THE American Journal of Humanities and Social Sciences Research (THE AJHSSR) 2022
E-ISSN: 2581-8868
Volume-05, Issue-05, pp-100-110
www.theajhssr.com Crossref DOI: https://doi.org/10.56805/ajhssr
Research Paper Open Access

THE INFLUENCE OF INFRASTRUCTURE ON PERFORMANCE OF CLEARING AND FORWARDING AT EMBAKASI INLAND CONTAINER DEPOT, NAIROBI COUNTY, KENYA

[1] Yussuf Ibrahim Mohamed [2]Dr. Isaac M. Abuga [3]Dr. Joseph W. Ndalilah
[1] Mount Kenya University, Thika
[2]School of Business and Economics, Mount Kenya University, Thika
[3]Department of Humanities and Social Sciences University of Kabianga, Kericho, Kenya

ABSTRACT

From 1970s to 1990s, there was a series of global changes. Important goods, trade liberalization, deregulation of many economies, and the emergence of economic integration of countries. These changes have affected trade and the economy, as well as ICT innovation and progress. The transport sector increased trade volume, sea freight, and many voyage vessels put pressure on existing ports. A dry port was introduced as an access to goods, reducing pressure on crowded and inefficient ports. Adoption of dry port concept started in Europe and North America, followed by Asia, South America, and finally Africa. A study of Embakasi Inland Container Depot in Nairobi County assisted to analyse the influence of infrastructure on performance level in the Depots. The study used both Goal Setting and Expectancy Theories to explain the influence of infrastructural performance on Embakasi depot in Kenya. Goal Setting theory stresses relationship between goal and performance. Expectancy theory holds that employee motivation is a result of how much a person wants a reward, the likelihood that the effort would lead to desired performance, and the belief that the performance will lead to reward. The study of Embakasi Inland Container Depot was crucial because it is a major point for transportation of goods across East Africa and a base for clearing and forwarding services. Data was collected using a questionnaire, evaluated using descriptive statistics formulas to determine the extent to which different infrastructure affects cargo operations at Embakasi Inland Container Depot. The relationship between infrastructure and performance was established using inferential statistics such as regressions and correlations analyses. This study was necessary to solve problems associated to clearing and forwarding companies in Kenya and assist in providing solutions for other parameters.

KEYWORDS: Influence, Containers, Infrastructure, Inland, Technology, Dry Port

1. INTRODUCTION AND BACKGROUND TO THE STUDY

For a successful process of clearing and forwarding, there are a number of variables whose interplay affects the performance. Inland container depot is also referred to as dry port where custom warehousing and depot located inland away from the seaport, provides handling and temporary storage services for bulk cargo entering and exiting the dry port by road, rail, or other means of transportation like, inland waterways or airports. In a fast-paced industry where products need to hit the market on time, container depot operators are an important aspect of the logistics chain and therefore need to guarantee a very reliable level of service to shipping companies. Depot efficiency is reflected in the freight of the carrier, the time required for the container ship, and the dwell time of the goods. The larger the container, the higher the cost.

Some countries in Africa have realized products and services in growing markets which requires increased transport of products to other countries by means of water transport, but there are significant challenges and risks in managing mainland, deep sea port or an inland container depot (Becker, McEvoy & Mullett, 2018). A study conducted by East African Logistics Performance found that, container depots were significantly more efficient. Continued reforms and improvements in the container depot infrastructure have yielded significant results, for example, reducing the average product retention time from 5 days in the year of 2015 to 3 days in the year of 2018. Despite these developments, Container Depot's efficiency is still below the nationally accepted standard of residence time of up to 3 days. Despite these initiatives, trucks take less time and the average truck mileage is less than 5,000 km per month, but the industry is 9,000 to 12,000 km per month (Prochowski, 2018).

