Innovativeness and export competitiveness in the East African Community

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Abstract

Purpose – The purpose of this paper is to examine the influence of innovation indicators: Internet usage, patent rights, innovation in exporting countries and innovation in the importing country on the export competitiveness of firms in the East African Community (EAC).

Design/methodology/approach – The study adopted the structural gravity model and the Poisson Pseudo Maximum Likelihood a nonlinear estimation method that was applied in STATA on balanced panel data from 2007 to 2018. Data were obtained from World Bank International Trade Center and World Bank development indicators.

Findings – Results show that innovation in the importing country, innovation in the exporting country and patent rights of exports are positive and significant predictors of export competitiveness in developing countries. While Internet usage is an insignificant predictor in the EAC.

Research limitations/implications – There is a need to examine the complicated nature of the EAC economy to further this study's findings.

Practical implications – Exporting countries need to take deeper reforms as regards structural transformation 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.

Originality/value – This study explains the complex dynamic interactions of technological innovation indicators in the EAC using quantitative data and that this interaction has an effect on the export competitiveness in import-oriented countries with less harmonization in their trade policies.

Keywords Export competitiveness, Innovation indicators, Internet usage, Patent rights protection, Innovation in import country, Innovation in export country, East African community

Paper type Research paper

1. Introduction

Export competitiveness is synonymous with a country's degree of innovativeness (Li and Lakzi, 2022). Innovativeness is a key tool for improving the production process and the quality of products and minimizing the manufacturing costs for exports (Pascucci, 2018). Innovation can be achieved through heightened business intelligence, new IT technologies, research and development and better public policies among others (Li and Lakzi, 2022). Indeed, if innovation tools are properly implemented in a country's production systems, they

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are likely to exacerbate the export competition efficiency of its products and eventually lead to increased export competitiveness. Nonetheless, a study by Pascucci (2018) indicates that the export competitive potential and performance of several developed and developing countries have been deteriorating since the second half of the early 21st century due to insufficient innovation. Yet, dismal export competitiveness worsens a country's balance of payment position and consequently reduces its GDP (Kemitare *et al.*, 2021).

Export competitiveness is construed as 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). It is considered a key indicator of the success of firms through increased export of value-added goods and services (Atkinson, 2013). Nevertheless, 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 goods and US$2 trillion in services (UNCTAD, 2020). The enormous 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). Thus, there is a need for more innovativeness to improve the current export position in those countries.

According to Li and Lakzi (2022), innovative tools such as advanced IT-based systems, public policies and business intelligence are positively influencing export competition efficiency in China. Also, innovation through research and development is positively contributing to the export strategy/activity in the United States of America manufacturing firms (Lee and Kwon, 2021). Moreover, Pascucci (2018) emphasized that firms in Italy should focus on both the traditional innovative elements such as having labels of where the product is made and also improving the technical know-how. However, studies on how innovation can improve export competitiveness have fundamentally been conducted in developed economies as presented in the aforementioned scenarios. Also, these studies have mainly been focused on an individual country or firm (Pascucci, 2018) and not a region or an economic block. Except for the study by Lee and Kwon (2021), which accentuates the synergistic effect of research and development and exports on performance in US manufacturing industries. To our knowledge, no study has empirically tested the role of innovation indicators such as Innovation for import, Innovation for export, Internet usage and patenting in an import-dominated economic block in a single study. Yet, in emerging economic blocks such as the EAC, there are a heightened need and policy reviews to enhance exportation to meet the needs of global goals such as SDG 9 which aims at building resilient infrastructure, promoting sustainable industrialization and fostering innovation across the world for higher economic growth, social development and climate action (Mhlanga, 2021).

Primarily, we reason that innovation enables the practical implementation of ideas that lead to the introduction of new goods or services or improvement in offering goods or services. As such, it is a strategic factor for survival, growth and management of competitive pressure at the global level (Pascucci, 2018). In this way, innovation can help a country to match its export potential to international standards by improving the quality of products, connecting to better markets and also keeping up-to-date with the developments in the world markets for better returns from international trade. Also, innovation helps to improve business and trade models (Tell *et al.*, 2016), and it is a key engine of industry capabilities (Lampel and Shamsie, 2003). Moreover, innovation also helps in serving key markets rather with reduced rejection and wastage risks. Accordingly, Pascucci (2018) reports that innovation helped Switzerland to emerge as a leading exporter in the world. The current study answers the call for several studies for extended and insightful practices for policymakers to improve the export competitiveness of developing countries such as those in the EAC (Kemitare *et al.*, 2021). This has remained a burgeoning concern to date.

