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The Impact of Physical Infrastructure on the Functionality of One Stop Border Post -A Case Study of the Nakonde Border Post

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ABSTRACT

The study examined the effect which the physical infrastructure has on the functionality of the Nakonde One-Stop-Border-Post (Nakonde OSBP) in Zambia. A Mixed Approach Methodology of descriptive study design, and a case study strategy were employed, to extract data from the relevant literature, focus group interviews and a structured questionnaire. The target population comprised the Nakonde border government agencies, custom brokers, cross-border drivers and, transporters who are situated and operate around the Nakonde OSBP. The stratified random and purposive sampling methods were employed to determine a sample size of 139 respondents. The findings of the study show a significant and positive relationship between physical infrastructure and the functionality of the Nakonde OSBP. The findings of the study also show that the independent variable factors have a varied influence on the dependent variables. In particular, the results of the study indicate that the with road network greatly enhances the functionality of the Nakonde OSBP. The results of the study also indicate that the storage facilities and the parking facilities have a reduced effect on the functionality of the Nakonde OSBP. Further, the results of the study show that the inspection facilities and operational equipment were not predictors for the functionality of the Nakonde OSBP. The study recommends investment and improvements in transport facilitation as it is a pre-requisite to regional integration, in-time supply of goods, movement of people, security of goods, reduction in time and trade cost.

Keywords: Regional Integration Trade Facilitation Physical Infrastructure Free Movement People Goods Services Nakonde One Stop Border Post Zambia.

INTRODUCTION

The New Partnership for Africas' Development (NEPAD), describes OSBP as a trade facilitation tool used at the border to encourage a coordinated and integrated approach to enabling trade the movement of people, and improving security (NEPAD,2016). The NEPAD states that OSBP is one of the many strategies available to ensure economic growth, trade facilitation, and regional integration. The OSBP trade facilitation technique establishes a point where persons and goods stop once to complete exit and entrance formalities when traveling from one country to the other. This technique has been observed to reduces trade cost and clearance times associated with international movements and trade. The notion presents an alternative to traditional border crossings, where goods and people often undergo two separate stops to fulfil border procedures both the originating, and destination countries (NEPAD,2016). The traditional border crossing is a duplicated process which results in increased costs, more paperwork, and longer border clearance time.

A publication by USAID (2017) stated how the Southern African border posts remain thick due to a high trade volumes handled serviced by a fragile and inadequate border infrastructure system. This infrastructure vulnerability hinders Africa's' competitiveness in global markets. To counter this challenge, the African

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Union in 2012 started the Programme for Infrastructure Development in Africa (PIDA) and the Priority Action Plan and rolled out the implementation of OSBP concept in Africa.

Inadequate infrastructure has been noted as one of the crucial factors contributing to the delays in the cross-border movement of the peoples, the goods and the services in Africa, (UNCTAD,2003). These delays in the clearance of the peoples, the goods and the services at the Southern African region borders in 2003 occasioned an estimated cost of US $48 million (UNCTAD,2003).

UNCTAD,2003 contextualized Border Posts as vital corridors in regional trade and international transits, especially for countries that lack access to maritime routes. The inadequate border infrastructure in most of the African countries abrogates the ratified regional treaties agreements on Regional Integration. The SADC Protocol on Trade in Goods 1996 and the COMESA Protocol on Free Movement of Persons, Labour and Services 2018 advocates to foster regional integration through Trade Liberalization, of which Whalley (2005) advised that trade liberalization policies be adopted after fixing the infrastructure problems at the border. A careful read of the COMESA Treaty 1993 and SADC Treaty 1980, reveals that Freedom of Cross Border Movement of the People, Goods, Labour and Services is a treaty right. The said read also reveal the fact that one of the ways of promoting cross-border trade is to enhance Trade Facilitation through provision of adequate physical infrastructure among other things.

Border functionality in Customs Management connotation entails the provision of suitable physical facilities which should be proportionate to the nature and scale of operations at the border post (Doyle,2010). The facilities should be adequately designed for seamless flow of trade and people. [1]The Nakonde OSBP, like many other cross-border posts in Africa, has poor and inadequate infrastructure (UNCTAD,2003) The configuration of the border is that facilities such as inspections and parking are 10 kms away from the Customs Control Zone. Moreover, the road is narrow, mostly supporting one-way traffic. These design and construction deficits cause congestion and delayed clearance of goods and traffic.

The Nakonde Border located in Nakonde District in Muchinga Province, the Northern Part of Zambia shares the boundary with the Republic of Tanzania. The Nakonde OSBP is a significant crossing point in the north-south corridor facilitating the movement of traffic and goods from Dar-es-Salaam, the Democratic Republic of Congo, Malawi, and Zimbabwe. The Time Release Study conducted in 2022 by the Ministry of Commerce, Trade and Industry (MCTI) stated that the Nakonde OSBP was launched as an OSBP in 2019. Even though it has been granted the status of a OSBP, its infrastructure does not seem to be adequate to facilitate the effective operation of an OSBP. This view seems to be supported by the traffic congestion which characterises the Nakonde OSBP. The Nakonde OSBP is one of the busiest border posts which facilitates imports, transits, and exports with an average of 800 trucks per day (MCTI,2022).

[2]The amount of traffic received at the border far outweighs the physical infrastructural handling ability hence causing congestion and delay in the clearance of goods and traffic exacerbating border delays and trade costs. The infrastructure on the Zambian side in its current state can only support the flow of traffic in one direction at any given point in time for commercial traffic (MCTI,2022). This gravely hinders the flow of trade between Zambia and its trading partners especially Tanzania.

These challenges, thwart the achievement of OSBP objectives, of quick clearance time, reduced trade costs and improved security.