Appelhans, Scholz, and Baumgart (2021) stated that, as trade and economic growth increases in East Africa, port activity, congestion increased at the Port of Mombasa. For example, from 2005 to 2008, importation at Mombasa Port increased by 9.7% in terms of liquid bulk, 11.5% container cargo and 23% in terms of dry bulk each year. Port services are also increasing and the development of existing seaports is restricted, requiring investment in dry ports, a trend that has recently led to investment in dry ports in East Africa. A report by East African Shippers Council (2013), Mombasa as East Africa's busiest container terminal, saw a 25% increase in container volume in the first half of 2012 alone, at estimated 840,000 Twenty Equipment Units (TEUs). Bulk liquid commodities such as lubricants, oil and petroleum are the prime single imports by weight, Kenya's economy which relies entirely on imports for all its oil demand, would collapse minus these imports. The largest commodities like maize, wheat and steel are important to meet the country's food needs (Aday and Aday, 2020).

As demand for container products grows, the operational capabilities of container products are especially critical. The Embakasi inland depot has serious capacity problems whose immediate short-term impact has increased clearance delays and additional port congestion charges causing significant delays in goods and higher costs for importers. Exporters also experience increased costs due to the potential unplanned setback. Customs clearance issues in the ICD can hinder trade growth within the region (Dere, 2021). To achieve economies of scale, the government needs to build a much larger capacity new container depot. KPA set up inland container depots in Embakasi, Naivasha Kisumu and Eldoret to bring port service nearer to customers and ease port congestion. These depots are connected to the container terminal at Mombasa Port by the Rail services (SGR). Imported goods are delivered directly from Mombasa to these depots via the bill of lading, while exports are integrated by ICD and shipped to the port (Erkyehun, 2021).

By 2017, Adan Mohamed Kenya's cabinet secretary for industrialization stated that "Because of infrastructure, the port of Mombasa during the last 4 years have seen its capacity doubled from 800,000 containers per year to 1.7 million containers that it can handle today, that has taken a significant amount of investment and nearly ksh 35 billion has been invested towards that expansion program and thanks to road infrastructure a truck carrying container can leave the port of Mombasa goes to Kampala and takes 18 days but now the same truck will take only 5 days to Rwanda beyond Kampala.

Embakasi's Inland Container Depot is a facility that enables to extend the port services to importers and exporters; it's a dry port far away from seaport. Embakasi ICD brings service closer to hinterland customers. With the SGR moving 20 million tonnes per year the ICD has upgraded storage from the initial 180,000 TEUs per annum to new capacity of 450,000 TEUs with stacking area of 99,000 sq meters. Rwanda, Burundi, Uganda, Sudan and Ethiopia are finding cost effective for their goods to pass through Mombasa port onwards to the ICD and eventually to their final destination. The Embakasi's Inland Container Depot will ease congestion at Mombasa Port and speed up the movement of goods from Kenya to its hinterland. With regard to product documentation, the port has made progress in digitalizing and automating commerce processes with the launch of an online clearance platform. The system aims to automate customs documents for goods through the integration of stakeholders and more than 1,000 users connect to government and financial institutions via the Kenyan Tax Office's iTax system and the government's eCitizen platform to guarantee an end-to-end product documentation platform (Gathogo, 2019).

The study will improve the recognition of requirements and diversity of agents that operate in the Inland Depot. Also, the study will look at the gaps in the approach to inland depots and to examine the determinants of efficiency at the Depots. The study will look at the gaps the Embakasi Inland port has in terms of the management system. Further to improve efficiency at the airports, the study will ensure study the gaps on the influences to performances in Embakasi Inland Depot.

The Need to Understand Influence of Infrastructure on Performance of Clearing and Forwarding at Embakasi Inland Container Depot, Nairobi County, Kenya.

