and transport, in which procedural and policy harmonization, political, technical, and financial inputs, and active engagement from these agencies result in an effective border management process.

For cross-border trade to run smoothly and affordably, border management must be secure and well organized. CBM must fulfilll three requirements for this to be feasible. First, interagency cooperation and coordination should fall under a single authority that enables ongoing training and can be held responsible for managing the relevant agencies. Second, regarding its trade and regulatory control statements, the relevant nation must operate under a single-window environment. Thirdly, all relevant agencies must continuously provide information and intelligence (Ogutu, 2022).

As a result of globalization, demand for trade facilitation and integration has increased, while also requiring revenue collection, safeguarding trade supply chains, and protecting society (World Bank, 2020). While trade is a key driver of wealth creation and economic growth, customs administrations primarily ensure its effectiveness by processing goods and people and enforcing compliance with legal and regulatory frameworks. Customs administrations also face changes in their operating environment, including more sophisticated and demanding customers who have made significant investments in information systems, inventory control, and modern logistics, as well as increased policy and procedural requirements related to international obligations.

Similarly, the growth of bilateral and regional trade agreements makes border and formalities management more difficult. Additionally, customs' function has shifted from overseeing the movement of products at border crossings to serving as the main border agency responsible for promoting trade and safeguarding the public by preventing the transport of hazardous and dangerous commodities across borders. Many nations have committed substantial resources to modernizing their customs administrations and implementing coordinated border management initiatives in response to these challenges; many governments have made customs modernization a top priority in their development agendas (De Wulf & McLinden, 2015).

1.1 Problem Statement

Cargo clearing efficiency is a very crucial determinant of international trade competitiveness, economic growth, and regional integration. In ideal conditions, cargo should be cleared within the shortest possible time, at minimal cost and with predictable and transparent procedures that facilitate the seamless movement of goods across borders (Huiden, & Tan, 2017). To improve the seamless flow of commodities across borders, many agencies must cooperate and coordinate. However, most borders often experience extended clearance periods and delays caused by lengthy procedures and traffic, which affect cargo flow.

Most border posts struggle to adopt efficient customs clearance procedures, even if international organizations like the World Trade Organization (WTO) and World Customs Organization (WCO) provide best practices for international trade (Nganga 2021). Long, complicated processes and excessive paperwork are the main causes of border-crossing delays in Kenya, which harm trade and raise operating expenses. Furthermore, overlapping duties and legislative mandates from different government agencies, along with the use of semi-automated

procedures, have created uncertainty in customs procedures, ultimately resulting in ineffective cargo clearance at border checkpoints (Kabui & Mwaura, 2019).

A survey report by NCTO (2020) found that long clearance lines remain a problem. The research found that lines at key OSBPS in Kenya, such as Namanga, Busia, and Malaba, were longer than five kilometers. Over the previous four years, importers and licensed clearing agents have frequently complained about delays in clearing their goods, with consignments taking more than 14 days to clear, a sharp contrast to WCO's requirement of three days. The survey recorded corruption risks and higher operational expenses for enterprises and customs officials, with companies' operating expenses rising by 60%, triple the ideal operating expense of 20%. According to a report by the Ethics and Anti-Corruption Commission (2022), the complexity and opaqueness of customs procedures, and a lack of coordination among government agencies at the border can create opportunities for corrupt practices, further hindering efficient trade, increasing costs for businesses, disrupting supply chains, and reducing global market competitiveness.

1.2 Objectives of the Study

i. To evaluate the effect of Infrastructure on cargo clearance efficiency at Namanga and Lungalunga one stop border posts in Kenya.
ii. To examine the moderating effect of human resource capacity on the relationship between Infrastructure and cargo clearance efficiency at Namanga and Lungalunga one stop border posts in Kenya

2. Literature Review

2.1 Theoretical Review

2.1.1 Systems Theory

Ludwig von Bertalanffy advanced Systems Theory in the 1950s, providing a holistic framework for analyzing complex phenomena composed of interrelated and interdependent components. In the context of border management initiatives, Systems Theory offers a valuable perspective on how customs operations function within a broader border management system involving multiple agencies and processes (Bertalanffy, 1950). Customs, immigration, health, standards, and security agencies operate as interconnected subsystems whose coordinated performance determines the overall efficiency of cargo clearance and border management outcomes (Meadows, 2008).

