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| RESEARCH ARTICLE

Trade Infrastructure and Export Competitiveness in the East African Community

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| ABSTRACT
The purpose of this paper is to examine the influence of trade infrastructure components: port infrastructure, telephone usage and electricity on the export competitiveness of firms in the East African Community (EAC). The study adopted the structural gravity model and the Poisson Pseudo Maximum Likelihood (PPML), a nonlinear estimation method that was applied in STATA on balanced panel data for the period of 2007 to 2018. Data was obtained from World Bank International Trade Centre (ITC) and World Bank development indicators. Results show that telephone usage, electricity and port infrastructure are positive and significant predictors of export competitiveness in East African Community partner states. The results of this study show that electricity usage, telephone usage and port infrastructure are important contributors to improving export competitiveness in the EAC. There is a need to examine the intricate nature of the EAC economy in order to further this study's findings. The EAC partner states need to embrace deep integration by removing the behind-the-border trade barriers, in addition to other trade restrictions, to create a common economic space among member states. This will further shrink the delivery time and the tracking and tracing of exports hence improving the competitiveness of EAC exports within the region and outside. Also, common and harmonized economic policies and regulations can be implemented through mutual recognition agreements where countries agree to recognize one another's conformity assessments.

| KEYWORDS

Export competitiveness**,** Trade Infrastructure**,** Electricity, Telephone usage, Port infrastructure, EAC.

| ARTICLE INFORMATION

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1. Introduction

A country's level of export competitiveness is important for its participation in international trade and eventual management of balance of payment and trade distresses. World over, countries are embracing and implementing international trade policies that are aimed at protecting and promoting local businesses in order to increase exports and enable controlled importation of certain products (Han, Li, and Zhang, 2015). Specifically, these trade policies encompass the aspects of economic transformation and industrial strategies in global trade at the same time. Export-led growth is perceived as one of the promising avenues for promoting economic growth in developing countries (Hakobyan, 2017). Exporting provides the opportunity to expand production, boost employment, reduce unit costs, and increase incomes. Economic transformation relies on the acquisition of new productive capabilities in higher value-added economic activities. Recent empirical evidence demonstrates that manufacturing is still a key engine for economic transformation in both developing and developed economies (CDA, 2020). Participation in international markets stimulates learning by exporting and competing, which drives productivity. The knowledge acquired through export competition in foreign markets can be applied to increase productivity through technological innovation activities that increase the export competitiveness of firms in the country (ACET, 2014). Indeed Osakwe & Moussa (2017) emphasise that technological innovation is key to increasing productivity, which results in improved export competitiveness.

Export competitiveness is the ability of a country or firm to produce and sell goods and services in foreign markets at price and quality that ensure long-term viability and sustainability (Adriana, 2010; Gaglio, 2015; Hausmann, 2007). It is considered a key indicator of the success of firms through increased export of value added goods and services (Atkinson, 2013). Indeed, UNCTAD (2020) indicates that there has been a significant increase in the volume of international trade since 2009. However, developing countries are recording more import volumes than export volumes compared to developed countries (UNCTAD, 2020). For example, in 2019, developed countries exported goods amounting to US$10.5 trillion and services worth US$4.1 trillion. Whereas developing countries exported up to US$8.5 trillion in regard to goods and US$2 trillion in regard to services (UNCTAD, 2020). The huge variations in exports between developing and developed countries clearly show that the export competitiveness of developing countries is still low, which leads to a negative balance of payments positions (Arvis *et al.,* 2018).

Despite the trade openness for over three decades, the competitiveness of export firms in the East African Community (EAC) remains low. Some scholars have attributed this to dynamic changes and challenges in the trade environment, leading to increased international trade costs. These may include emergency of better producers, digitisation of trade, fragmentation of global value chains, regulations, non-tariff barriers (NTBs) and climate change, among others, which increase trade flow uncertainty (Browne, 2011; Danida, 2011; EAC, 2017; Klaus, 2013). In addition, with the current escalation of globalization, liberalization of trade and financial services, intensification of world trade flows, the emergence of new competitors and increased Foreign Direct Investment (FDI), firms are faced with stiff competition in both domestic and foreign markets (Browne, 2011; Klaus, 2017; UBOS, 2013; UNCTAD, 2005).

This is exacerbated by the low levels of product transformation and poor or lack of value addition in EAC intra-industry trade. In addition, the manufacturing firms in these countries are faced with a low level of technological sophistication in their exports. Their competitiveness is below the UNIDO standard scale of 1 (EAC, 2017). UNIDO assigns a scale of between 0 and 1; the best performing country is assigned 1, and the worst performing country is assigned a scale of 0 for the level of technological sophistication of manufactured goods. All the EAC countries have a scale close to 0 (UNIDO, 2018a). Moreover, the firms in EAC rely mainly on the export of primary products, agricultural products that require robust product specific inspections and procedures. Manufacturing value added on average is about 7.5% of GDP, yet manufacturing is a major driver to increased and sustained productivity, employment, innovations, technological progress and export competitiveness of firms (AfDB, 2018). The export competitiveness of manufacturing firms due to increased reliance on primary products exports from EAC to the EU and Asian markets while the import of high value-added products from the EU and Asian is on the increase.

In this study, innovation indicators of innovation in the exporting country, innovation in importing country, internet usage and patent rights are considered as possible explanations of export competitiveness as there is scant evidence as to whether there is a direct relationship between these indicators and export competitiveness in EAC firms and Africa firms at large. Yet, Innovation increases the efficiency, productivity and profitability that make firms enter new markets by increasing their competitiveness (Uyar & Oralhan, 2017). Indeed, the growth and competitiveness of firms in economies are largely dependent on the application and implementation of science, technology and innovation activities. This makes the exporting firms become more competitive in the foreign markets by producing more sophisticated products that may not lose value so easily. Uyar & Oralhan (2017) indicate that innovation is more important for exporting nations than importing nations leading to increased export competitiveness. However, Fassio (2018) argues that the foreign demand effect of exporting activities affects firms` strategies by increasing the potential output. The study argues that the technological learning effect has a positive effect on the introduction of brand-new product innovation, while the demand effect of exporting activity induces innovation strategies directed towards efficiency since it is very sensitive to the increase in the volume sold.

A critical analysis of the existing studies on export competitiveness shows no study linking the innovation indicators of internet usage, patent rights, innovation in the exporting country and innovation in the importing country to export competitiveness in a single suite in developing land locked and majorly agricultural countries like Uganda, Burundi, Rwanda and South Sudan in the EAC. Scholars of export competitiveness in the agricultural sector have rather focused on single country-level factors such as irrigation, exchange rates, the quantity of agricultural exports, labor cost and domestic consumption (Huo, 2014). But, Pascucci (2018) shows that a combination of both external and internal factors can explain the inadequate competitive performance and competitive potential since they have been worsening since the second half of the early twenty-first century. However, Pascucci only studied Italian companies. Another study by Suwannarat (2017) focused on the export competitiveness of economic products such as cassava, computer equipment and components in Thai without exploring the logistical factors that can promote their competitiveness in the world market.