The study aimed to fill the gap, if at all, how current status of physical facilities affect OSBP functionality. The study will also go further to extrapolate the importance, of these facilities in ensuring functionality if they were fully developed. To address this challenge, the research answered the following questions;

1. What is the effect of physical infrastructure on the functionality of a OSBP?

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2. To what extent do independent variable factors such as inspection facilities, storage facilities, Parking facilities, Road Network and Operational Equipment influence the functionality of OSBP.

BACKGROUND TO THE PROBLEM

The USAID,2017, study noted that challenges at Zambian borders include non-availability, inadequacy, and poor-quality compliance testing facilities for food and plant materials, quarantine facilities for animals, people, and seized products, and non-intrusive inspection equipment. The border posts grapple with inadequate machinery for offloading and loading and once goods are offloaded during inspections, they cannot be repacked, therefore posing a challenge to transporters (USAID,2017).

These inadequacies make border posts vulnerable in comparison to cargo volumes received and often times cause acrimonious relations between border officials and traders, these shortcomings render border posts thick (USAID,2017).

The Time Release Study conducted by the Ministry of Commerce, Trade and Industry in 2022 reports that the Nakonde OSBP was launched as an OSBP in 2019. Even though it has been granted the status of a OSBP, its infrastructure has been observed to be inadequate to facilitate the effective operation of an OSBP. This view seems to be supported by the traffic congestion which characterises the Nakonde OSBP. The Nakonde OSBP is one of the busiest border posts facilitating imports, transits, and exports with an average of 800 trucks per day (MCTI,2022).

The Nakonde OSBP is an important entry and exit point for the commercial final clearance of goods and therefore, is a major revenue-generating post for Zambia. In 2021, the post generated about ZMW 3.1 billion (USD 189 million) accounting for 17.6% of the total annual revenue collected by the Zambia Revenue Authority. It handles 19.2 % of the total volume of consignments by customs, therefore being the border handling the highest number of consignments among all the Zambian borders (MCTI,2022, pg. 43). The minimum time taken for a truck to be cleared at the Nakonde border is 1 hour 26 minutes, while the maximum taken during the period is 5 days 7 hours 20 minutes against the international best practice average clearance time of 5 hours and less at Nakonde OSBP (MCTI, 2022). Clearance time in hours at Nakonde OSBP is shows variance to international best practice average time.

The Nakonde OSBP physical infrastructure, possess challenges in the quick clearance of goods and services. The deplayment in the clearance of goods is mainly due to infrastructure deficit, therefore causing congestion. The Nakonde OSBP has been cited to cause congestion on the Tunduma side as traffic does not stop only once as per requirement of the OSBP operational requirement. The traffic stop in Tunduma, and can only proceed on the Zambian side once clearance has been completed. This is because of lack of parking facilities within the OSBP on the Zambian side.

The operational equipment such as scanner is not effective, as it takes a minimum of 10 minutes to scan one truck.

Significance of the Study

The study has a relevant contribution to the research field and as a source of reference for policy, and decision-making when designing and constructing OSBP infrastructure.

The value this study brings to the existing knowledge in providing a justification that having elaborate physical infrastructure facilities does not improve trade facilitation. The study is also novel as it has disaggregated physical infrastructure to see how each component[3] impacts functionality of OSBP.

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LITERATURE REVIEW

The role of physical infrastructure on OSBP functionality cannot be underestimated as it facilitates the seamless flow and increase trade volume. Improving physical infrastructure is associated with reduced clearance times at the border, thereby reducing trade costs and improving security (NEPAD,2016).

Border physical infrastructure comprises warehouses, parking, operational equipment, and offices for border personnel (NEPAD,2016).

- **Inspection Facilities**

Inspection facilities are designated areas or places where goods are inspected by customs authorities and other government regulatory agencies. The availability, adequacy, and quality design of inspection facilities is imperative to facilitate efficient and meticulous inspection procedures (NEPAD,2016). The incorporation of weather elements within the design phase along with the proximity of the inspection bay to the administration block must be considered. The administration ‘s block to the inspection bay proximity is of utmost importance as it significantly impacts the frequency of inspections. Over-designing of the inspection yard is not recommended as it may impede the timely movement of cargo through over-inspection (NEPAD,2016).

- **Storage Facilities**

Storage facilities are places where goods are kept whilst pending further customs clearance, shipment or delivery. It is imperative that storage facilities be meticulously designed; incorporating considerations for all meteorological factors and the various types of stored goods, including those classified as dry or wet cargo, food products, and chemicals. To avoid the potential for unnecessary confiscations and detentions, storerooms should be thoughtfully designed without excess (NEPAD,2016).

- **Operational Equipment**

Operational equipment includes machinery, apparatus, and appliances which are used in the operations of customs office or in the performance of customs function‖. These may range from x-ray machines, metal detectors, drones, electronic seals, ladders, folk lifts, trolleys, offloading bay and other inspection equipment. It is imperative that operational equipment is available, adequate and be meticulously designed; incorporating considerations of fit for purpose.

- **Road Network**

A border road is a road running along or near a national border, which is of international economic significance. The provision of adequate and high- quality road infrastructure within and around the customs control zone is crucial for efficient traffic flow and time saving purposes. It is imperative that the road network be designed with separation of passenger and freight cargo traffic in mind (NEPAD,2016). Specifically, freight cargo roads have to feature at least three lanes, namely the green, red, and return lanes (NEPAD,2016).The green lane should be designated for expedited clearance of pre-cleared goods and those transhipped by Authorised Economic Operators, while the red lane should be reserved for goods that require physical inspection or have inadequate documentation or have delayed duty payment (NEPAD,2016).The picture below depicts the current status of the Nakonde border post road network, where trucks, passenger vehicles, private vehicles and pedestrians all use same lanes.