From a systems perspective, cargo clearance is most effective when border management agencies integrate policies, procedures, and technologies across all relevant subsystems. According to Systems Theory, effective feedback mechanisms are essential for system performance and continuous improvement. Positive feedback loops emerge when customs administrations exchange real-time trade data, risk profiles, and inspection outcomes with other border agencies, improving targeting, reducing duplicated controls, and speeding clearance processes. Conversely, negative feedback manifested through bureaucratic delays, fragmented procedures, and data silos disrupts system equilibrium and undermines cargo clearance efficiency (Sterman, 2000).

A key Systems Theory principle relevant to border management initiatives is synergy, where coordinated interaction among subsystems produces outcomes superior to those achievable when agencies act independently. This principle is evident in the implementation of Single

Window Systems (SWS), where customs administrations integrate clearance processes with port authorities and regulatory agencies through a unified digital platform. Such integration streamlines documentation, improves compliance management, and significantly enhances cargo clearance efficiency (UNECE, 2020). Similarly, integrated border management models, such as the European Union's Integrated Border Management framework, demonstrate how aligning multiple enforcement functions through shared systems reduces redundancy and strengthens both efficiency and control (European Commission, 2018).

Despite the advantages of a systems-oriented approach, Systems Theory also highlights challenges that arise when subsystems operate in isolation or lack interoperability. Conflicting institutional mandates, overlapping regulations, and incompatible information systems across border agencies often constrain cargo clearance efficiency. For instance, limited integration between customs and immigration databases can result in inconsistent cargo and passenger information, creating bottlenecks that slow clearance processes and increase transaction costs. Addressing these systemic weaknesses requires deliberate border management initiatives focused on inter-agency coordination, interoperable ICT infrastructure, and standardized operating procedures (Tanaka & Mori, 2020).

In conclusion, Systems Theory provides a comprehensive analytical lens for examining how border management initiatives affect cargo clearance efficiency. By emphasizing interdependence, feedback mechanisms, and synergy among border agencies, the theory underscores the importance of integrated policies, shared technologies, and coordinated decision-making. Strengthening system-wide integration and information-sharing frameworks remains critical for achieving sustained improvements in customs efficiency and overall border management performance (World Bank, 2020).

2.2 Empirical Review

Infrastructure constitutes a foundational determinant of customs operations efficiency. Within the CBM framework, infrastructure encompasses physical facilities, technological systems, and utility services. Global evidence shows a strong correlation between infrastructure quality and outcomes in customs operations. Improvements in border-related infrastructure, particularly well-designed buildings, ICT, and transport networks, substantially improve export performance and customs operations. Their study found that infrastructure quality often affects trade performance more than tariff reductions, highlighting its central role in cargo clearance (World Bank, 2020).

The World Bank Logistics Performance Index (LPI) reports consistently identify infrastructure as a major determinant of customs clearance performance. Countries with well-developed port facilities, scanning equipment, and automated systems record shorter clearance times and lower transaction costs. Conversely, poor road connectivity and limited inspection facilities contribute to cargo congestion and prolonged dwell times (World Bank, 2020).

Hiraide et al. (2022) examined the efficiency of document and border procedures for international trade sustainability. The findings of that study were that countries that invested in modern border infrastructure, digital documentation systems and efficient transport facilities experienced significantly shorter border clearance times compared to countries with inadequate infrastructure. The study concluded that physical infrastructure complements customs reforms by eliminating operational challenges that delay cargo movement.

Bhero et al. (2015) examined the use of information-exchange technologies and radio-frequency identification (RFID) systems at Southern African border posts. The study found that technological infrastructure improved cargo visibility, reduced manual verification, and significantly shortened border clearance times. The researchers argued that investments in both Information and Communication Technology (ICT) and physical infrastructure are crucial to efficient cross-border cargo movement. Furthermore, Kabui et al. (2019) found that ICT infrastructure plays a complementary role by facilitating effective sharing of customs information among border agencies, as shown in their study of the impact of the National Electronic Single Window System on cargo clearance efficiency at the Port of Mombasa, with a focus on electronic procedures. The study demonstrated that integrated systems reduce document processing times, eliminate duplication of procedures and enhance cargo clearing efficiency.