Further still, Thazhugal and Nair (2020) and Vamvakidis (1998) suggest that in order to spur economic growth, economic groups are now focusing more on intra-regional trade, diversification and investment liberalization and the potential effects of the same. Hence, a need for technological innovation to spur structural transformation. As a matter of fact, the few existing empirical studies

on export trade infrastructure components and export competitiveness have been based in developed countries such as those in Europe (e.g., Hoekman & Shepherd, 2015; Paelo, 2017; Arvis *et al.,* 2018) which are predominantly export-minded and with extensively harmonized transport policies. The current study explores the phenomenon in EAC countries, which present a unique international trade environment. EAC countries are currently more import oriented, and they operate on minimally harmonized trade policies. As such, this study will explore whether the findings from other environments match with the EAC countries for a longer period, that is, 12 years more than a study by Puertas et al. (2014) which explored the progress made in logistics by EU Member States over a 5-year period. Another study by Martí and Puertas (2017) on the importance of export logistics in emerging economies with a maritime border, such as Kenya, which is in EAC, suggested continuous improvement in logistical infrastructure to boost both their trade and export competitiveness. The current study is also aimed at following up with such recommendations by prior scholars even in non-maritime border countries such as Uganda, Rwanda and Burundi together with maritime countries that is Kenya and Tanzania. Overall, calls for further studies on promoting exports are eminent (Thazhugal and Nair, 2020; Lai, *et al.,* 2019; Puertas *et al.,* 2017; D'Aleo, and Sergi, 2017).

Thereupon, the current study examines the contribution of export trade infrastructure components on export competitiveness in EAC countries by addressing the following research questions:

RQ1. What is the effect of port infrastructure on export competitiveness?
RQ2. How does telephone usage affect export competitiveness?
RQ3. What is the effect of electricity on export competitiveness?

The aforementioned research questions were answered by using secondary panel data for a period from 2007 to 2018. The findings indicate that timely delivery and tracking, and tracing had a significant and positive effect on export competitiveness in the EAC. The present study results are important in several ways. The study informs policy makers that sustainable improvements in export competitiveness require multifaceted changes in a range of policy dimensions in areas including shipment frequency, timely delivery, trade facilitation and services. This requires concerted efforts and persistent focus of the regional countries. The current study also adds to the already scant existing literature on export competitiveness by providing initial empirical evidence on the contribution of shipment arrangements, timely delivery, customs quality, trade infrastructure quality, and tracking and tracing using evidence from African developing countries (EAC countries).

The rest of this paper is organized as follows. The next section is a literature review and hypotheses development. Next is the methodology section, which is then followed by results. The discussion section then follows, and finally, a summary and conclusion are provided.

2. Literature review and hypotheses development

2.1 Theoretical foundation

In this study, the New Trade Theory (Krugman, 1979) is used to explore the contribution of export logistics infrastructure on export competitiveness. The New Trade Theory posits that economies of scale provide an alternative to differences in technology or factor endowments as an explanation of specialization and international trade. The New Trade Theory explains intra-industry trade, which contributes greatly to world trade today (Markusen, 2007). The theory explains that producers in different countries while using the same production function, compete against the producers of similar products at a level of costs lowered by a larger scale of production. This necessitates countries to form regional integrations to generate more benefits (Schiff & Winters, 2003). The theory seems to offer a reasonable explanation of the export competitiveness of industry through economies of scale, increasing returns to scale, product differentiation and consumer preference for variety where export logistics infrastructure contributes greatly to the export competitiveness of firms. Theoretically, an improvement in trade infrastructure reduces transaction costs in international trade which increase economies of scale and productivity.

The order of the economy appears to emerge from the complex interactions of the agencies that constitute the evolutionary processes of the economy. Therefore, for a firm to remain competitive requires a high level of innovation and adaptability which is achieved through the influential interactions of the trade agencies and institutions, resulting in the emergency of novelty (Arthur, 2013; Byrne, 2005; Hausmann *et al.*, 2013). The Economic Complexity Theory focuses on the dynamic systems to which the outcome of the behaviour of each firm and of the systems into which each firm is embedded is dynamic and can only be understood as the result of multiple interactions among heterogeneous firms embedded in evolving structures (Antonelli, 2011). Cristelli *et al.* (2015) argue that the wealthiest and most competitive economies are usually those which exhibit the highest diversity of export, which may not be adequately explained by the main stream trade and economic theories. The complexity theory is chosen because of its applicability and ability to provide an understanding of the export competitiveness of firms in the dynamic and complex trade environment in developing countries (Abbasi, 2014). This is because the economy, especially in developing countries, is a complicated set of arrangements and actions wherein firms compete, offer services, innovate and adapt in such a way that markets

form, prices form, and trading arrangements form from individual behaviour, creating a recursive loop which connects value chains (Arthur, 2013). Arthur adds that due to non-equilibrium in an economy, both increasing and diminishing returns to scale may exist, whereby the economy forms from constantly developing institutions, arrangements and technological innovations. This study will combine the economic complexity theory with the new-new trade theory to explain and predict the export competitiveness of firms in EAC.

2.2 Trade facilitation infrastructure

Logistics is construed as an integrated information, packaging, storage and transport system that observes time, quality and cost demands (Puertas *et al.,* 2013). Logistics performance is important for competitiveness and ultimate economic growth (Puertas *et al.,* 2013). Inefficient logistics raises the transaction costs in international trade and reduces the potential for both international and domestic integration into the global supply chains (LPI, 2018). The logistics performance index of the World Bank is analyzed through six indicators; The efficiency of customs and border management clearance, the ease of arranging competitively priced international shipments, the quality of trade and transport related infrastructure, the competence and quality of logistics services, the ability to track and trace consignments and the frequency with which shipments reach consignees within scheduled or expected delivery time (LPI, 2018). The quality of logistics infrastructure, the distribution of intermodal facilities within countries, the number of logistics operators and their specifications are very important in enhancing export competitiveness and expanding the market share of firms in foreign markets (Bensassi *et al.,* 2015). Since logistics performance has become a decisive consideration in export competitiveness (Puertas *et al.,* 2013), it is plausible to examine the exact contribution of each component of export logistics infrastructure on export competitiveness, which is still inadequate in international trade literature. In the proceeding literature, we explain the relationships of each export logistics component with export competitiveness.