Theoretically, Melitz (2003) under the "New" New Trade Theory indicates that only highly productive firms/countries can be engaged in profitable export trade and be able to meet the large fixed costs required for export operations. We anticipate that innovation can help increase the productivity of firms and countries and also minimize the enormous fixed costs for exporting countries to benefit from international trade. As to whether this assumption of the "New" New Trade Theory has been tested on data from an African contest it has remained a lacuna that the current study addresses. On the other hand, 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 (Centre for Development Alternatives, 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 and Moussa (2017) emphasize that technological innovation is key to increasing productivity, which results in improve export competitiveness.

8In this study, innovation indicators of innovation in exporting countries, innovation in importing countries, Internet usage and patent rights are considered as possible explanations for 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 and 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 more competitive in the foreign markets by producing more sophisticated products that may not lose value so easily. Uyar and Oralhan (2017) indicate that innovation was more important for exporting nations than for 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 toward efficiency since it is very sensitive to the increase of 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 landlocked, and majorly agricultural countries like Uganda, Burundi, Rwanda and South Sudan in the EAC. Liu and Xie (2020) only explored technology innovation and export competitiveness in the manufacturing industry focusing on export value added for an export-oriented country (China). These recommended further studies to explore other aspects of technology innovation and in other sectors such as the low developed countries like Uganda. Scholars of export competitiveness in the agricultural sector such as Uganda have rather focused on single country-level factors such as irrigation, exchange rates, the number of agricultural exports, labor cost and domestic consumption (Huo *et al.*, 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. Further still, Thazhugal Govindan Nair (2020) and Vamvakidis (1998) suggested that 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, there is a need for technological innovation to spur structural transformation. Thus, the current study examines the contribution of innovation

indicators to export competitiveness in EAC countries by addressing the following research questions:

RQ1. What is the effect of innovativeness in the importing country on export competitiveness?

RQ2. How does Internet usage affect export competitiveness?

RQ3. What is the effect of innovativeness in the export country on export competitiveness?

RQ4. What is the effect of patent rights 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 innovation in the importing country, innovation in the exporting country and patent rights of exports are positive and significant predictors of export competitiveness in developing countries. While Internet usage is an insignificant predictor in the EAC. The present study results are important in several ways. Firstly, the results inform policy on how the EAC can improve innovativeness to increase productivity in terms of value creation and addition to increase the competitiveness of EAC exports. Secondary, the study contributes to the existing literature on export competitiveness by evaluating the contribution of innovativeness which had remained an empirical question in most economies. The rest of this paper is organized as follows. The next section is the literature review and hypotheses development. Next is the methodology section which is then followed by the results. The discussion section then follows and finally, a summary and conclusion are provided.

2. Literature review and hypothesis development

2.1 Theoretical foundation

The New-New trade theory posits that there is a firm-level reallocation effect that arises due to firm heterogeneity. This is because even within industries, some firms are larger, more profitable and more productive than others (Melitz, 2003). Hence, productivity induces firms to self-select into export markets and therefore firm-level productivity leads to increased export competitiveness of firms (Ciuriak *et al.,* 2011; Melitz, 2003). Thus, better-performing firms survive and expand into foreign markets while the worst-performing firms shut down in the face of competition (Melitz, 2003). This is supported by the empirical work of Medin (2014) who found that firms that are more productive and larger are more likely to serve foreign markets and export greater volumes if those markets are relatively large. Similarly, firms may have market power and earn high profits in foreign markets due to the availability of efficient logistics infrastructure (Medin, 2014). Melitz (2003) adds that there are significant sunk costs at the firm level that must be cleared to be able to profitably enter the foreign market such as foreign market intelligence, distribution services, networks and after-sales services. Because of this, intra-industry trade and value chain raise the productivity efficiency of firms within the industry by expanding the market size which encourages the firm to raise their productivity through innovations.