Several studies have looked at the infrastructural performance in the developed world especially in Europe, North America and Asia. Furthermore, since most of the earlier studies were on the topic of study were carried on developed nations, there is limitation on the area under study. At the same time, only a few studies on infrastructural performance have been examined on inland ports in Africa. None of the studies, particularly, has examined the Embakasi Inland Container Depot, Nairobi County, Kenya apart from Gathogos (2019) work on Port Management Systems and Operational Efficiency at the Inland Container Depot-Embakasi which in my view was speculative and a mere generalization like some of the earlier studies elsewhere. It handled the entire infrastructural performance whose scope was very wide. Further, with increased traffic and technological changes in the transportation industry, inland container depots are facing increasing pressure to modernize and

make container handling more efficient. There are challenges in providing enough and efficient tools to curb and reduce transit and latency, enabling high-capacity storage, improving infrastructure and ensuring connectivity to other regions (Giordani and Zorzi, 2020). The operation of inland container depots is not only affected by the increase in the number of products, but also by the increase in product size fluctuations (Vrakas, Chan and Thai, 2021). In that case scholars need to take a fresh look and present a systematic analysis. Hence this study seeks to bridge this gap.

2. MATERIALS AND METHODS

This study focused on the influence of technology, storage facilities and material handling equipment on efficiency of clearing and forwarding operations in Kenya. The unit of observation was Kenya Port Authority staff working at the Embakasi Inland Container Depot, freight shipping agents and traders operating at the container depot. The target population was managers, staff, and traders at the ICD in Embakasi as the unit of observation.

A mixed research methodology concerning both quantitative and qualitative data analysis methods was engaged. Triangulation method was used to aid gathering and collection of wide-ranging and complete data. The study employed descriptive survey research method in the collection of quantitative and qualitative data. The situation of import and export in the Embakasi ICD is explained using descriptive survey research, as well as the relationship between existing infrastructure and the efficiency of the system. The study targeted a population size of 200, including: 120 staff, 50 clearing and forwarding agents, and 20 goods owners (importers and exporters).

The study used stratified random sampling to group members of the same quality and character from the target population. To identify clearing and forwarding agents from whom data was obtained, a selective sampling method was used. Primary data used was collected through questionnaires with both closed and open questions. Accurately filled questionnaires were subjected to coding, tabulation and analysis using the SPSS version 21. A descriptive survey approach was used for the research. Descriptive design included collecting data to provide answers to questions relating to the present conditions under study. Data collection instruments also involved respondents being interviewed to obtain explanations by interviewers. Other sources included books, Journals, Newspapers, Magazines, Articles and Theses.

3. RESULTS AND DISCUSSION

3.1 Introduction

A review of the literature on the influence of infrastructure on the performance of clearance & forwarding at Embakasi inland container depot in Nairobi County, Kenya reveals that, technology directly affects most parameters of container processing efficiency and the technical system used for receiving and releasing. More efficient systems are expected to lead to improved overall functionality of inland container depots and vice versa (Abu Aisha, Ouhimmou, and Paquet., 2020). The computer system follows certain steps when receiving imports and exports. In the case of import, goods arriving at the port are transported to a computer system, sealed by customs officers, and then stacked in the system. After receiving the permit, the container is registered with customs escorts and a specific system with a guarantee that the goods can be unloaded. The importer submits the receipt to customs through the clearing warehouse, after which the customs clearance for assessment, inspection and payment of customs duties is completed.

The Embakasi inland container depot is important for Kenya's economy. By the second half of 2023, many ports in Europe (Brautigam, Bhalaki, Deron and Wang, 2022) and ports on the coast of west of North America both Los Angeles and Long Beach will reach historically high levels of congestion, providing space for shipping containers. These ports were overloaded with empty containers that had to be returned to Asia and imported containers that had to be shipped to customers in the hinterland. The problem of port congestion should not only improve port efficiency and productivity, but also be addressed by the joint efforts of workplace operators, shipping companies and barge operators. ICD overlays are required for high product output. To achieve economies of scale and meet increasing import demand, traders import and export goods that need to be stored in ICDs, requiring a lot of space often exceeding existing storage capacity. In that case therefore, Customs clearance will be delayed.