2.2.1 Port infrastructure quality

Transport infrastructure encompasses the quality and reliability of a country's transport and telecommunications facilities (Puertas *et al.,* 2013). These are crucial in the export trade of an economy. Nordås and Kim (2013) argue that better service quality improves the export competitiveness of firms through reduced costs and making products that the consumers are willing to pay for. Theoretically, accessibility to efficient, reliable and reasonable transport, distribution, finance, utilities, telecommunication and business services are crucial for the efficient productivity and competitiveness of firms. The service intensity of firms may affect their productivity and, thereby, their competitiveness in foreign markets. Services are very instrumental in connecting firms to foreign markets helping them to differentiate their offerings from those of other firms (Lodefalk, 2014). World Trade (2019) indicates that the effective rate of protection provided by transport costs is higher than that of tariffs. The factors affecting transport costs may include types of products, level of containerization, traffic on some routes, quality of export infrastructure and logistics. The report adds that the difference in these costs across countries is a source of both absolute advantage and comparative advantage, which affects the volume and pattern of trade. Hence the relatively low levels of trade in Africa are due to a lack of appropriate transport infrastructure. Arvis *et al.* (2018) reported that infrastructure affects the economic development of a country in terms of raw materials and final products; hence a sound infrastructure facilitates the mobility of factors of production, which, in turn, improves productivity and reduces costs which are key measures of export competitiveness. Infrastructure increases the flow of information and reduces market imperfections, which increases economies of scale and return to scale that are enjoyed by the exporters. According to Arvis *et al.* (2018), efficient transportation is an important determinant of export competitiveness as it helps reduce problems of customs delays, incompatible standards, the insufficient flow of information and non-integrated time schedules. Therefore, high transport costs inhibit firm entry into new markets, thereby contributing to a high rate of exit of firms from markets, reducing their export competitiveness (Nordås & Kim, 2013). We, therefore, hypothesize that:

H1a: The port infrastructure has an influence on the export competitiveness of firms

2.2.2 Telephone usage

OECD (2005) defines innovation as "the implementation of a new or significantly improved product or process, a new marketing method or a new organizational method in business practices, market place organization or external relations". Uyar & Oralhan (2017) found that innovation correlates positively and significantly with export performance. They argue that with the increasingly competitive environment, it is crucial for firms to carry out technological innovation that makes a difference to their customers. Innovation increases the efficiency, productivity and profitability that make firms enter new markets by increasing their competitiveness. Export competitiveness in developing countries is now becoming more influenced by the level of firm heterogeneity through increased innovation activities and the quality of logistics infrastructure such as transportation, customs administration, telecommunication networks, electricity and infrastructural services, among others (Ketels, 2010; Melitz & Redding, 2014). The new international trade theories, based on the assumption of firm heterogeneity, posit that a country's capacity to engage in trade relies on various elements, including fixed and variable costs to trade, but mainly firms' productivity. Communication is through direct calling customers, sending text messages and the use of social media apps. This is supported by empirical literature. For instance, Vickers and Pena-Mendez (2015) found that the mobile technology revolution has had a positive

economic and social impact in many developing countries. This reduces the transaction cost, that enables firms to adapt very easily to changes in the foreign markets. Efficient and effective information and communication determine what is traded internationally. Inomata (2017) argues that with the advances in transportation, information and communication technology, production processes are now divided into several production stages, each corresponding to a particular task or activity such as design, parts procurement, assembly, and distribution, among others. These activities are located and relocated across borders to areas where the activities are performed most efficiently. Baimbill-Johnson, (2017) suggest that connectivity can transform both conventional business models and how buyers and sellers interact in the market. Arvis *et al.* (2018) indicate that the export infrastructure in terms of transportation and communication systems is a foundation for the trade costs, global competitiveness and development prospects of a country as they provide a good measure of trade efficiency and effectiveness.

H1b: The telephone usage has an influence on export competitiveness of firms

2.2.3 Electricity usage

Electricity consumption helps the usage of machinery and equipment, which are run by electric power in the production process. This suggests that the export firms will be more productive and competitive in the foreign markets when the electricity usage of the export component becomes faster and more efficient. Firms will be more competitive and more productive when electricity connections become easy, reliable and cheaper, making it easy to adapt very quickly to changes in foreign markets. Electricity is very important for production and transportation and increases the speed of clearance at the borders by facilitating the usage of the internet, for example, the application of a single window in the EAC. This is supported by Hoekman & Shepherd (2015), who found that firms of all sizes benefit from improved trade facilitation by exporting more in response to the improvement in the reduction of time taken to export. An increase in the amount of electricity consumed by the manufacturing sector indicates an increase in the speed of operation in the production process, which eventually leads to an increase in productivity and output. This is supported by the (OECD, 2014), which indicates that electricity services are used throughout the value chain to upgrade the quality of products, lower cost and enhance the efficiency of firms. Electricity supply is an important driver of economic growth and development processes by facilitating the production of goods and services, increasing the export competitiveness of firms as a result. Electrification and access to improved modern energy are key drivers to economic development due to the interdependency between the energy sector and other economic activities that result in increased productivity. Indeed Nalule (2016) indicates that because the cooperation and the EAC state jointly developing the East Africa Power Master Plan (EAPMP) aimed at lowering the cost of developing the power sector, shows that there are economies of scale associated with electricity interconnections and trade within EAC.

H1c: Electricity has an effect on the export competitiveness of firms

3. Methodology

3.1 Study setting

The East African Community is an intergovernmental organization comprised of countries of Burundi, DRC Congo, Kenya, Rwanda, Tanzania, South Sudan and Uganda. Since the establishment of the regional block, the partner countries have operationalized the customs union in 2005 and the common market in 2010, aimed at easing the movement of goods, services, people and capital within the region (EAC, 2017). Following the implementation of the EAC Customs Union (CU), the total volume of trade between the EAC partner countries registered a significant increase (Shinyekwa & Othieno, 2011). In addition, the governments in the region have introduced tools and measures to facilitate trade, improving the trading environment and thereby boosting the export competitiveness of firms in the region (World Bank, 2016). For instance, all the countries put in measures that have simplified the process of starting a business by eliminating the stringent requirements and improving online registrations for firms and other actors. Rwanda removed the mandatory pre-shipment inspection for imported consignments; Uganda has constructed one-stop border posts in the majority of the border customs posts; Tanzania implemented the Tanzania Customs Integrated System (TANCIS), which is an online system for processing customs documents, thereby reducing the time taken to clear a consignment for both import and export. Likewise, Uganda implemented ASYCUDA world, an electronic system, and Burundi eliminated the cumbersome and costly requirements for pre-shipment inspection that require submission of a clean sheet of findings (World Bank, 2016). In addition, the EAC countries have a number of export promotion tools in common that include duty drawback, manufacturing under bond and export processing zones (EPZs), among others, with a view of increasing export competitiveness since goods benefiting from these schemes are primarily destined for export.