Helpman (2004) posits that at the firm level, there is a strong relationship between exporting and innovations which increases firm productivity leading to increased export competitiveness. Therefore the New-New trade theory makes a tight link between international trade and productivity implying that firms entering export markets tend to adopt newer and better production technologies and adapt quickly to market changes, which increase the firm productivity (Ciuriak *et al.*, 2011). However, in modern international trade with many production processes broken down into separate parts and spread across different countries, attributing the full value of the product to one country from which it is exported would be misleading hence the theory does not explain the importance of value chains in

export competitiveness of firms (Ciuriak *et al.,* 2011; Yan, 2015). The theory ignores the strategic interaction of firms in the value chain influencing economies of scale resulting in increased export competitiveness of the less productive firms (Abbasi, 2014; Arthur, 2013; Melitz and Redding, 2014). This would imply that there is a predetermined threshold for firms to enter the market. Then the Economic Complexity Theory could be necessary to explain the interaction of firms.

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 emergence of novelty (Arthur, 2013; Byrne, 2005). The Economic Complexity Theory focuses on the dynamic systems to which the outcome of the behavior 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 mainstream 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 behavior creating a recursive loop that 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 The influence of technological innovation

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, marketplace organization or external relations". One of the categories of innovation is a technological innovation which focuses on the technological aspects of a product or service. Technological innovation involves research and development and or technology introduction (Cheng and Li, 2018). Liu and Xie (2020) state that technology innovation leads to faster returns on innovation performance. However, technology innovation varies significantly depending on the sector and the country (Giget, 1997). But, most studies on technology innovation and export competitiveness have been conducted in countries with better technology and innovation penetration such as China (Liu and Xie, 2020). Liu and Xie's study focused on increasing China's export competitiveness through the manufacturing Industry. However, in the current study, we focus on all sectors of the economy that generate exports such as tourism, manufacturing, services and energy. Since technological innovation improves the quality of the products that increase the demand for the goods compared to others in the foreign markets. But, also it reduces both the average cost of production and the transaction cost which results in reduced final prices of goods in the foreign markets. Indeed, the growth and competitiveness of firms in economies may be largely dependent on the application and implementation of science, technology and innovation activities. Therefore, in this study we explore the contribution of the aspects of technological innovation to export competitiveness, in terms of innovatiness in the importing countries, innovativenes in the exporting countries, patent rights and internet usage.

2.3 Innovativeness in importing countries

The innovation in the importing country could mean that the export firms in EAC are affected either positively or negatively by the technological improvement in the importing countries. This could also mean that the production processes of export firms in the EAC are affected by the technological innovation in the importing countries. The innovations could be implemented in sectors/firms that are either or not related to the export sectors/firms that produce exports from EAC. World Trade Organization (2019) indicate that nearly 90% of the EAC's trade in goods takes place outside the region, with imports originating mainly from China, India, the European Union and the United Arab Emirates, which are the main export markets. It is also consistent with African Development Bank (2019) which indicates that all the countries in EAC depend on primary commodities for export. However, empirical literature suggests that there is a link between importation, exportation and innovation. Fassio (2018) shows that the foreign demand effect of exporting activities affects firms' strategies by increasing the potential output. The study concludes 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 toward efficiency since it is very sensitive to the increase of the volume sold. Şeker (2012) suggested that reforms that increase global engagement of firms through both importing and exporting are likely to increase trade. The study concludes that there is complementarity between imports, exports and innovation. Damijan and Kostevc (2015) suggested that firms learn from import links, which enables them to innovate products and processes and then start exporting. They argue that there is stronger sequencing running from imports through innovations to export and to further innovation. They conclude that the import links are important for smaller firms by enabling them to learn in terms of production processes as well as improving their product characteristics. Jhingan (2012) shows, that innovations in the importing country will lead to an increase in the price of importable products because the output reduces while there is an increase in the exportable products because the price reduces due to an increase in the output.

H1. The innovativeness of the importing country influences the export competitiveness of firms.