Matheka (2019) investigated factors influencing cargo clearance efficiency at the Inland Container Depot (ICD) Nairobi. The study revealed that infrastructure, including cargo handling equipment, road networks, gate capacity, and warehousing facilities, had a statistically significant positive effect on cargo clearance efficiency. The study further established that the continuous improvements in infrastructure reduced cargo clearance delays and overall operational performance. Additionally, infrastructure improvements must go hand in hand with customs modernization initiatives to achieve meaningful improvements in cargo clearance times (Nganga, 2021).

Despite the strong positive association between infrastructure and cargo clearance, some studies highlight persistent financing and maintenance challenges. The African Development Bank (2019) notes that infrastructure investments often face sustainability issues due to limited maintenance budgets and rapid growth in trade volumes. Without continuous upgrades, infrastructure improvements may not sustain efficiency over time.

In summary, both physical and technological infrastructure significantly influence cargo clearance. Adequate infrastructure reduces congestion, speeds processing, enhances risk inspection capacity, and supports automation systems. However, infrastructural effectiveness depends on complementary institutional coordination and human resource capacity.

In his study, "Effect of Dry Port Operational Factors on Trade Facilitation in Kenya," Gichuhi (2021) evaluated the effects of staff capacity, customs automation, infrastructure development, and interagency cooperation on trade facilitation at the Nairobi Inland Container Depot (ICD). This study drew on queuing theory, stakeholder theory, systems theory, dynamic capability theory, and new trade theory. Descriptive statistics, correlation analysis, and multiple regression analysis were used to examine the primary data that was gathered from a closed-ended structured questionnaire. The results show that infrastructure development has a favorable and statistically significant effect on trade facilitation at Nairobi ICD. The study also found significant positive effects of personnel capacity, customs automation, and interagency coordination. The report notes that infrastructure expansion improved trade facilitation and reduced transaction and clearance problems at the dry port. To ease trade, the report suggests continuously improving infrastructure at Nairobi ICD.

Kitolo (2022) investigated the factors influencing scanner management efficacy at the Inland Container Depot in Nairobi, Kenya. Infrastructure, capacity building, and system integration had the greatest impact on scanner management effectiveness. The study offers valuable

insights into cargo clearance processes because scanners are essential components of the physical and technological infrastructure used for cargo inspection. This study used surveys to gather primary data from key individuals involved in scanner management at the ICD. An important component impacting scanner management efficiency was determined to be infrastructure. The study's results show that efficient customs inspections and freight movement depend on readily available scanning infrastructure and related systems.

Richard (2025), in his study titled "Impact of Cargo Clearance Procedures on Port Throughput Efficiency at the Kenya Ports Authority (KPA)," explored the relationship between cargo clearance processes and port throughput efficiency at the Port of Mombasa. A concurrent mixed-methods research design was utilized in this study. The study collected qualitative data through key informant interviews and quantitative data through surveys. Key informants included customs agents, shipping companies, freight forwarders, KPA officers, and KRA staff. Secondary data came from annual logistics reports from KPA, KRA, and the World Bank. According to the report, infrastructure issues partly caused inefficiencies in the cargo clearance process. For example, the availability of scanners and the outdated berth infrastructure were cited as physical obstacles to the port's effectiveness. The study found that the scanner line could take 12 to 18 hours during peak hours.

3. Methodology

The study used a quantitative research design and structured questionnaires to collect data from 222 respondents, including clearing agents, customs officials, freight forwarders, and port health officers. The determined sample size was 222. Because the population had a variety of traits that fit into several strata, the study used stratified sampling when determining the sample size. The study used descriptive and inferential statistics to analyze the gathered data in SPSS Version 27. Descriptive statistics (mean, standard deviation, and frequencies) summarized respondent demographics and variable trends. Inferential statistics included hierarchical regression analysis to evaluate the study's hypotheses, such as the moderating effect of human resource capability, and Pearson's correlation analysis to investigate associations. Tables, charts, and graphs displayed the data.