Exports in the EAC expanded mostly in the early 2000s. The export share in the total GDP increased from 13% in 2000 to 18% in 2015. In the same period, imports, on the other hand, expanded from 21% to 28%, creating a high trade deficit in the region (UNIDO, 2018). Tanzania, Rwanda and Uganda experienced relatively high increases in merchandise export as compared to Burundi and Kenya, whose merchandise export reduced (UNIDO, 2018). The merchandise export in the region has been dominated by primary products and, to some extent, resource-based manufacturers. The role of EAC in intra-regional trade has been significant,

although trade is still dominated by countries outside the region, such as the EU and Asian countries. While the primary products continue to dominate the markets of the EU and Asia, the imports from these markets are mainly high value-added manufacturers. This reflects the inadequate efforts of structural transformation in the region, lowering the export competitiveness of firms (UNIDO, 2018).

3.2 Research Design and data source

This study used secondary panel data for indicators of competitiveness for a period from 2007 to 2018 because there is already an existing body of data on the variables under study. Specifically, the researcher obtained the data for the EAC exports from the World Bank International Trade Centre (ITC). Data on the independent variables were obtained from World Bank Development Indicators. The use of panel data was to enable control for variables that may not be observed or measured over time, like differences in business practices across firms (Hsiao, 2014). Panel data brings out the relationship between the variables under study, and it accounts for individual firm heterogeneity to minimize the unobserved and endogeneity bias (Baltagi,2014). It helps make inferences about the causal relationship between variables in real-world practices as it has the ability to determine the direction of the causal relationships. It is suited to the studies of dynamic changes in the economy, such as export competitiveness (Hsiao, 2014). This is because export competitiveness is dynamic in nature that requires panel data analysis to make more accurate inferences and predict the export potential of firms in the East African Community. The study was descriptive, mainly focusing on the quantitative aspect of the study that involved obtaining information and making statistical explanations about the situation that exists (Dawson, 2002; Kumar, 2014; Neuman. 2007).

3.3 Model Specification and variable measurement

The study adopted modifications to the structural gravity model as used by Anderson & Van Wincoop (2004) to explain the effects of trade costs on the pattern of trade across countries. This model was adopted because it is relevant when making inferences on the portion of trade costs of firms or countries that cannot be directly measured in the data and the interactions between countries that are not direct trade partners (Anderson, 2011; Anderson, 2010, 2014). In the current study, we have incorporated trade costs in terms of Distance, Contingency, Common language, Common colony, Transport cost for exports, Transport cost for imports, Tariffs, GDP for importing country, GDP for the exporting country and Real exchange rate to explain export competitiveness in EAC counties. These trade costs are conceptualized as control variables since Bartov et al. (2000) suggest that the inability to provide for confounding factors can lead to falsely rejecting the hypotheses when in fact, they should be accepted. The predictor variables in the model are derived from the World Bank development indicators, and they are Electricity, Telephone usage and Port infrastructure. The mathematical expression of the derived model is as follows:

$$EC = \beta 0+\beta 1TU+ \beta 2EU+ \beta 3PI+ \beta 4Dist+ \beta 5Conti+ \beta 6Comlang+ \beta 7ComCol+ \beta 8TCE+ \beta 9TCI+ \beta 10Tari+ \beta 11GDPM+ \beta 12GDPE+ \beta 13REER+ \varepsilon j$$

Where: EC is export competitiveness; TU is telephone usage; EU is electricity Usage; PI is port infrastructure; Dist is distance; Contig is Common boarder; Comlang is common language; Comcol is common colony; TCE is transport cost export; TCI is transport cost import; GDPM is the GDP for the importing country; GDPE is the GDP for the exporting country; Tari is tariff on import; REER is real exchange rate; and εj is the error term.

The Poisson Pseudo Maximum Likelihood (PPML), a nonlinear estimation method, was also adopted to account for heteroskedasticity, fixed and random effects and the possible loss of information due to zero trade flows, thereby producing robust results. Since the components of the variables were measured in different units, the observations were normalized or standardized to permit averaging, with the average regarded as a composite index. The normalization used in this study was the min-max formula, which adjusts the normalized components to take values between 0 and 100 over the indicated period. The min-max technique gives a linear transformation on the original range of data. It keeps the relationship among the original data, and it fits the data in a predetermined boundary (Vafaei, Ribeiro & Camarinha-Matos 2018).

4. Results

4.1 Normality, multicollinearity and Diagnostic test for model Specification

We tested for normality by both the graphical and numerical using the Kernel density, Quantile-Quantile plot (Q-Q plot) and Jarque-Bera test. The kernel density is a better estimator than the histogram, which allows the estimated function to be smooth as well as to figure out a more detailed structure due to its statistical accuracy (Travis et al., 2016; Goedele, Yuri & Armelle, 2013). The results in Figure 1 depict a fairly bell-shaped distribution of export competitiveness. Therefore, the data were normally distributed, and the application of the parametric tests is appropriate for this study. The Quantile-Quantile plot (Q-Q plot) was used to estimate the variations in terms of export competitiveness under the normal distribution of the data, as shown in Figure 2. The results show that the plots lie approximately on a straight line suggesting a linear and normal distribution.

We also applied the Jarque-Bera test (See table 1), which is theoretical and the skewness-kurtosis test (empirical) to test for normality. Jarque-Bera test is a goodness-of-fit test to estimate whether the data have the skewness and kurtosis matching a normal distribution. The Skewness of the data is 0.000, and the kurtosis is 0.000 based on excess kurtosis determination. Both values are 0, as you would expect for a normal distribution. Therefore, this is an indication that the data is normally distributed.

Table 1

Jarque-Bera test model 3

Variable	Pr(Skewness)	Pr(Kurtosis)	adj chi2(2)	Prob>chi2
Competitiveness	0.0000	0.0000	81.23	0.0000
Transport cost exp	0.0000	0.0000	41.9	0.0000
Transport cost imp	0.0000	0.0000	7.28	0.0000
Tariff	0.0000	0.0204	11.97	0.0000
GDP imp	0.0000	0.0000	20.1	0.0000
GDP exp	0.0000	0.0001	14.09	0.0000
Real exchange rate	0.0000	0.0036	39.51	0.0000
Electricity usage	0.0000	0.0000	32.70	0.0000
Telephone	0.0000	0.0000	5.28	0.0000
Port infrastructure	0.0009	0.0394	11.75	0.0008

Source: Own computations

To establish the degree of Multicollinearity between the predictor (independent) variables. The rule of thumb is that if any of the Variance inflation factor (VIF) values exceed 10, it implies that the associated regression coefficients are poorly estimated due to multicollinearity (Kumar, 2014). Therefore, none of the VIF values were up to 10, and the mean VIF of the model was less than 10, as shown in Table 2. It means there was no collinearity in the model.