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- **Parking Facilities**

The provision of parking facilities that are sufficiently available, adequate, and designed to support the amelioration and navigation of vehicular flow represents a crucial aspect of ensuring effective traffic management (NEPAD,2016). The customary protocol pertaining to border management necessitates that vehicles be parked while drivers and facilitating agents carry out formalities and procedures. It is imperative to mention that prolonged parking beyond the agreed time with the transporter incurs demurrage to the importer and /exporter (NEPAD,2016).

Empirical Literature

OSBPs have been said to confer economic benefits, Svensson (2021), using difference-in – difference and two-way fixed effects model established that the construction and implementation of OSBP result in improved trade facilitation, therefore rendering positive benefits in Uganda and the Intra –African region (Svensson,2021).This study, took interest to explore the effect of physical infrastructure on functionality of OSBP.[4]Physical Infrastructure facilities at Nakonde OSBP have been observed to be disproportionate to the trade volumes.

Trade volumes and flows suffer from significant negative impact due to time delays at the border which cause higher trade costs and reduced security for goods and cross-border traders and drivers, (Djankov et al.,2006). To support the outcome of this research, Nordås, and Piermartini (2004), also concluded that poor quality infrastructure causes spoilage of goods and therefore increases transaction cost. Nordas and Piermartini (2004) have similarly determined that inadequate infrastructure leads to product spoiling and subsequently raises transaction costs, so providing further support for the findings of this research. This study will establish if storage facilities reduce or raise transaction costs.The literature reviewed in this study indicate that much has been written on OSBPs' however, there is no study conducted on Physical Infrastructure effect on OSBP functionality. Moreover,no study to the authors knowledge has dissected how the factors of physical infrastructure, individualy influence the functionality of OSBP.

Conversely, Ochieng at.al. (2020), concluded that available and adequate physical infrastructure promotes trades through lowering of trade costs.

Opasanon and Kitthamkesorn (2016), conducted a study, using a simple linear regression model to design customs infrastructure and related border control facilities at the new Sadao Customs post in Thailand. The study aimed at postulating expected future traffic of goods and people incorporating modern cross-border practices. The conclusion is that the design of customs infrastructure plays a critical role in the performance of transit and inter-state transport as it significantly influences cross-border clearance.

Willie (2020), concludes that improving or investing in border infrastructure is not the sole contributor to trade facilitation. He attributes the current concessioning regimes do not yield optimal efficiency because they lack complementarity in both soft and hard infrastructure investment. This study will amplify on the complementarity aspect of the hard and soft infrastructure. Streatfeild (2017) however, had a different finding on complementarity in the research conducted to assess if trade-related infrastructure such as border posts and ports influences customs improvement. The findings of this study were that improvement of trade-related infrastructure has a minor impact on customs performance, as the later also involves personnel attitudes and attributes to ensure border efficiency.

Fitzmaurice, and Hartmann (2013) used surveys and questionnaires as their main research techniques to explore the effect of temporal obstacles on cross-border trade within the Northern corridor of Africa. Their research revealed that lengthy transportation and cross-border operation delays for fully loaded trucks

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resulted in huge trade costs that were close $ 384.40 for every 24- hour delay. The study offers empirical evidence to back up the significance of having operational and effective OSBPs, as a key strategy to reduce border clearance time, and as a result reduce associated cost.

RESEARCH METHODOLOGY

The research was conducted at the Nakonde Border Post in Zambia. The border was conferred as an OSBP in 2019, to ease the movement of people, traffic, and goods.

The research used primary data extracted from administered questionnaires to 139 sample respondents using stratified random sampling. This sampling method was suitable for this research because the samples were drawn from specific organizations with purposively different experiences. The population for this study was unknown in terms of size, therefore study adopted the formula recommended by Daniel and Cross (2013) to determine the sample size when sampling from an unknown population or when the population is large enough.

The sample size for the research was determined as follows:

$$\mathbf{n= Z^2_{pq} / d^2}$$

Where: – n is the sample size

Z is the value of Z at 95% confidence level = 1.96

d is the desired level of precision or sampling error at 5%

p is the variability of the population estimated at 10%

q is 1-p=0.9

Therefore, n= 1.962 (0.1) (0.9) / 0.052 = 138.2

The sampling size for the research was **139;** which was stratified as follows 30 from government agencies, 30 from custom brokers, and 79 from importers, transporters, and cross-border drivers. The sample size was broken down in such a manner because there are 15 government agencies and 15 registered custom brokers, therefore 2 officers from each government agency and custom broker was part of the sample. The rest 79, were drawn from drivers, importers, and transporters because they form a substantial percentage of the unknown population.

The measurement of the questions was done using the ordinal scale ranging from 1 to 5. The data collected were coded, cleaned and analysed using regression analysis (OLS) to show the relationship between dependent and independent variables, referenced from a study conducted by Cheruiyot and Rotich (2018) and Kabui et al. (2019). The method was suitable as the survey was used to collect primary data, which was later consolidated to determine descriptive statistics then the analysis is done using ordinary least squares.

$$Y=\beta0+\beta1X1+\beta2X2+\beta3X3+\beta4X4+\beta5X5+\xi$$

Where: Y – is the dependent variable: OSBP functionality

β0 – is a constant (Y-intercept)

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β1 – is the coefficient for availability, adequacy, and quality of inspection facilities.

β2 – is the coefficient for availability, adequacy, and quality of storage facilities.

β3 – is the coefficient for availability, adequacy, and quality of operational equipment.

β4 – is the coefficient for availability, adequacy, and quality of road network.

β5 – is the coefficient for availability, adequacy, and quality of parking facilities.

X1- is the independent variable 1: availability, adequacy, and quality of inspection facilities.