4. Results and Discussion

4.1 Descriptive Results

4.1.1 Descriptive Statistics on Infrastructure

Respondents were asked to indicate their level of agreement with statements on infrastructure. Results are shown in Table 1.

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Table 1: Descriptive Statistics on Infrastructure

Statement	Strongly disagree	disagree	neutral	agree	strongly agree	Mean	std. dev
Office facilities adequately support customs operations.	14.40%	20.90%	7.00%	34.30%	23.40%	3.31	1.41
Parking yards are adequate for efficient cargo handling.	8.50%	9.00%	15.40%	50.20%	16.90%	3.58	1.13
Cargo scanners are adequate and operational.	16.90%	17.90%	7.50%	35.30%	22.40%	3.28	1.43
Weighbridges are adequate and functional.	8.50%	23.90%	6.50%	33.80%	27.40%	3.48	1.34
Internet connectivity is reliable during customs operations.	9.50%	15.90%	7.50%	33.30%	33.80%	3.66	1.34
Electricity supply is stable with minimal interruptions.	13.40%	10.40%	5.50%	44.30%	26.40%	3.60	1.34

The findings show that office facilities sufficiently facilitate customs operations, according to most respondents (57.7%) (Mean = 3.31, SD = 1.41). The majority of respondents (67.1%) thought parking yards are sufficient for effective cargo handling (Mean = 3.58, SD = 1.13). The majority of respondents (57.7%) thought cargo scanners were sufficient and functional (Mean = 3.28, SD = 1.43). The findings also showed that 61.2% of respondents believed that weighbridges are sufficient and useful (Mean = 3.48, SD = 1.34). The data also showed that most respondents (67.1%) thought internet access is dependable during customs operations (Mean = 3.66, SD = 1.34). The findings also revealed that most respondents (70.7%) agreed that there are few disruptions to the steady supply of energy (Mean = 3.60, SD = 1.34). The findings suggest that the existing infrastructure generally supports customs operations and efficient cargo clearance, although improvements to physical and technological facilities could further enhance operational performance.

4.1.2 Human Resource Capacity

Respondents were asked to indicate their level of agreement with statements on human resource capacity. Results are shown in Table 2.

Table 2: Descriptive Statistics on Human Resource Capacity

Statement	Strongly disagree	disagree	neutral	Agree	strongly agree	Mean	std.dev
Staff receive adequate training for customs operations.	12.90%	1.00%	7.50%	46.3%	32.30%	3.84	1.26
Officers possess adequate ICT skills.	10.90%	2.00%	24.9%	35.8%	26.40%	3.65	1.21
Officers have sufficient knowledge of risk management procedures.	9.00%	8.50%	25.9%	25.9%	30.80%	3.61	1.25
Staffing levels are adequate.	14.40%	4.00%	8.50%	47.8%	25.40%	3.66	1.30
Continuous professional development improves staff performance.	10.90%	3.00%	8.50%	50.2%	27.40%	3.80	1.20
Officers adapt effectively to new customs procedures	10.00%	2.00%	12.9%	43.3%	31.80%	3.85	1.19

According to the statistics (Mean = 3.84, SD = 1.26), 78.6% of respondents agreed that employees receive sufficient training for customs procedures. The majority of respondents (62.2%) felt that officers have sufficient ICT skills (Mean = 3.65, SD = 1.21). Additionally, 56.7% of respondents agreed that officers are sufficiently knowledgeable about risk management methods (Mean = 3.61, SD = 1.25). The majority of respondents (73.2%) believed that staffing levels are acceptable, according to the data (Mean = 3.66, SD = 1.30). The findings also showed that 77.6% of participants believed ongoing professional development enhances employee performance (Mean = 3.80, SD = 1.20). The findings also revealed that 75.1% of respondents reported that officers successfully adjust to new customs procedures and technology (Mean = 3.85, SD = 1.19). The findings imply that adequate training, skills, staffing, and continuous professional development have strengthened human resource capacity, enabling customs officers to support coordinated border management initiatives effectively.