At some facilities, customs clearance does not contribute significantly to the overall efficient customs clearance of goods and is therefore effectively managed by customs clearance and freight carriers. However, time lost in customs clearance due to lost documents, filing errors, or simply lack of foresight, enlightens a vital part of the long delay. Authorities are just one of the other parties involved in processing formal procedures (Oei and Osofsky, 2018). Security and customs regulations can significantly delay the operation of depots, so it is important to negotiate synchronization with the authorities and incorporate safety practices into in the port management.

Increases in depot productivity and reliability, according to Jasmi and Fernando (2018) will necessitate more tracking, more container visibility, and a higher focus on environmental and regulatory compliance, especially as depots already occupy crucial roles in the supply chain. Infrastructure is typically separated into physical and soft components. Physical infrastructure encompasses not just operating facilities such as berths, cranes, yards, and tugs, as well as inter-modal transportation such as roads and trains.

Container carriers are constantly improving their carrying capacity, and containers designed for huge transport units are being considered for foreign container transport. This large scale of expansion necessitates the construction of new, capital-intensive cargo processing facilities in gateway ports. Inter-modality is especially important for getting products into and out of a gateway port quickly. That is why congestion and delays may reduce the efficiency of container depot operations if adequate linkages are not in place (Cruijssen, 2020).

Against the background, presentation of information on the return rate of the questionnaire, respondents' demographic characteristics, findings interpretation based on data obtained on how infrastructure endowment influences the performance of Embakasi inland container depot, Nairobi County, Kenya over a period of 8 years were relayed as captured below.

3.2 Response Rates

From a total of 133 questionnaires that were sent out to the respective respondents, there were 102 respondents who responded to the questionnaire, representing a return rate of 76.69%. This was enough for the study.

3.2.1 Age Distribution of Respondents

Table 1: The table shows the age bracket for the respondents from all the categories; ICDE workers, clearing and forwarding agents, and the owners of goods.

	Frequency	**Percentage**
Below 23 years	25	24.51
24 – 30 years	19	18.63
31 – 45 years	30	29.41
46 – 50 and above	28	27.45
Total	**102**	**100%**

3.2.2 Demographic Characteristics of the Respondents

The research study targeted three categories of respondents, that is, the ICD staff, clearing and forwarding agents, and goods owners. Based on gender, presented in table 4 below is the demographic information about the respondents who form part of the ICD staff.

Table 2: ICD Staff Gender Demographic Information

	Frequency	Percent	Valid Percent	Cumulative percent
Male	30	100.0	100.0	100.0
Female	30	100.0	100.0	100.0
Total	**60**	**100.0**	**100.0**	**100.0**

There were an equal number of both male and female respondents sampled from the ICD staff. All those who were selected responded to the questionnaire, representing 100% response rate.

Table 3: ICD Clearing and Forwarding Agents Gender Demographic Information

	Frequency	Percent	Valid Percent	Cumulative percent
Male	18	75.0	75.0	75.0
Female	6	25.0	25.0	25.0
Total	24	100.0	100.0	100.0

From the sample of clearing and forwarding agents, the total number sampled was 24. Based on the questionnaire responses, there were 18 males representing 75% of the total number, while there were 6 females, representing 25% of the total number of clearing and forwarding agents sampled.

Table 4: Goods Owners Gender Demographic Information

	Frequency	Percent	Valid Percent	Cumulative percent
Male	10	55.56	55.56	55.56
Female	8	44.44	44.44	44.44
Total	18	100.0	100.0	100.0

There was a total of 18 responses from the goods owners. Based on gender demographics as presented in the table 3 above, there were 10 males, accounting for 55.56% of the goods owners, and the females were 8, representing 44.44%.

3.3 Influence of Infrastructure on the Performance of Embakasi Inland Container Depot

The goal of this study was to identify how the operation and performance of ICD is influenced by infrastructure. This was a critical aspect because the data and information obtained from the respondents would show the researcher areas in which the depot has limitations for corrective action to be taken, and those areas it is performing well in terms of infrastructural support for the operations being undertaken at the site. The researcher therefore sought answers from all categories of respondents on how infrastructure is directly affecting operations at the Inland container depot at Embakasi. The information collected was therefore categorized into the effects of technology, storage infrastructure, and the material handling resources. Table 7 below shows the findings.