X2- Is the independent variable 2: availability, adequacy, and quality of storage facilities.

X3- Is the independent variable 3: availability, adequacy, and quality of operational equipment.

X4- Is the independent variable 4: availability, adequacy, and quality of road network.

X5-Is the independent variable 5: availability, adequacy, and quality of parking facilities.

ε – Is the error term

The analysis of the hypothesis was conducted by generating a variable coefficient. The testing was done by comparing the P-value with the level of significance (□) at 0.05.

The study was similar in approach and methodology to peer-reviewed study by Cheruiyot and Rotich (2018) and Kabui et al. (2019), factors affecting the implementation of OSBP, as case study of the Malaba border, and the effects of single window in Kenya, respectively.

To gain more insights of the border, focus group were selected based on position and number of years served at the border. The researcher works at Nakonde border, therefore utilized the time during the Joint Border Committee meetings to meet government agencies and custom brokers to get their insights over the matter. A zoom meeting was convened for importers and transporters, since they are based in Lusaka. Separate physical meeting was held with the drivers. Data analysis techniques involved both qualitative and quantitative; where descriptive statistics and regression analysis were used, respectively. Findings were presented using charts and tables to present a qualitative analysis. Data validity was done using exploratory factor analysis (EFA) based on principle component analysis. This is necessary to decide the extent to which the research instrument will test the concepts at hand. The internal consistency reliability is carried out to assess the reproducibility and consistency of data based on the values of Cronbach‘s Alpha Coefficient, of which values above 0.5 are considered good and 0.7 very good.

Diagnostic tests were conducted using the correlation analysis to estimate strength of association. The variance Inflating Factor tests for multi-collinearity of variables and heteroscedasticity test was conducted using Breusch Pagan Test and its presence is determined if Chi-Square is less than 5%.

To estimate the unknown parameter, ordinary least squares was applied.

Theoretical and Conceptual Framework

The Ice-berg Model

Inadequate physical infrastructure results in losses and cost which culminates from border inefficiencies,

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spoilage of goods and inventory holding. This analogy was coined by Samuelson in 1954, as the –iceberg model, that has been used as a tool for analyzing the effects of trade costs. The efficiency gains (iceberg) approach, considers that the implementation of trade facilitation, inclusive of the OSSSSBP lowers the cost of trade and raises the quantity of imports consumed compared to the quantity exported through the import-augmenting technological change (World Trade Report,2018).

The Supply Chain Model.

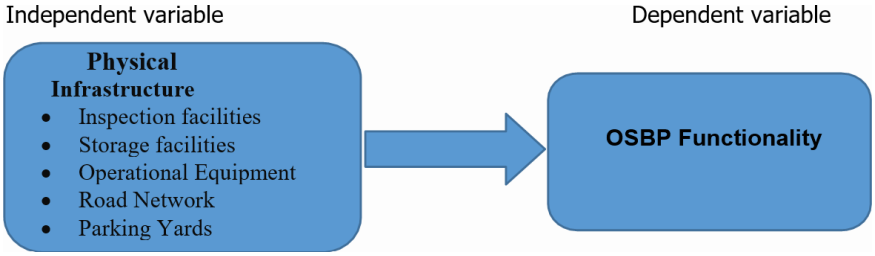
The supply chain model depicts the importance of reducing the border clearance time and costs.It recognizes that the complex goods in contemporary manufacturing is made up of parts and components made in different countries (World Trade Report,2018).This global value chain concept boosts global production and therefore amplifies costs.

The iceberg and supply chain theories attest that border infrastructure is one of the causes of border inefficiencies and therefore affects trade facilitation. Border infrastructure is cardinal in the achievement of TF and therefore has been recognized as one of the important pillars on which the OSBP concept is anchored.

Figure 4.1 below shows the conceptual framework for this research. The independent variable was physical infrastructure disaggregated into inspection facilities, storage facilities, operational equipment, road network, and parking yard. The dependent variable is OSBP functionality.

The iceberg and supply chain theories attest that border infrastructure is one of the causes of border inefficiencies and therefore affects trade facilitation. Border infrastructure is cardinal in the achievement of TF and therefore has been recognized as one of the important pillars on which the OSBP concept is anchored. It is worth noting that all four pillars must be well complemented for an OSBP to have an impact on the fast clearance of goods and reduction of trade costs; especially for the busiest borders such as Nakonde.

Figure 4.1: Conceptual Framework



DATA ANALYSIS AND DISCUSSION OF FINDINGS

Key aspects of the analysis included the demographic profile of the respondents, descriptive statistics of the scores for all the variables, validity and reliability statistics, and regression analysis.

Consistency and Accuracy of Data

Validity Statistics.

The KMO value was 0.803 (way above the 0.7 threshold) which meant that the sampling was adequate, so factor analysis could be carried out. The P-value for the Chi-Square of the Bartlett‘s Test of Sphericity was 0.000 meaning the statistic was significant and affirmed a good validity of collected data. The Rotated matric component was used to determine the strength of relationship between components and

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constructs(items) of variables. The retained factor loadings were above 0.55 and ranged from 0.595 to 0.887, denoting that the relationships between the components and the items were strong. Overall, the statistics showed that the data validity was good for the research.

Reliability Statistics

Cronbach‘s Alpha values were above the 0.5 mark for acceptable reliability; storage facilities, operational equipment OSBP functionality variables alpha coefficients were above the 0.7 mark for strong reliability and inspection facilities, border road network, parking facilities variables slightly below 0.7 but still acceptable. Overall, the statistics confirmed that the data collected was consistent, reproducible, and thus, reliable.

Border Post Experiences

The respondent ‘s demographic designation at the Nakonde OSBP was distributed as 20% government officials,17.7% custom brokers,10% importers,6.9 % transporters, and 45.4% cross- border drivers. As shown in Table 5.1, it is evident that drivers were the most respondents.