Table 2

VIF

Variable	**VIF**	**1/VIF**
Electricity usage	3.5	0.2857
Transport cost exp	3.03	0.3299
GDP exp	3.01	0.3325
Telephone	2.97	0.3372
Transport cost imp	2.33	0.4295
Contig	2.23	0.4494
Distance	2.18	0.4588
Port infrastructure	1.81	0.5519
Tariff	1.78	0.5619
GDP imp	1.5	0.6648
Common colony	1.5	0.6667
Common language	1.37	0.7303
Real exchange rate	1.16	0.8620
Mean VIF	**2.18**	

Source: Own computations

Additionally, we carried out the logistics regression diagnostic test for model specification using a Link Test in line with (Murteira & Ramalho, 2016; Torres-Reyna, 2007). The idea behind the Link Test is that if the model is properly specified, there should not be any additional predictors that are statistically significant. The Link Test uses the linear predicted value (-hat) and the linear predicted value squared (-hatsq) as predictors to rebuild the model (Torres-Reyna, 2007). The variable (–hat) should be statistically significant as expected since it is the predicted value from the model unless it is completely mis-specified. On the other hand, the variable (-hatsq) should not have much predictive power, and it should not be significant unless some relevant variables have been omitted from the model (Murteira, 2014). The results in Table 3 show that the predicted value of (-hatsq) was not significant as expected

with a p-value of 0.432, meaning that the model had no specification errors and the variable (-hat) was significant since the p-value of 0.000, which is close to 0.05. We conclude that all the necessary variables were included in the model, implying that we did not exclude any important variables that should be in this model.

Table 3
Model Link test

Compet	**Coef.**	**Std. Err.**	***p*>t**	**(95% Conf. Interval)**	
_hat	2.2572	0.5626	0.000	1.1544	3.3599
_hatsq	-0.2888	0.1253	0.432	-0.5344	-0.0432
_cons	-1.3547	0.6289	0.748	-2.5873	-0.1220

Source: Own computations

4.2 Descriptive statistics

Table 4 displays the descriptive statistics for all constructs. The Mean and standard deviation, together with the minimum and maximum statistical results, were generated in order to summarize the observed data. This was necessary because the means represent a summary of data while the standard deviation indicates how well the means represent data. Looking at the export competitiveness with a mean of 9.2551, a minimum value of 0 and a maximum value of 14.0424 imply that most firms in the EAC are fairly competitive in foreign markets. The coefficient of variation was used to determine the degree of variability in the data. The lower the value of the coefficient of variation, the more precise the estimates are, while the higher the value, the greater the level of dispersion.

The results indicate that there was moderate variability in port infrastructure. This variance creates an unpredictable trade environment, which affects the export competitiveness of firms. Low variability was revealed in electricity usage and telephone usage. This is a reflection of what is happening in export trade in the East African Community. Low variability would imply that these variables are important in determining the export competitiveness of firms in EAC.

Table 4
Descriptive

Variable	Mean	Std. Dev.	Min	Max
Competitiveness	9.2551	2.6132	0	14.0424
Distance	8.3430	0.8921	5.1930	9.4501
Contig	0.1377	0.3447	0	1
Common language	0.4072	0.4914	0	1
Common colony	0.2216	0.4154	0	1
Transport cost exp	2.8655	0.7832	0.2558	4.0019
Transport cost imp	3.9444	0.2684	3.5134	4.4002
Tariff	2.1754	1.3546	-0.3857	4.7875
GDP imp	3.3723	0.2020	2.7992	3.6590
GDP exp	2.6639	0.4309	1.8558	3.1897
Real exchange rate	4.6382	0.1098	4.4518	4.8660
Electricity usage	3.5967	0.3099	2.8430	3.9635
Telephone	11.4385	1.1432	9.4200	13.4062
Port infrastructure	1.1632	0.1822	0.5000	1.5041

Source: Own computations

4.3 Correlation results

Pearson's Correlation analysis was conducted to measure the strength of linear associations between independent and the study variables (Table 5). The study variables were measured on a continuous scale, and thus Pearson pairwise correlation was found to be the most appropriate to test the relationships between export competitiveness and independent variables. Therefore, the results indicate that low and moderate for most of the variables between the export competitiveness and independent variables. At this level of analysis, port infrastructure, electricity usage and telephone usage are significantly and positively related to export competitiveness ($r=-0.0370^{**}$, $r=-0.2431^{**}$, and $r=-0.1665^{**}$, respectively at $p<0.01$).

Table 5

Correction and sign for model 3

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Competitiveness	1.000													
Distance	-0.184*	1.000												
Contig	0.256*	-0.691*	1.000											
Common language	0.049*	-0.288*	0.270*	1.000										
Common colony	0.187*	-0.381	0.414*	0.350*	1.000									
Transport cost exp	0.298	-0.011	0.006	0.989*	0.104*	1.000								
Transport cost imp	-0.463*	-0.010	-0.042	0.079*	-0.181*	-0.555*	1.000							
Tariff	0.124*	0.053*	0.075*	-0.039	0.110*	0.071*	-0.299*	1.000						
GDP imp	-0.010	-0.016	-0.019	0.041	-0.014	0.039	-0.087*	-0.110*	1.000					
GDP exp	0.524*	0.022	0.072*	0.038	0.233*	0.213*	-0.389*	0.167*	0.209*	1.000				
Real exchange rate	0.012	0.005	0.003	0.009	0.005	-0.039	0.167*	-0.182*	-0.261*	-0.003	1.000			
Electricity usage	0.263	-0.044	-0.140	0.084	-0.215	0.299	0.236	-0.465	0.217	-0.457	0.014	1.000		
Telephone	0.535	-0.001	0.057	-0.091*	0.246*	0.136*	-0.429*	0.207*	0.115*	0.754*	-0.087*	-0.512*	1.000	
Port infrastructure	0.373	-0.021	0.009	-0.054*	0.139*	0.348*	-0.380*	-0.218*	0.181*	0.336*	0.046*	-0.028	0.410*	1.000

Source: Own computations

4.4 Regression results

Results in Table 6 show that electricity usage, telephone usage and port infrastructure predict 50.6% of the variance in export competitiveness (R-squared= 0.5059). All the variables significantly contribute to export competitiveness in EAC since they all have a significant and positive variation with export competitiveness in EAC. These results were obtained from secondary panel data for a period from 2007 to 2018 for indicators of competitiveness and show that they had a significant and positive effect on export competitiveness.

The main consideration with port infrastructure is cargo handling facilities, storage facilities, container turnaround time, the efficiency of clearance, container throughput and intermodal connections, among others. From testing the hypothesis, results show that there is a positive and significant impact of port infrastructure on the export competitiveness of firms in EAC with a p-value less than 0.05 (p-value = 0.000). This shows that a unit improvement in the efficiency of port infrastructure will lead to an increase in export competitiveness by about 0.235, and the results support the hypothesis. This suggests that the export firms will be more

competitive in foreign markets when the port infrastructure becomes more efficient and reliable. Firms will be more productive and competitive when port infrastructure becomes more efficient and reliable in terms of more cargo handling facilities, more storage facilities, reduced clearance time and costs, reduced turnaround time for consignments, increased throughput and improved intermodal connections to access the foreign markets.