2.4 Innovativeness in exporting countries

Technological innovation is crucial in enhancing the productivity and competitiveness of an industry (Liu and Xie, 2020). It has been established that in export-oriented countries like China the types of technological innovation significantly promote the export competitiveness of the manufacturing industry. However, there is a need to explore the impact of technological innovations in importing countries. This is because technological innovation in the export country improves the quality of the products that increase the demand for the goods compared to others in the foreign markets. It reduces both the average cost of production and the transaction cost which results in reduced final prices of goods in the foreign markets. This makes the exporting firms more competitive in the foreign markets by producing more sophisticated products that may not lose value so easily. 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, marketplace organization or external relations". Uyar and Oralhan (2017) found that innovation correlates positively and significantly with export performance. They argue that with the increasingly competitive environment, firms must 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. They conclude that the adoption of technology-intensive methods through increased research and development (R&D) activities,

by developing innovative approaches and developing high added value, increases productivity that results in increased export competitiveness. This is in support of Lileeva and Trefler (2010) who found that improved access to foreign markets encourages firms to simultaneously export and invest, which raises productivity. They show that firms that start to export or export more experience increased labor productivity, engage in more product innovation activities and adopt advanced manufacturing technologies. They suggest that there are plants that find it profitable to export and invest even though it may not be profitable only to export or only to invest. This implies that exporting and investing in productivity improvement are complementary activities in international trade. However, this will depend on who exports and why export due to firm heterogeneity.

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 infrastructures such as transportation, customs administration, telecommunication networks, electricity and infrastructural services among others (Melitz and 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. Scholars such as Farole *et al.* (2010) have indicated that previously, the focus has been on reducing barriers to market access through trade policy mainly reduction of tariffs and non-tariff barriers. Much as these measures are necessary, they are not sufficient the barriers the developing economies face are poor infrastructure and logistics services which raise firm productivity through the exploitation of economies of scale, thereby increasing the export competitiveness of firms.

Studies by Lanz and Miroudot (2011), show that operating in globally competitive markets may force firms to become more engaged in innovative activities as a result of increased flows of foreign technology. This helps firms to reallocate resources toward higher value-added activities increasing productivity growth. The resulting productivity effects will help businesses to remain profitable, lower prices and offer better products and services hence increasing export competitiveness. Over the years, firms have tried to generate value addition and sustain profits by developing new and innovative products and services targeted at foreign markets. Hence due to globalization, firms in developing countries are under pressure to improve their performance and increase their export competitiveness (Amador and Cabral, 2014). In addition, Amiti *et al.* (2009) argue that services off-shoring and vertical intra-industry trade activities have a positive significance on firm productivity hence increased export competitiveness.

In contrast, Chung (2018) argues that productivity may not be the only source of firm heterogeneity in developing countries where preferential policies and political connections may significantly influence the success and the size of firms. The connection may influence the provision of subsidies, and favorable access to credit and tax holidays, which would make firms grow larger, and will be able to survive and prosper. However, Chung (2018) reveals that firm heterogeneity based on political connections and discriminative policies may lead to wastage and misallocation of resources across firms. For instance, destination-specific subsidies may distort the decisions made by a firm on how much to sell in foreign markets and domestic. However, studies of firm-level analysis on the effect of firm productivity on export competitiveness are scarce (Amador and Cabral, 2014). This study is aimed at closing such a knowledge gap by explaining how the interaction of technological innovation and logistics infrastructure may lead to increased productivity due to firm heterogeneity resulting in increased export competitiveness of export firms in Uganda.

H2. The innovativeness of the exporting country influences the export competitiveness of firms.

2.5 Patent rights and export competitiveness

A patent is an exclusive right granted by the government for an invention either a product or process, which helps inventors to prevent others from taking advantage of their ideas or inventions. Tekin and Hancioglu (2017) argue that there is a positive and significant relationship between export performance and innovation activity in developing countries. They conclude that the development in the political, regulatory and business environment in the developing countries especially the increase in higher education, positive R&D investments, infrastructure development, advances in information technology and increase in patents, increase the efficiency of innovations activities. However, Chalioti *et al.* (2016) show that patenting is expensive due to the legal requirements, fees involved and the penalties faced for any possible infringement once granted. They argue that if the number of non-innovative firms is large and competition among them is stiff domestically, the innovative firms will sell higher quantities in more distant markets than in domestic markets. This is a reflection in the foreign market where the innovative exporters who produce high-quality products under monopoly rights due to patenting, faces stiff competition from non-innovative exporters in the domestic markets.