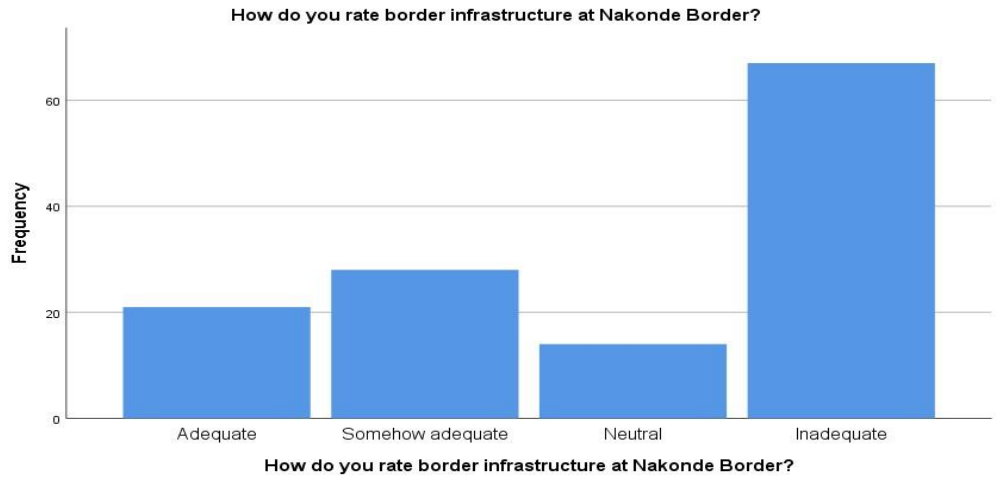
Table 5. 1: Role in border Post Operations

What is your role in border operations					
Group		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Government Official	26	20.0	20.0	20.0
	Clearing agent	23	17.7	17.7	37.7
	Importer	13	10.0	10.0	47.7
	Transporter	9	6.9	6.9	54.6
	Driver	59	45.4	45.4	100.0
	Total	130	100.0	100.0	

Source: Authors computation using statistical tools.

Figure 5.1; show that over 50 % of the respondents observes that infrastructure was inadequate and insufficient to fully support effective operations.

Figure 5.1 of infrastructure adequacy



Source: Authors compilation

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Table 5.2 below show responses on whether current physical infrastructure supported OSBP function at the Nakonde border. 20% of respondents indicate _Yes‘, 61.5% indicate _No‘,16.2% indicated Somehow ‘, while 1.5% were neutral and 0.8% opted for other options. Since 61.5% of respondents indicated No, ‘which was the majority, it could be inferred that physical infrastructure does not fully support OSBP functionality.

Table 5. 2 Infrastructure support for OSBP functionality

Does the current border infrastructure support OSBP functionality?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	26	20.0	20.0	20.0
	No	80	61.5	61.5	81.5
	Somehow	21	16.2	16.2	97.7
	Neutral	2	1.5	1.5	99.2
	Other	1	.8	.8	100.0
	Total	130	100.0	100.0	

Source: Authors computation

Respondents were asked how long it took to receive customs services on the Tunduma side of the border. As shown in Table 5.3,43% indicated less than 12 hours,11.5% stated 12 to 48 hours,32.3% indicated 3 to 7 days,4.6% 8 to 14 days, while 8.5% above 14 days. The modal class is for those who chose less than 12 hours, implying that the service took less than 12 hours on many occasions. If the service took longer, it was mostly for 3 to 7 days. Therefore, it was deduced that there was efficiency in the clearance of goods at the Tunduma border since 43.1% of respondents were served in less than 12 hours.

Table 5. 3: Cargo Clearance at the Tunduma OSBP

How long did you wait at the Tunduma border before entering Nakonde Customs Control Zone?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 12 hours	56	43.1	43.1	43.1
	13 to 48 hours	15	11.5	11.5	54.6
	3 to 7 days	42	32.3	32.3	86.9
	8 to 14 days	6	4.6	4.6	91.5
	Above 14 days	11	8.5	8.5	100.0
	Total	130	100.0	100.0	

Source: Authors computation

Respondents also scored the time cargo clearance takes from entering the customs control zone (Zambian Gate) to the time consignment is released (all formalities exhausted, including inspections by other government agencies). As shown in Table 5.4 ,16.2% indicated it took less than 12 hours,23.8% observes it took 13 to 48 hours,38.2% observed it took 3 to 7 days, 16.2% observed it took 8 to 14 days whilst those who indicated above 14 days’ accounted for 5.4%. Since 38.2% said it took 3 to 7 days to clear cargo on the Zambian side, it was presumed that physical infrastructure deficit impacts the clearance process.

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Table 5. 4: Cargo Clearance Time at Nakonde OSBP

How long does cargo clearance take from the time of entering the customs control zone (Zambian Gate) to the time consignment is released (all formalities exhausted including inspections by other government agencies)?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 12 hours	21	16.2	16.2	16.2
	13 to 48hours	31	23.8	23.8	40.0
	3 to 7 days	50	38.5	38.5	78.5
	8 to 14 days	21	16.2	16.2	94.6
	Above 14 days	7	5.4	5.4	100.0
	Total	130	100.0	100.0	

Source: Authors computation

Results from focused group interviews

Respondents who participated in the research were interviewed in groups or one-on-one especially for importers and transporters who are based in Lusaka. The subjective view of the impact of physical infrastructure on OSBP functionality is highly significant, with road infrastructure being of paramount importance.