Table 5: Factors Influencing the Performance of ICD

Category	Indicator
Technology Infrastructure	❖ Inadequate automated systems ❖ Frequent downtimes ❖ Inadequate training for personnel ❖ Irregular system updates ❖ Outdated systems ❖ Over-reliance on analog systems ❖ Lack of visibility on the movement of goods ❖ Delays in processing and clearing
Storage	❖ Inadequate storage space ❖ Poorly maintained storage facilities ❖ Loss of goods ❖ Too much time wasted on tracing and retrieving goods
Materials handling	❖ Breakdown of handling equipment ❖ Poor handling of goods leading to damages ❖ Inadequate safety features and precautions

After identification of factors affecting operations at the ICD, they were asked to offer practical solutions that would ensure efficiency of operations at the depot. Some of the suggestions were investing in modern software and handling equipment that will improve how the depot operations are done, hence saving on time, boosting the morale and satisfaction of the employees, clearing, and forwarding agents and the owners of the goods. Automation should also be revamped by enhance visibility and make it possible to track the movement of each good for easy retrieval when needed. The staff needs to undergo regular training on new technology infrastructure to equip them with the skills needed to operate the new systems. Additionally, the material handling equipment should be properly serviced and regularly replaced with new ones to ensure operations do not stop due to breakdown of handling equipment. The government needs to invest more in the expansion of the depot to eliminate congestion and create adequate space for handling goods, storage, and minimize on damages caused by poor storage facilities which expose goods to destructive elements like weather.

3.4 Technology Utilization at the ICDE

In this section, the study sought to find out the efficiency of automation is the management of processes and systems at the port. They were asked whether automated systems were effective and performing the intended role as expected. From the results, 80 respondents indicated that automated systems were performing as expected. The results are summarized in the table below.

Table 6: Efficiency of Automation

	Frequency	**Percentage**
Automation is working	80	78.43
Automation is not working	22	21.57
Total	**102**	**100.00**

3.4.1 Rate of the Influence of Technology on the Performance of Clearing and Forwarding

Table 7: The table below shows the degree of influence of technology on the performance of clearing and forwarding activities as seen by the respondents in the different categories.

 Crossref DOI: https://doi.org/10.56805/ajhssr

	Never	Rarely	Moderately	Greatly	Total
ICDE workers	0	0	21	39	60
Clearing & forwarding agents	0	0	0	24	24
Owners of goods	0	1	5	12	18
Total	**0**	**1**	**26**	**75**	**102**

3.5 Technology Adoption According to Embakasi's ICD Workers

Table 8: Responses from the ICDE Workers with Regards to Technology Adoption at the Depot

	Statements	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	TECHNOLOGY	**1**	**2**	**3**	**4**	**5**
1.	Our organization has an explicit policy on adoption of technology in clearing and forwarding operations	0	1	5	14	40
2.	Our organization has adopted online clearing and forwarding operations	0	0	0	10	50
3.	Our organization has adopted modern Information and Communication Technology (ICT) in clearing and forwarding operations	0	0	0	9	51
4.	Our organization has adopted modern security and surveillance technology in clearing and forwarding operations	0	1	1	15	43
5.	Our organization has adopted modern goods inspection technology in clearing and forwarding operations	2	5	4	16	33
6.	Adoption of modern technology has helped reduce clearing and forwarding costs at Embakasi ICD	5	1	2	3	49
7.	Adoption of modern technology has helped reduce time spent in clearing and forwarding operations at the Embakasi ICD	10	8	8	12	22
8.	Adoption of modern technology has helped reduce errors in clearing and forwarding operations at the Embakasi ICD	9	18	9	11	13