Results further show the ease of getting connected, reliability of the network and price or tariffs on telephone use. From testing the hypothesis, results show that there is a positive and significant impact of telephone usage on the export competitiveness of firms in EAC with a p-value less than 0.05 (p-value = 0.000). This shows that a unit increase in telephone usage will lead to an increase in export competitiveness by about 0.073, and the results support the hypothesis. This suggests that the export firms will be more productive and competitive in foreign markets when they increase the usage of telephones. Firms will be more competitive and more productive when there is an improvement in their communication. This reduces the transaction cost, which enables firms to adapt very easily to changes in foreign markets. This will increase the economies of scale for the firms through increased volume of commodities exported. The exporters are able to communicate with their customers and able to assess the market needs.

The results also show the ease of getting connected, reliability of supply and price of electricity. From testing the hypothesis, results show that there is a positive and significant impact of electricity usage on the export competitiveness of firms in EAC with a p-value less than 0.05 (p-value = 0.000). This shows that a unit increase in electricity usage will lead to an increase in export competitiveness by about 0.102, and the results support the hypothesis. This large marginal increase suggests that the export firms will be more productive and competitive in the foreign markets when the electricity usage of the export component becomes faster and more efficient. Firms will be more competitive and more productive when electricity connections become easy, reliable and cheaper to able to adapt very easily to changes in foreign markets. Electricity is very important in the production process, cargo processing, communication and internet usage. This reduces the transaction cost and increases the volume and quality of exports.

Table 6

Regression Model

Competitiveness	**Coef.**	**Robust Std. Err.**	***p*>z**	**[95% Conf. Interval]**	
Distance	-0.0336	0.0076	**0.000**	-0.0484	-0.0187
Contig	0.1250	0.0191	**0.000**	0.0876	0.1623
Common language	0.0464	0.0129	**0.000**	0.0212	0.0717
Common colony	-0.0737	0.0135	**0.000**	-0.1001	-0.0473
Transport cost exp	-0.0316	0.0114	**0.005**	-0.0538	-0.0093
Transport cost imp	-0.3128	0.0355	**0.000**	-0.3823	-0.2433
Tariff	-0.0048	0.0042	0.252	-0.0129	0.0034
GDP imp	-0.2851	0.0348	**0.000**	-0.3532	-0.2169
GDP exp	0.2398	0.0312	**0.000**	0.1787	0.3010
Real exchange rate	0.0820	0.0440	0.062	-0.0042	0.1682
Electricity usage	0.1019	0.0278	**0.000**	0.0474	0.1565
Telephone	0.0731	0.0079	**0.000**	0.0577	0.0885
Port infrastructure	0.2353	0.0408	**0.000**	0.1555	0.3152
_cons	2.2617	0.2751	0.000	1.7224	2.8009
R-squared*= *0.5059					

Source: Own computations

5. Discussion

This research explored and tested the contribution of electricity usage, telephone usage and port infrastructure on export competitiveness. From the results in section 4.4, all three variables have a positive and significant impact on the export competitiveness of goods in the EAC over the period under study. As such, the proceeding discussion confirms that telephone usage and electricity usage increase the competitiveness of goods exported by firms in EAC. Also, the results show that an improvement in port infrastructure leads to an increase in the export competitiveness of export firms.

From testing the hypothesis, results show that there is a positive and significant effect of electricity usage on the export competitiveness of firms in EAC. The results suggest that an increase in electricity usage leads to an increase in the exportation of goods from the EAC, which leads to an increase in the export competitiveness of firms. This is in line with Hasson, Ashwaq & Mansur (2017), who found a positive relationship between energy consumption and economic growth. Electricity consumption helps the usage of machinery and equipment, which are run by electric power in the production process. This suggests that the export firms will be more productive and competitive in the foreign markets when the electricity usage of the export component becomes faster and more efficient. Firms will be more competitive and more productive when electricity connections become easy, reliable and cheaper, making it easy to adapt very quickly to changes in foreign markets. Electricity is very important for production and transportation and increases the speed of clearance at the borders by facilitating the usage of the internet, for example, the application of a single window in the EAC. This is supported by Hoekman & Shepherd (2015), who found that firms of all sizes benefit from improved trade facilitation by exporting more in response to the improvement in the reduction of time taken to export. An increase in the amount of electricity consumed by the manufacturing sector indicates an increase in the speed of operation in the production process, which eventually leads to an increase in productivity and output. This is supported by the (OECD, 2014), which indicates that electricity services are used throughout the value chain to upgrade the quality of products, lower cost and enhance the efficiency of firms. Electricity supply is an important driver of economic growth and development processes by facilitating the production of goods and services, increasing the export competitiveness of firms as a result. All the EAC states improved the mechanisms of connecting businesses to electricity supply. For instance, Kenya streamlined the process of getting electricity by introducing the use of a geographic information system which eliminates the need to conduct a site visit, thereby reducing the time and interactions needed to obtain an electricity connection. The utility in Uganda reduced delays for new electricity connections by deploying more customer service engineers and reducing the time needed for the inspection and meter installation. Rwanda improved the monitoring and regulation of power outages by beginning to record data for the annual system average interruption duration index (SAIDI) and system average interruption frequency index (SAIFI). Rwanda also made getting electricity more time and cost efficient by having the utility supply all connection materials. Burundi made getting electricity easier by eliminating the electricity utility's monopoly on the sale of materials needed for new connections and by dropping the processing fee for new connections. In addition, the EAC member states of Burundi, Tanzania and Uganda 2015 adopted and signed the International Energy Charter (IEC) as a way of attracting increased investment in the energy sector. The EAC developed the interconnection Code, a regional grid Code, to govern the design and operation of electricity interconnection in the region. EAC also developed a cross-border electrification programme that enables border areas to access electricity cheaply. All these are aimed at reducing the transaction costs and increasing the economies of scale in regard to increased interconnections, which increases trade flows in the region, resulting in improved export competitiveness of firms in the EAC. Indeed Nalule (2016) indicates that because the cooperation and the EAC state jointly developing the East Africa Power Master Plan (EAPMP) aimed at lowering the cost of developing the power sector, shows that there are economies of scale associated with electricity interconnections and trade within EAC. Electrification and access to improved modern energy are key drivers to economic development due to the interdependency between the energy sector and other economic activities that result in increased productivity. The results render support to the New Trade Theory (Krugman, 1979), which focuses on the increasing economies of scale and increased return to scale hence increased productivity of firms participating in international trade, which is an indicator of an increase in their export competitiveness. The findings also render support to the New-New Trade Theory (Melitz, 2003), which emphasizes the firm level productivity heterogeneity due to the presence of fixed and sunk costs resulting in reallocation effects of firms in an industry which influences the more productive firms to export and less productive firms to exit thereby increasing general productivity level. Indeed, investment in electrification infrastructure involves the reallocation of resources where some firms may increase their productivity while others may exit the production process and increase export competitiveness.