- **Narrative of Government Agencies**

Government agencies expressed the lack of infrastructure as hindering OSBP functionality. The inspection bay was located 10km away from the border perimeter, presenting a challenge to conduct physical regulatory controls. The Zambia Revenue Authority and Zambia Compulsory Standards Agency were the only agencies capable of inspecting consignments as they have reliable transport to get to the inspection yard. The other agencies only conduct documentary inspection and do not hold on to consignments longer than necessary. The state of rented inspection facility was a challenge to OSBP functionality, as it was devoid of a structure /shelter to protect the consignments from weather elements. During rainy season few consignments were inspected to prevent mud from spoiling consignments or soaking the consignments. During rainy season most consignments inspections were postponed which leads to delayment in the release of consignments and hence adding to trade costs. Demurrage was rampant in the rain season due to delayments of trucks being inspected.

Therefore, to counter the demurrage costs pegged at about $ 80/truck/day translating to $ 29,200 annually, most consignments were conditionally released for import formalities to be completed inland.

- **Narrative of Importers and Transporters**

The importers pointed out that physical infrastructure impacts OSBP functionality, as evidenced by a maximum time of 6days it took to finalise customs clearance, despite implementing the use of ASYCUDA system and pre-clearance procedures. However, at times the delayment was due to custom official's attitude to duty who delayed consignments un-necessarily. The inadequate and poorly designed inspection facility negatively impacted OSBP functionality as delayments were mostly experienced in the rainy season. Therefore, to counter the delay, finalising clearance inland helped to reduce clearance time, trade costs, and improve security of consignments. Trade costs were incurred through demurrage (about $80 per day per

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truck) translating to annual costs of $29,200.00, and bribery (about $ 50 per truck = $ 18,250.00 annually), if importer does not want inspection to be conducted or truck delayed further. The group called for improvements to the Great North Road, which runs from the Nakonde border to Lusaka and Copperbelt, as it is an international commercial route.

- **Narrative of Clearing Agents**

The clearing agents 'narrative was that facilities at the Nakonde border like inspection, and parking facilities should be located within the Common Customs Zone. The inspection facility located at ZAMESCO compromised the quality and safety of goods during inspection. The lack of goods handling equipment led to further clearance delays as most consignments were compressed packaged. When these goods are unloaded at the border, not all them are reloaded. To counter loading expenses, government agencies resorted to superficial inspection. There was only one scanner available which was usually on and off and sometimes gives blurry images that officers failed to interpret. The blurry images subjected consignments for further physical inspections causing a delayment in the clearance of goods.

- **Narrative of Drivers**

The driver's perception was that physical infrastructure was not adequate to handle the traffic it received. Facilities such as road network were in a deplorable state exacerbating the risk of transporting goods and safety, through delayed clearance, transportation and, wastage through accidents and thefts. These factors contributed to trade costs and delayed clearances. The inspection facility was not conducive to befit a border that brings in revenue for the government. It had no shelters/shades needed to prevent goods and drivers from weather elements. This had a negative effect on the wellbeing of drivers as it is an occupational health hazard.

Descriptive Statistics

Descriptive statistics were calculated to understand the pattern of scoring on myriad items (constructs) of the variables by the respondents. Key statistics to describe the nature of the scores included minimum score, maximum scores, the mean, the standard deviation, skewness, and kurtosis. The minimum score for each variable was 1 (strongly disagree), while the maximum score was 5 (strongly agree). The minimum score was 2.18 for storage facilities, followed by 2.50 for inspection facilities and road network; parking yards had a score of 2.56 and operational facilities 2.80. The OSBP functionality variable had a score of 3.32. The mean values for independent variables ranged between 2.18 and 2.80, showing that factors were negatively influencing OSBP functionality.

The standard deviation ranged from 1.179 to 1.381, the skewness for all the variables ranged from -0.28 to 0.98, ranging between -1 to +1, showing that curves for scores were symmetrical and did not significantly deviate from normality. The kurtosis for all the variables ranged from -0.16 to -0.83, the values were the within range of -1 to +1, which implied that the peaks of the curves for the scores were within the normal range and did not significantly deviate from normality.

Table 5.5: Summary of Descriptive Statistics

Variable	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Inspection Facilities	130	1.00	5.00	2.50	1.34	0.43	.212	-0.83	.422

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StorageFacilities	130	1.00	5.00	2.18	1.30	0.98	.212	-0.19	.422
Operational Equipment	130	1.00	5.00	2.80	1.18	0.22	.212	-0.63	.422
Road Network	130	1.00	5.00	2.50	1.32	0.51	.212	-0.75	.422
Parking Yards	130	1.00	5.00	2.56	1.38	0.45	.212	-0.81	.422
OSBP Functionality	130	1.00	5.00	3.32	1.23	-0.28	.212	-0.16	.422

Source: Authors computation.

Inferential Statistics

Correlation Analysis

The table shows correlation analysing of the variables.

Table 5. 6: Correlations

Correlations							
		OSBP Functionality	Inspection Facilities	Storage Facilities	Operational Equipment	Border Road Network	Parking Yards
Pearson Correlation	OSBP Functionality	1					
	Inspection Facilities	-.044	1.000				
	Storage Facilities	-.242	.386	1.000			
	Operational Equipment	.030	.315	.383	1.000		
	Border Road Network	.196	.415	.332	.380	1.000	
	Parking Yards	-.147	.355	.588	.552	.551	1.000
Sig. (1-tailed)	OSBP Functionality	.					
	Inspection Facilities	.308	.				
	Storage Facilities	.003	.000	.			
	Operational Equipment	.367	.000	.000	.		
	Border Road Network	.013	.000	.000	.000	.	
	Parking Yards	.048	.000	.000	.000	.000	.

Source: Authors calculation from SPSS.