9.	Our organization provides continuous training on modern clearing and forwarding technology	2	4	6	15	33

From the data gathered, it is important to note that the workers have different opinion on the success of technology in enhancing efficiency and boosting the performance of different tasks within the Inland container depot. Generally, most workers strongly agree that technology has had a significant influence on the daily operations from technology adoption to provision of continuous training on modern clearing and forwarding technology. Online clearing and forwarding are also being used to better manage the inflow and outflow of goods and information. Additionally, ICT infrastructure is a critical component of managing operations at the ICDE, hence the management has heavily invested in adopting ICT resources and training of personnel. This has helped reduce errors that were common during the era of manual systems. However, more training should be provided to the staff to equip them with the technical skills on how to operate new systems and provide them with knowledge on modern clearing and forwarding technology. More investment should also be made towards acquiring and installing advanced technology that will integrate and streamline all operations within the depot and cross all its external networks that links it to other industry players.

3.6 Efficiency of the storage facilities

Storage facilities play an important role in supporting the activities at the ICDE. They are the structures that hold goods before they are cleared and dispatched to their respective owners. Special attention should therefore be given to these facilities. Storage infrastructure consists of the available storage facilities and the storage space that allows the inland container depot to hold goods on transit or those awaiting collection by their respective owners. The data shows that there are strong policies that guide on how the good should be stored. However, the costs involved have not been reduced as expected with the improvement in storage space. Thus, despite a reduction on cases of damaged goods, the cost involved in storing these goods is still high. Furthermore, according to the study, the depot is also equipped with adequate special storage and preservation facilities such as cold rooms to meet clearing and forwarding needs for perishable goods.

3.7 Material handling infrastructure

The daily operations at the ICDE involve handling incoming and outgoing materials daily. This study therefore sought to collect the views of the different stakeholders on how the depot was handling the goods it was receiving. Table 11 below shows responses on how the materials are handled.

Table 11: Responses on how the materials are being handled (Based on all the categories)

	Statements	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
I	**MATERIAL HANDLING EQUIPMENT**	1	2	3	4	5
1.	Our organization has an explicit policy on material handling in clearing and forwarding operations	5	8	13	15	61
2.	Our organization has adopted automated material handling systems in clearing and forwarding operations	9	9	4	36	44
3.	Our organization has adequate material handling equipment in clearing and forwarding operations	10	18	8	16	50
4.	Our organization has an appropriate maintenance program for material handling equipment used in clearing and forwarding operations	15	10	4	34	39

5.	Adoption of modern material handling equipment has helped reduce clearing and forwarding costs at Embakasi ICD	16	20	6	18	42
6.	Adoption of modern material handling equipment has helped reduce time spent in clearing and forwarding operations at the Embakasi ICD	15	6	6	37	38
7.	Adoption of modern material handling equipment has helped reduce damages and injuries in clearing and forwarding operations at the Embakasi ICD	0	4	0	31	67
8.	Our organization provides continuous training on modern material handling equipment	20	11	7	24	40

From the results in table 11 above, the policy on material handling in clearing and forwarding operations has been widely adopted and operationalized at the Embakasi Inland Container Depot. This has seen the adoption of modern material handling equipment helping to reduce damages and injuries in clearing and forwarding operations at the Embakasi ICD as reported by those who submitted their responses through the questionnaire. This initiative is further supported by the continuous training being given to the personnel on modern material handling equipment

3.8. Descriptive Analysis

Table 12: Descriptive Data Analysis

	Level of Infrastructure %	**Rate of Technology**	**Level of Storage infrastructure**	**Level of Material Handling infrastructure**
Mean	17.95	5.2	103.65	8.36
Standard deviation	2.35	2.8	s9.48	4.83
Minimum	15.6	2.0	102.59	2.7
Maximum	20.3	6.7	105.96	16.2
Standard error	0.29	0.52	1.50	0.78
N	102	102	102	102

Source: Calculation from raw data

The levels of infrastructure influence over a period of 8 years were indicated from the findings with 17.95 and 2.35 as the mean and standard deviation respectively. Minimum level of influence was 15.6% and maximum level was 20.3%. The rate of technology changes over 8 years varied with 5.2 and 2.8 as mean and standard deviation respectively. Minimum rate of technology was 2.0% and maximum rate of technology was 6.7%. The Level of Material Handling infrastructure over the eight-year period had variations with 8.36 and 4.83 as the mean and standard deviation sequentially. The Level of Storage infrastructure has been fluctuating over the period while on a steady increase with the minimum value being 102.59 and the highest value as 105.96. The sample size was 102 since quarterly data has been obtained over the eight-year period, 2012 – 2019.