From testing the hypothesis, the results show that there is a positive and significant impact of telephone usage on the export competitiveness of firms in EAC. The results indicate that an increase in telephone usage leads to an increase in exportation in the EAC, which results in an increase in the export competitiveness of firms. This suggests that the export firms will be more productive and competitive in foreign markets when they increase the usage of telephones. Firms will be more competitive and more productive when there is an improvement in their communication. Communication is through direct calling customers, sending text messages and the use of social media apps. This is supported by empirical literature; for instance, Vickers & Pena-Mendez (2015) found that the mobile technology revolution has had a positive economic and social impact in many developing countries. This reduces the transaction cost, which enables firms to adapt very easily to changes in foreign markets. Efficient and effective information and communication determine what is traded internationally. Inomata (2017) argues that with the advances in transportation, information and communication technology, production processes are now divided into several production stages, each corresponding to a particular task or activity such as design, parts procurement, assembly, and distribution, among others. These activities are located and relocated across borders to areas where the activities are performed most efficiently. Baimbill-Johnson, (2017) suggest that connectivity can transform both conventional business models and how buyers and sellers interact in the market. Arvis *et al.* (2018) indicate that the export infrastructure in terms of transportation and communication systems is a foundation for the trade costs, global competitiveness and development prospects of a country as they provide a good measure

of trade efficiency and effectiveness. Adapting to new technology helps to place the EAC partner states on a new development trajectory in the form of improved productivity, trade performance and export competitiveness. For instance, the COVID-19 Pandemic has affected phone usage with an increase in app usage for social media communication, texting and calling to access both domestic and foreign markets for their products to keep within the guidelines of the restrictions on physical contact. Due to social distancing amidst COVID-19 Pandemic, mobile money transfers increased in all EAC countries. The Pandemic has increased the demand for digital technology solutions for many businesses and traders in the EAC. Affordability and reliable access to modern mobile technology is important for firms to integrate into global value chains. This reduces the average cost of production and increases economies of scale for firms that engage in international trade. The liberalization of the telecommunication sector in the EAC has opened up the entry of the leading telecommunication service providers to expand their operations and competition in the market, increasing their brands. For instance, most EAC states have more than 3 operators, which leads to a decrease in the price of the hand sets and the cost of broadband connections due to the increase in the competition in the market. This is supported by Vickers & Pena-Mendez (2015), who found that affordable prices for handsets and cheaper broadband connections are the major two drivers of transformation, which has seen African countries, leapfrog landline technology to mobile connectivity. This is also consistent with Mbekean (2007), who argues that the increased competition in major markets forces businesses to adopt to just in time principle to improve production and management systems, flexibility, speed and reliability in the delivery of goods to enhance their competitiveness. This increases timely information on the market conditions, which enables firms to adapt quickly to the changes in the market, thereby increasing the productivity and export competitiveness of firms participating in both domestic and foreign markets. In EAC states, mobile telecommunication coverage has extended to the rural areas and given that agriculture is the backbone of the EAC economies, this coverage enables increased productivity in the agriculture sectors, increased market access and increased volume of international trade flows. There are a number of initiatives that have been implemented in the EAC to help farmers; for instance, in Kenya mCollect, a data collection system that enables exporters to gather information about commodity prices from rural markets and link with the world markets. NOVUS International, which is educating animal farmers in both Kenya and Uganda. Olam International and Vodacom for providing information to farmers in Tanzania. All these platforms provide farmers with mobile services in order to improve their productivity through text messages, which increases the export competitiveness of firms of the EAC. This linkage between farmers and other players in the economy increases the dynamic interaction between different sectors of the economy that increases the productive knowledge and capabilities resulting in increased productivity and export competitiveness of firms in the EAC. This finding supports the Economic Complexity Theory (Arthur, 2013; Gill, 2013; Hausmann *et al*., 2013), which focuses on the complex interactions of the agencies that constitute the evolutionary processes of the economy. Therefore, for a firm to remain competitive requires a high level of innovation and adaptability which is achieved through the influential interactions of the firms resulting in the emergency of novelty. The theory emphasizes that the application of technical knowledge is necessary for production to meet the needs of both the domestic market and foreign market. Generally, the mobile phone penetration in EAC partner states has steadily increased at a rate ranging between 50% and 75%. The countries rolled out the e-government services and rapid adoption of electronic payment systems using mobile money, which has increased the access and usage of internet services.

From testing the hypothesis, results show that there is a positive and significant impact of port infrastructure on the export competitiveness of firms in EAC. The results indicate that an improvement in the efficiency of port infrastructure leads to an increase in the exportation of goods in the EAC, resulting in an improvement in the export competitiveness of firms. This suggests that the export firms will be more competitive in foreign markets when the port infrastructure becomes more efficient and reliable. This implies that when port infrastructure becomes more efficient and reliable in terms of more cargo handling facilities, more storage facilities, reduced clearance time and costs, reduced turnaround time for consignments, increased throughput and improved intermodal connections, it will increase access to foreign markets. Port efficiency is very important in improving trade activities through administrative customs activities. An improvement in port efficiency results in increased market penetration through reduced transport costs. Ports serve as important transportation hubs that facilitate the movement of goods to regional markets and especially exports from landlocked countries in the region. The improvement in port efficiency helps to increase the capacity of our ports to handle larger vessels so as to benefit from economies of scale. This is supported by the empirical literature. For instance, Raballand *et al.* (2012) show that the quality and reputation of a particular customs can contribute to the popularity of a port as a basis of increased international trade. And suggest that reducing dwell time through structural problems such as rents, customs clearance, poor handling and customs border inefficiencies have long term positive effects on port operations thus, increased export competitiveness. Eberhard-ruiz and Calabrese (2018) found that the reduction in the trade facilitation barriers along the transit corridors in EAC, such as weighbridges, slow border crossing time and police roadblocks, resulted in cost savings. And suggested that improvement in trade facilitation across East African Countries can enhance increased export competitiveness, fostering a better integration of the region`s production process to the global value chain. Paelo (2017) argue that good transport networks and the ability to transport goods efficiently from areas of production to areas of consumption are critical to intra-regional trade and economic development. Over the years, the governments of EAC have invested in the expansion of the transport and infrastructure network with a view of reducing the cost of doing business while creating new businesses and employment opportunities. The EAC Road Sector Development Program identified road corridors; the Northern Corridor and the Central