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The relationship between inspection facilities and OSBP functionality was weak, negative and insignificant (R = -0.044 ;P-value = 0.308;P> □).The relationship between storage facilities and OSBP functionality was moderate, negative and significant (R=-0.242;P-value = 0.003;P<□).The relationship between operational equipment and OSBP functionality was weak, positive and insignificant (R= 0.030;P-value=0.367;P > □).The relationship between border road network and OSBP functionality was fairly moderate, positive and significant (R= 0.196,P-value =0.013;P <□). The relationship between parking yards and OSBP functionality was fairly weak, negative and significant (R=-0.147; P-value = 0.48;P< □).

The R-value (Pearson Correlation) for the relationship between the 5 independent variables and the dependent variable was 0.532. This means that there was a moderate positive correlation between physical infrastructure and OSBP functionality.

Regression Analysis

Regression Assumption

There was no multi-collinearity among independent variables as tolerances were above 0.1 and the variance inflation factors were within the range of 1 to 5; the lower and upper limits for moderate correlation amongst predictor variables.

Regression Analysis Results

Table 5.7: Regression analysis of physical infrastructure impact on OSBP functionality.

OSBPfunx	**Model 1**	**Model**
Inspectionfac	-0.065 (0.078)	-0.053 (0.069)
Storagefac	-0.239 (0.082) **	0.193 (0.079)
Operationalequip	0.147 (0.084)	0.125 (0.063)
Borderdnt	0.405 (0.094) ***	0.376 (0.084) ***
Parkingfac	-0.288 (0.101) **	-0.241 (0.096) **
Constant	3.735 (0.26573)	2.869 (0.26811)
R-squared	0.501	0.517
Adjusted R-Squared	0.471	0.467
R-Value	0.532	0.541
Prob > F	0.000	0.058
Control variables	NO	YES
Observations	130	125
Hypothesis	Reject	Fail to reject

- OSBPfunx means OSBP functionality, Inspectionfac = Inspection facilities, Storagefac= Storage facilities, Operationalequip = Operational equipment, Borderdnt=Border road network and Parkingfac=Parking facilities
- Robust standard errors are in parenthesis
- ***P<0.01, **P<0.05, *P<0.1 and no star means that the variable insignificant.
- Control variables not reported are included column 2, these are role at the border, position in the

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organisations and period respondent had worked or used Nakonde Border.

- Model 1 has results for 5 variables of interest and Model 2 has results include control variables.
- OLS equation; **Y=3.735-0.065X1 – 0.239X2 +0.147X3 + 0.405X4 –0.288X5 +0.266.**
- Null Hypothesis is that "physical Infrastructure has no impact on OSBP functionality"; the decision rule for the hypothesis is to reject H0, the null hypothesis if its P-value is smaller than the level of significance (i.e**.; P ≤ 0.05).**

The role of physical infrastructure on OSBP functionality cannot be underestimated as it facilitates the seamless flow and increase trade volume. Improving physical infrastructure is associated with reduced clearance times at the border, thereby reducing trade costs and improving security.

The overall empirical results indicated that physical infrastructure at the Nakonde border has a positive impact on OSBP functionality as shown by the rejected null hypothesis. The R-value (Pearson Correlation) for the relationship between the 5 independent variables and the dependent variable was 0.532. This means that there was a moderate positive correlation between physical infrastructure and OSBP functionality. This finding was coherent with the study by Ochieng et al. (2020), which showed that physical infrastructure promotes trade through the lowering of transport costs. The finding also coincided with Limao, and Venables (2001), Nordås, and Piermartini (2004), Portugal–Perez and Wilson 's (2012), Odero (2020), and Cheruiyot and Rotich (2018), which concluded that infrastructure deficiencies result in border inefficiencies. These inefficiencies cause spoilage of goods and delayment in the global supply chain therefore causing high trade costs and clearance times as depicted by the iceberg ', and supply chain 'models. The operation efficiency at the Nakonde OSBP is less than 50% as reported by MCTI (2022), time release study and as indicated by respondent. This inefficiency is partly due to inadequate physical infrastructure, however, the fact that some upgrade of infrastructure is underway, beneficial effects are being recorded in the clearance turnaround time.

Functional OSBP brought about by available, adequate, engineered designed, and constructed infrastructure aid in curbing high trade costs, holding all other factors constant. Odero (2020), reiterates how significant investment in roads and buildings has improved the effectiveness and efficiency at the Malaba border. Opasanon and Kitthamkesorn (2016), pinpointed the critical role the design of customs infrastructure has in cross-border clearance, which has to be compatible with the clearance procedures (Harmon,2014). The findings of Willie and Chikwabi's (2017) substantiate Harmon's (2014) assertion regarding the significance of infrastructural design. Specifically, their study highlights the virtual implementation of Zimbabwean customs automated risk management systems with no corresponding physical infrastructure.

The results from focused groups and general information from the questionnaire concludes that the current physical infrastructure does not supports OSBP functionality. Further,39% of the respondents spent 3-7 days before the consignment could be cleared. This finding was in tandem with MCTI (2022) observation which stated that the maximum border clearance time at the Nakonde border was 6 days. The current state of infrastructure at the Nakonde border hinders the achievement of OSBP functionality, as the road network was dilapidated and narrow, inspection facilities were located 10km away from the border, and of poor design and construction. Therefore, improvement in the configuration of the border in terms of physical infrastructure would have a remarkable contributory effect on ensuring OSBP functionality in terms of reduced trade costs, clearance time, and enhanced security as shown by the positive effect of the road network.

The aggregated empirical outcome showed that physical infrastructure significantly influenced OSBP functionality by 50.1 %. The rest,49.9 % of the variation would be explained by factors beyond the scope of this research. The P-value for F-Change was 0.000 depicting that the relationship was significant.