3.8.1. Regression

A multiple regression was conducted to measure the relationship on influence of infrastructure and the performance of Embakasi Inland Container depots in Nairobi County. The quantitative data was conducted though inferential statics and descriptive statics through the application of Statistical Package for Social Sciences (SPSS) version 26. The questionnaire structure was used to develop the coding of the quantitative. The relationship between the dependent and independent variables was achieved through correlation analysis. This was conducted at a significance level of 0.05 and applied a 95% confidence level. In this context independent variables had a significant effect on the dependent variable where the p-value was less than the significance level of 0.05.

Table 13: Regression Statistics Tables

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Observations
1	0.787	0.620	0.549	0.392616	102

From table 13 above, the value of R-square is 0.62 whereas the coefficient of correlation was 0.787, which implies that independent variables in this study account for 62.0% of performance in Embakasi Inland Container Depot in Nairobi County, Kenya. The coefficient of determination is the Adjusted R-square which explains variations in the dependent variable due to changes in the independent variables. In this scenario, adjusted R-square is 0.549 implying that there was a variation of 54.9% on performance level due to changes in the independent and control variables which include, level of infrastructure, technology, storage infrastructure and material handling infrastructures.

3.8.2. Analysis of Variance

Analysis of Variance (ANOVA) is the study of the total sum of squares (TSS) and its components which are explained sum of squares (ESSs) and residual sum of squares (RSS), to test for the significance of the relationship between variables.

Table 14: Analysis of Variance

Sources of variation	Sum of Squares	Df	MSS	F	*Significance* F
Regression	48.46	4	12.115	4.384	0.043
Residuals	41.45	27	2.763		
Total	89.91	31			

Source: Research findings

Table 14 above shows processed data with a significance level of 4.3%. The model is statistically significant since level of significance 0.043<0.05.

Table 15 shows regression coefficients for independent variables.

Table 15: Regression model coefficients

	Coefficients	**Standard error**	***t* Stat**
Intercept	-24.98	8.385	-2.692
Technology	5.32	1.628	2.864
Storage Infrastructure	-0.026	0.047	-0.449
Material Handling infrastructure	-0.032	0.039	-0.659

Source: Research findings

From the statistics above, the regression equation obtained was as follows.

$$Y = -24.98 + 5.32X_1 – 0.026X_2 – 0.032X_3s$$

3.9. Summary of the findings

Performance level = -24.98 + 5.32*Technology – 0.026*Storage Infrastructure– 0.032*Material Handling infrastructure

When technology, storage infrastructure and material handling infrastructure performance, were constant, performance level was -24.98. As technology increased by 1 unit, performance level increased by 5.32 units. When storage infrastructure increased by 1 unit, performance level decreased by 0.026 units. If Material Handling infrastructure increased by 1 unit, interest rate decreased by 0.032 units.

4. SUMMARY AND CONCLUSIONS

This study set out to establish how infrastructure endowment influences the performance of the inland container depot at Embakasi. It focused on the impacts of the available technology infrastructure, storage facilities, and the material handling infrastructure on time and costs. The study further investigated automation of processes,

record keeping, storage facilities, storage space, the handling capacity of the depot, and material handling equipment. It was noted that, performance level, technology, storage infrastructure and material handling infrastructure have a perfect positive relationship with themselves. For instance performance level has a strong positive relationship with technology but had a weak positive link with storage infrastructure and material handling infrastructures.