Corridor. In order to bring port services closer to its customers and reduce port congestion, Kenya Ports Authority (KPA) has constructed inland container depots (ICDs) at Nairobi, Naivasha, Kisumu and Eldoret. The ICDs are necessary for aiding handling, temporary storage, inspection and customs clearance of freight moving in international trade. These depots are linked to the Mombasa Port container terminal by a rail-tainer service. Imports are delivered directly from Mombasa to the depots on a Through Bill of Lading document, while exports are also consolidated at the ICDs and railed to the Port for shipping to foreign markets. In addition, the Port of Mombasa has two container terminals, namely the Mombasa Container Terminal and the newly built Kipevu Container Terminal, to improve the facilitation of trade flow at the port. Likewise, Tanzania Ports Authority (TPA) operates a system of ports serving the hinterland of Tanzania and the neighbouring land locked countries. The construction of Kwala dry port, located in the coastal region, is expected to relieve the roads from serving heavy cargo trucks by carrying cargo by trains from the port of Dar es Salaam. The TPA has been carrying out projects to improve the lake ports to allow them to handle the expected higher levels of rail-hauled cargo from Dar es Salaam. As a result, the opening of the One Stop Centre (OSC) has reduced the time required to clear goods passing through the Port of Dar es Salaam. In addition, One-Stop Border Posts (OSBP) were established to improve the efficiency of the movement of goods and services within the region. Further, according to UNECA (2019) Implementation of the Single Customs Territory (SCT) - a trade facilitation initiative meant to improve the efficiency of the Northern and Central corridors- in July 2014 reduced the transit time on the Northern Corridor from 18 days to four days from Mombasa in Kenya to Kampala in Uganda and from 21 days to six days from Mombasa-Kigali. Similarly, on the Central Corridor, the transit time between the port of Dar es Salaam and Kigali (or Bujumbura) has been reduced from over 20 days to just six days. These trade facilitation initiatives are aimed at faster customs clearance and speedier handling of cargo at ports and terminal depots. They lower the transaction costs and increase the trade flow, productivity and export competitiveness of firms in the EAC. These findings render support to the New Trade Theory (Krugman, 1979), as cited by Ahmed (2012) and Melitz (2003), which explains that export logistics infrastructure such as financial services, insurance services, transport services, port handling services, logistics, customs facilitation and communication provide crucial inputs in trade thereby lowering the average cost of production, increasing the level of productivity of a firm resulting into increased export competitiveness. This is because export logistics infrastructure may generate positive externalities that will contribute to the increased productivity of firms through increased economies of scale. However, the outbreak of the COVID-19 Pandemic caused challenges in facilitating cross-border trade. This affected the performance of the ports and the transport corridors. UNCTAD (2020) reports that the disruptions at the crossing points at borders caused delays in the returning of empty containers to the port of Mombasa, which led to retention charges imposed by the shipping lines, hence increasing the transaction costs. The disruptions also led to blank sailings and vessel cancellations due to fewer staff at the port to operate the equipment, leading to delays in cargo transfers and clearance. The time taken to pick up cargo after clearance from customs increased due to the time taken by trucks to return to the port due to the restrictions imposed to contain the spread of the Pandemic. The COVID-19 disruptions affected both the Port of Mombasa and the land borders of Malaba and Busia, which are the busiest post between Uganda and Kenya. These border posts together have been the largest source of inefficiency for regional trade during COVID-19, increasing both costs and transit times across the Northern Corridor, thereby slowing down trade in the EAC region. However, UNCTAD (2020) reports that Member States of the Northern Corridor Transit and Transport Coordination Authority have ratified various protocols and strategic responses, at both the national and international levels, aimed at enhancing safe trade in the region. This is aimed at improving the performance of the port of Mombasa in facilitating international trade more efficiently amidst the Pandemic.

6. Conclusion and implications

This study was conducted to investigate the effect of trade infrastructure components on the export competitiveness of firms in the East African Community (EAC). This study was motivated by the low level of export competitiveness of export firms in EAC partner states, especially for manufactured goods, due to the low levels of product transformation and poor or lack of value addition. Also, there is scanty literature on improving export competitiveness in import-oriented countries like those in the EAC since current studies have been conducted in export minded countries such as those in Europe (Puertas et al., 2017; 2014). To achieve the purpose of the study, three hypotheses were stated and tested. The study adopted the structural gravity model and employed the Poisson Pseudo Maximum Likelihood (PPML) estimation method, a nonlinear estimation method on balanced panel data of export firms in EAC between 2007 and 2018. The study provides evidence that trade infrastructure components that include; electricity usage, telephone usage and port infrastructure in the exporting country have an impact on the export competitiveness of firms in the EAC. An improvement in trade infrastructure reduces the average trade costs and increases economies of scale. Specifically, results show that all the independent variables are positive and significant predictors of export competitiveness in the EAC.

This study contributes to academic research by providing empirical evidence to support the theories that are relevant to explain export competitiveness, but also it has implications for a larger body of knowledge which could benefit other related studies. While the New Trade Theory emphasizes increasing economies of scale, increasing return to scale, product differentiation and consumer preference for variety. This study develops a model that integrates the three independent variables of export competitiveness. The study makes a contribution to the growing body of literature and debates on the concept of competitiveness by bringing out how

the trade infrastructure components interact and contribute to the new trade and economic complexity theories by reducing transaction costs, resulting in increasing economies of scale and increased productivity. These interactions link with global markets to increase productivity and export competitiveness. For the first time, this study has explained the complex dynamic interactions of these factors in the EAC using quantitative data and that this interaction has an effect on export competitiveness.

The findings of this study have a number of managerial and policy implications for the exporters and their associations, export firms, transporters, government agencies and the governments of partner states. For policy purposes, these results imply that trade between EAC countries and other trade partners needs to be enhanced through improvement in trade facilitation to improve export competitiveness. In addition, the EAC partner states need to take deeper reforms as regard trade infrastructure to enable firms to integrate into the Global Value Chains (GVCs) to enable them to increase their productivity by reviewing the existing policies to match the changes in the market. The EAC partner states need to embrace deep integration by removing the behind the border trade barriers, in addition to other trade restrictions, to create a common economic space among member states. This helps the implementation of common and harmonized economic policies and regulations since it involves mutual recognition agreements where countries agree to recognize one another's conformity assessments.

The EAC partner states need to enforce the reduction of non-Tariff barriers (NTBs) by reducing the number of check points, weighbridges, documentary requirements and regulations, improve and harmonize the operations of one stop border points (OSBP) by building a comprehensive data network with professional systems and common IT platforms to reduce on transit and clearance time at borders and ports. This will increase the fast tracking and tracing of cargo in transit, which will minimize cargo loss and reduce the delivery time into foreign markets.

The study limitations open up opportunities for further research. This study purely focused on export competitiveness in EAC. Future studies may build upon our findings and study the subject in other developing countries and regional groupings. Such studies would be important to compare the results from different countries or regions that are heterogeneous in nature. In this study, the findings on the impact of trade infrastructure had a significant and positive effect on export competitiveness. Further research could be conducted in other developing countries or regions on trade in goods and services to confirm the impact of these trade infrastructure components on export competitiveness; probably, the results could be different.

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