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4.1.3 Cargo Clearance Efficiency

Respondents indicated their level of agreement with statements on cargo clearance efficiency. Results are shown in Table 3.

Table 3: Descriptive Statistics on Cargo Clearance Efficiency

Statement	Strongly disagree	disagree	neutral	agree	strongly agree	Mean	std.dev
Cargo is cleared within the expected processing time.	4.50%	13.90%	18.40%	39.30%	23.9%	3.64	1.12
Cargo dwell time has been reduced.	10.00%	11.40%	14.40%	33.30%	30.8%	3.64	1.30
Cargo clearance procedures are predictable	8.50%	2.50%	7.00%	28.90%	53.2%	4.16	1.20
Compliance costs associated with cargo clearance have reduced.	8.00%	4.00%	2.50%	24.40%	61.2%	4.27	1.20
Cargo throughput has improved.	11.90%	3.00%	12.90%	48.30%	23.9%	3.69	1.21
Overall cargo clearance efficiency has improved.	7.00%	5.00%	15.40%	46.30%	26.4%	3.80	1.10

Most respondents (63.2%) agreed that cargo is cleared within the anticipated processing period (Mean = 3.64, SD = 1.12). The majority of responders (64.1%) agreed that cargo dwell time has decreased, according to the results (Mean = 3.64, SD = 1.30). Most respondents (82.1%) found cargo clearance procedures predictable and consistent (Mean = 4.16, SD = 1.20). The findings also showed that 85.6% of respondents felt that cargo clearance compliance costs have decreased (Mean = 4.27, SD = 1.20). The majority of respondents (72.2%) agreed that cargo throughput had increased (Mean = 3.69, SD = 1.21). The findings also revealed that 72.7% of respondents thought cargo clearance had become more efficient overall (Mean = 3.80, SD = 1.10). The findings suggest that cargo clearance has become more efficient through more predictable procedures, lower compliance costs, shorter processing times, and higher cargo throughput, reflecting the positive outcomes of coordinated border management initiatives.

4.2 Inferential Analysis

Inferential statistics helped gauge associations among variables, including correlation analysis and regression analysis. The inferential analysis was undertaken after subjecting the data to various tests.

4.2.1 Correlation Analysis

Table 4: Outcomes for Correlation

		Cargo clearance efficiency	infrastructure
Cargo clearance efficiency	Pearson Correlation	1	
	Sig. (2-tailed)		
Infrastructure	Pearson Correlation	.701**	1
	Sig. (2-tailed)	0.000	

The results show that infrastructure is positively and significantly associated with cargo clearance efficiency (r=0.701, p=0.000).

4.2.2 Regression Analysis Results before Moderation

Table 5: Regression Coefficients

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	0.014	0.197		0.07	0.944
Infrastructure	0.661	0.048	0.645	13.752	0.000

The objective **Ho1** Infrastructure has no statistically significant effect on cargo clearance efficiency at Namanga and Lungalunga one-stop border posts in Kenya. Since the p-value was less than 0.05, the null hypothesis was rejected, and infrastructure was found to have a statistically significant effect on cargo clearance efficiency at Namanga and Lungalunga one-stop border posts in Kenya.

4.2.3 Regression Analysis Results after Moderation

The following hierarchical regression models were used to assess the moderating effect of human resource capacity on infrastructure at the Namanga and Lungalunga one-stop border posts in Kenya.

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Table 6: Moderation Coefficients

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-0.014	0.197		-0.07	0.944
Infrastructure	0.661	0.048	0.645	13.752	0.000
(Constant)	-0.018	0.202		-0.09	0.928
Infrastructure	0.661	0.048	0.645	13.716	0.000
Human resource capacity	0.004	0.041	0.005	0.108	0.914
(Constant)	0.711	0.216		3.292	0.001
Infrastructure	0.621	0.105	0.606	5.899	0.000
Human resource capacity	-0.074	0.039	-0.085	-1.894	0.060
X2.M	0.1	0.019	0.668	5.226	0.000

The results also showed that the coefficient for the interaction term between infrastructure and human resource capacity (X2.M) was 0.583, with a p-value of 0.000. Therefore, we rejected the null hypothesis H01a, which stated that human resource capacity does not moderate the relationship between infrastructure and cargo clearance efficiency at Namanga and Lungalunga One Stop Border Posts in Kenya. This means human resource capacity statistically significantly moderated the relationship between infrastructure and cargo clearance efficiency.