The study confirms the importance of technology, storage and material handling infrastructure which cannot be ignored when talking about operations at Embakasi container depot. It is evident that the management of the depot has made significant strides in modernizing its infrastructure through automation. However, it still faces other challenges like inadequate training for personnel, irregular system updates, the use of outdated systems, and over-reliance on analog systems and other problems experienced in handling goods and the management of storage facilities. Generally, there is lack of an elaborate online system that tracks goods in real time. With increase in global market, some of the resources that were originally effective at the depot are no longer viable due to the increase in the number of goods to be handled and stored. There is therefore need for the management and other stakeholders to invest in additional storage facilities equipped with modern technology for easy handling of goods.This study concludes that, Embakasi container depot heavily contributes to Kenya's economic growth and development. The outcome of this study provides in-depth knowledge of the practical impact of infrastructure on Kenya's container processing efficiency and it benefits all stakeholders out and within the inland container depot, operators and policy makers.

REFERENCES

1. Kenya Transport Association, 2018.
2. Abu Aisha, T., Ouhimmou, M. and Paquet, M., 2020. Optimization of Container Terminal Layouts in the Seaport-Case of Port of Montreal. *Sustainability*, *12*(3), p.1165.
3. Aday, S. and Aday, M.S., 2020. Impact of COVID-19 on the Food Supply Chain. *Food Quality and Safety*, *4*(4).
4. Appelhans, N., Scholz, W. and Baumgart, S. eds., 2021. Transport Planning and Mobility in Urban East Africa. Routledge.
5. Becker, A.,Ng, A. K.,McEvoy, D., & Mullett, J. (2018).Implications of Climate Change for Shipping:Ports and Supply Chains. *Wiley Interdisciplinary Reviews: Climate Change*, *9*(2), e508.
6. Brautigam, D., Bhalaki, V., Deron, L. and Wang, Y., 2022. *How Africa Borrows From China: And Why Mombasa Port is Not Collateral for Kenya's Standard Gauge Railway* (No. 2022/52). Working Paper.
7. Cruijssen, F., 2020. Cross-chain Collaboration in Logistics. International series in Operations Research and Management Science (ISOR), 297.
8. Dere, A., 2021. *Effect of Customs Electronic Systems on Trade Facilitation at Key Entry Points (JKIA, ICD and Mombasa Port) in Kenya* (Doctoral dissertation, Moi University).
9. Erkyehun, E., 2021. *Determinant of Dry Port Operational Performance Of Ethiopian Shipping And Logistic Service Enterprise (Eslse):The Case Modjo And Kality Dry Port Branchs* (Doctoral Dissertation, St. Mary's University).
10. Gathogo, C.W., 2019. *Port Management Systems And Operational Efficiency at The Inland Container Depot-Embakasi* (Doctoral dissertation, University Of Nairobi).
11. Giordani, M. and Zorzi, M., 2020. Non-terrestrial networks in the 6G era: Challenges and opportunities. *IEEE Network*, *35*(2), pp.244-251.
12. Heilig, L., Stahlbock, R. and Voß, S., 2020. From Digitalization to Data-driven Decision Making in Container Terminals. In *Handbook of Terminal Planning* (pp. 125-154). Springer, Cham.
13. Jasmi, M.F.A. and Fernando, Y., 2018. Drivers of Maritime Green Supply Chain Management. *Sustainable cities and society*, *43*, pp.366-383.
14. Oei, S.Y. and Osofsky, L.Z., 2018. Constituencies and Control in Statutory Drafting: Interviews with Government Tax Counsels. *Iowa L. Rev.*, *104*, p.1291.
15. Prochowski, L.(2018).Evaluation of the Process of Mileage Growth during the Operation of Motor Trucks,in several categories of engine cubic capacity. *Eksploatacja i Niezawodność*, *20*(3).
16. Vrakas, G., Chan, C. and Thai, V.V., 2021. The Effects of Evolving Port Technology and Process Optimisation on Operational Performance: The Case Study of an Australian Container Terminal Operator. *The Asian Journal of Shipping and Logistics*, *37*(4), pp.281-290.