This result shows the importance of complementarity in the achievement of OSBP functionality as Willie

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(2020) concluded on the importance of improving the quality of border infrastructure. Willie (2020) stated that physical infrastructure is not the sole contributor to trade efficiency as a complementarity exists between border infrastructure, customs procedures, ICT, legal and institutional frameworks. To compound on the significance of complementarity, OECD (2009), concluded that the effectiveness and efficiency of administration modernisation and training of staff is dependent on the availability and upgrading of ports, airport warehousing facilities, and communication facilities. This means that there should be complementarity between soft infrastructure and hard infrastructure investment/implementation as physical infrastructure also impacts OSBP functionality. Freud and Rocha (2010), had an antagonistic conclusion on complementarity as their finding was that poor road quality and insecurity are a substantial barrier to Africa‘s exports than documentation and customs handling delays. Streatfeild (2017) also a different view on complementarity with a conclusion that trade related infrastructure has minimal impact on customs performance, as attitude drives customs performance.

Disaggregating the independent variable showed that inspection facilities and operational equipment, even though important, are insignificant in achieving OSBP functionality, while the border road network show a positive and significant impact OSBP functionality. This favourable effect could be attributed to the road improvements that begun during research period. Storage facilities and parking facilities even though significant negatively impact on OSBP functionality as they are underdeveloped and traders would have to pay for their services, therefore, increasing trade costs and compromising on the security of their commodities.

Border Road network has a standardized beta coefficient of 0.405 and was a significant predictor of the dependent variable, with a P-value of 0.000. Therefore, a 10% improvement in road network would increase OSPB functionality by 4.5%. This means that clearance time and trade costs will be reduced by 4.5% if the road network was improved. The road network at the border is currently in poor condition, causing congestion and delays, especially for priority treatment trucks. A moderate, positive, and significant association exists between border road network and OSBP functionality, mostly because at the time of this research road construction works had commenced.

Improvements in road network would therefore, increase OSBP functionality by reducing clearance times, reducing trade costs and improving security. This is because even if documents are compliant, trucks are hindered from crossing because of limited infrastructure, causing delays, leading to increased logistical costs, and compromising and security of goods and the driver. The availability, adequacy, quality design of infrastructure is crucial in enhancing free trade flow as found by Fitzmaurice and Hartmann (2013), Freud and Rocha (2010), and Kingombe (2014).

Storage facilities is a significant predictor of OSBP functionality with a P-value of 0.023 and beta coefficient of -0. 239.This signifies that a 10% improvement in storage facilities would lead to a reduction in OSBP functionality by 2.4%. The study found that the relationship between storage facilities and OSBP functionality is moderate, negative, and significant. The negative and significant result means that the current storage facilities are underdeveloped and therefore increase trade cost expenses as the traders have to pay for the service The storage facilities are available but inadequate, as the facility is a forty-foot container used to store dry cargo only. Government agencies and traders pay to access storage facilities as they are not provided by the government. Moreover, different government agencies have specific storage requirements depending on their mandate. The Veterinary services, require animal holding panes, to monitor the incubation period of suspect animals, the Drug Enforcement Commission requires animal kennel for storage of canine animals. The government and business community should therefore collaborate to increase and improve storage facilities to aid in the quick clearance of goods (OECD, 2009).

NEPAD (2016), states the counter effects of excessively designing storage facilities as it might contribute negatively to OSBP functionality through misuse of space and un-necessarily seizing and detaining

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consignments.

The relationship between parking yards and OSBP functionality was weak, negative, and significant. Parking yards had a standardised coefficient of -0.288 and was significant with a P- value of 0. 019. This implies that a 10% improvement in parking facilities would have a reduced effect on OSBP functionality, by increasing clearance time and trade costs by 2.8%. Nakonde border Post's parking facilities are located away from the border and traders use private parking services, which increases trade costs. The private parking even though available and adequate, their design and construction is devoid of shelters, paved platforms, and sanitation. They lack regulatory / operational functionality and are unsecured, compromising goods, vehicles, and drivers 'security.

The finding revealed a weak, positive, and insignificant association between operational equipment and OSBP functionality. Operational equipment had a beta coefficient of 0.405 and was insignificant with a P-value of 0. 139. This implied that operational equipment was not a predictor of OSBP functionality, and may be attributed to the unavailability of vital operational equipment. More research is therefore needed to reconcile this difference.

Inspection facilities had a negative and statistically insignificant impact on OSBP functionality, with a beta coefficient of -0.065 and a P-value of 0.492, making it a non- predictor of OSBP functionality.

CONCLUSION AND RECOMMENDATION

The Zambian government needs to prioritise Transport facilitation on the North-South corridor as it greatly impacts OSBP functionality and making regional integration a reality. Construction of road network will be Zambia demonstration to its COMESA and SADC Treaties commitments on seamless cross border movement.

The study recommends for development of adequate infrastructure for inspection facilities, parking facilities and storage facilities at the border to prevent misuse by government officials; and from drivers or importers through over inspecting / un-necessarily detaining of consignments and access of free parking and storage services respectively. Investment and development in road network must be top of the agenda, as it plays a vital role in regional integration, and the movement of goods and persons across borders (USAID,2012).

The limitation aspects of this study was that the research design used a questionnaire with so many options which could have affected the outcome of the study. The moderate R-squared could be attributed to data containing both factual and subjective data. Binary questions could have been a better option as they could have been easy to understand and analyse. Language spoken by most of the cross-border drivers is Kiswahili, therefore it is possible that they might have understood and answered the questions from a different context. The limited understanding of questions made collection of data difficult, however, this challenge was countered by having an interpreter when collecting data.

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FOOTNOTES

[1] this is an observable fact

[2] this is an observable fact

[3] Inspection Facilities, Storage Facilities, Parking Facilities, Road Network and Operational Equipment

[4] This is an observable fact