4.2.4 Mod Graphs

Figure 4.10 presents the mod graph for the moderating effect of human resource capacity on the relationship between infrastructure and cargo clearance efficiency.

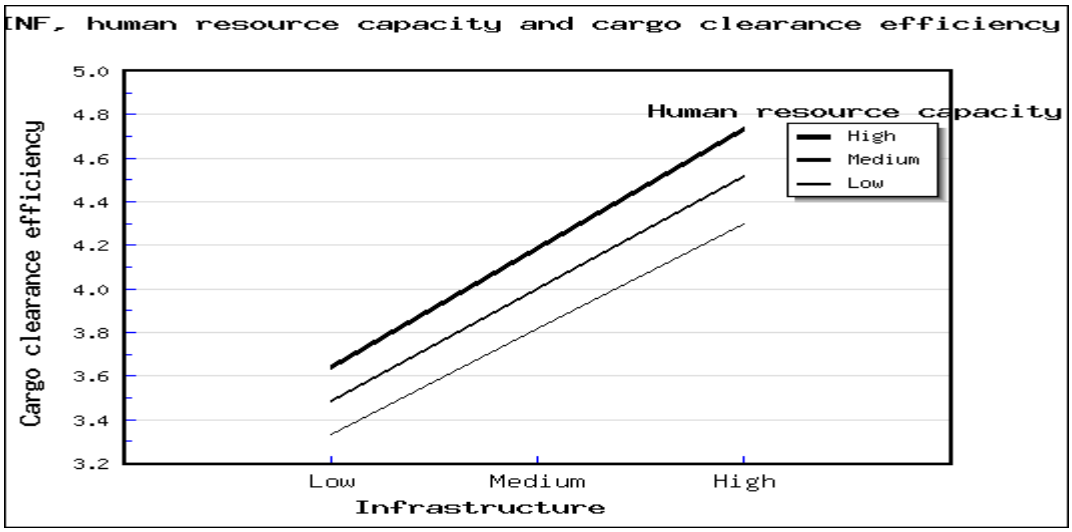


Figure 1: Mod Graph for the Moderating Effect of Human Resource Capacity on the Relationship Between Infrastructure and Cargo Clearance Efficiency

Figure 1: shows that the three slopes representing different levels of human resource capacity are positive, revealing that infrastructure has a positive relationship with cargo clearance efficiency. The slope for high human resource capacity is steeper than those for medium and low levels, indicating that human resource capacity moderates the relationship between infrastructure and cargo clearance efficiency by strengthening the positive association at high levels.

5. Conclusion

The study also concluded that infrastructure has a positive and significant effect on cargo clearance efficiency at Namanga and Lungalunga One Stop Border Posts. Functional cargo scanners, weighbridges, reliable internet connectivity, stable electricity supply, and adequate office facilities support effective customs operations and faster, more reliable cargo clearance. The results suggest that investment in modern border infrastructure enhances operational efficiency, reduces congestion, minimizes cargo processing time, and facilitates seamless cross-border trade. Therefore, continued investments in physical and ICT infrastructure are essential to sustain efficient cargo clearance.

6. Recommendations

Recommendations include the need for continued investments by the Government of Kenya through its border management agencies in border infrastructure through expansion of office spaces, introduction of more cargo scanning machines and weighbridges, internet connectivity and supply of electricity. The study also emphasizes maintaining existing infrastructure to ensure smooth customs procedures and improve cargo clearance efficiency.

The study suggests that the Kenya Revenue Authority and its partner border agencies continue investing in human resource capacity through ongoing training, developing personnel expertise, and building ICT capacity. It is also important to have enough officers with the knowledge and skills required to implement coordinated border management. Enhancing human resource capacity will make information flow, infrastructure use, and risk management more efficient.

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