In addition, Dorn *et al.* (2016) found that the impact of the change in import exposure on the change in patents produced is strongly negative. They conclude that firms that experience larger increases in import penetration suffer larger reductions in patenting both in domestic and foreign markets. Shu and Steinwender (2018) found that trade has a positive effect on firm productivity and innovation, especially for larger and more productive firms. Thus, large and more productive firms gain more from trade liberalization through increased productivity and innovations. They suggest that export opportunities increase the returns to innovating by expanding the output market to which a firm has access. However, on the other hand, import competition may harm firm innovation, reducing productivity and export competitiveness. It is important to consider how export access, import competition, importation of intermediates and export opportunities interact to increase productivity, innovation and export competitiveness, which is the focus of this study. Aghion *et al.* (2018) argue that innovation allows firms to reduce their production costs by an amount that increases with the size of the innovation investment. They found that patenting robustly increases more with demand for initially more productive firms. They emphasize that the positive interaction between a firm's initial productivity and the export demand is primarily driven by those export destinations where product market competition is highest. They conclude that an export demand increase has a more positive effect on innovation in high productivity firms but a negative effect in low productivity firms due to high competition for the product in the foreign market. Shrimoyee and Rajat (2020) posit that export competitiveness is based on a higher proportion of productivity, the quality or the innovative aspects and not the economic policies such as excessive subsidies for export and devaluation of national currency. This is in line with Porter (1990) who argues that companies achieve competitive advantage through acts of innovation which could be manifested in a product design, a new production process, a new marketing approach or a new way of conducting training. Porter adds that companies gain an advantage against the world's best competitors because of pressure and challenge; they benefit from having strong domestic rivals, aggressive home-based suppliers and demanding local customers. Cameron and Caldecott (2011) add that the level of productivity determines the rate of the returns experienced by investments in the economy which in turn are fundamental drivers of its growth; hence a more competitive economy is likely to grow faster.

H3. Patent rights affect the export competitiveness of firms.

2.6 Internet usage and export competitiveness

The Internet usage in the form of customs automation, electronic documentation and application of a single window system would reduce the transaction cost to the exporting firms, increasing the export competitiveness as a result. This is in line with Hummels *et al.* (2018) who argue that the available technology in transportation, information and communication, determines what is traded internationally. In the same direction, Gijrath (2018) shows that the greater technological advances in telecommunication networks with the availability of high bandwidth network infrastructure globally, have created new types of business services traded within different time zones. 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. Therefore, according to Inomata (2017), modern trade is not only the movement of final products but also the cross-border transfer of tasks or the value-added generated by the various tasks relocated across borders to exploit the cost differentials of production factors in various countries. Baimbill-Johnson (2017) reveals that the emergence of global value chains has increased the integration of firms, countries or regions into global production networks which has accelerated economic growth. Increased connectivity through participation in global value chains has made countries and firms more economically interdependent. Connectivity can transform both conventional business models and buyers and sellers interact in the market. Soobramanien and Worrall (2017) indicate that new trade opportunities are emerging through the reduction of a variety of trade barriers to networks which include; minimum scale economies in production, small market size and underdeveloped national systems of innovation. They add that with vertical production fragmentation, remote locations could be open to new trade opportunities that enable the firms to integrate easily within global hubs of economic activity in different regions of production establishments whereby they can integrate into various products and tasks. Therefore, participation in global value chains opens channels for technological learning, process improvement and product upgrading. The following hypotheses are thought for this study:

H4. Internet usage affects the export competitiveness of firms.

3. Methodology

3.1 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 Center (ITC). Data on innovation indicators was got 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 can 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 EAC. 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 (Kumar, 2014).

3.2 Model specification

The study adopted with modifications the structural gravity model as used by Anderson and 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, 2014). The gravity model is the workhorse of international trade because it makes it possible to estimate the impact of trade-related policies such as tariffs and behind-the-border measures. The structural gravity model which is theoretically grounded considers the multilateral resistance effects of both the exporter and the importer. It explains trade flows at different levels in the economy including country, sector, industry, firm and product levels. 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 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 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 Internet usage, patent rights, innovation in exporting countries and innovation in importing countries. The mathematical expression of the derived model is as follows:

$$\begin{aligned}\ln(\text{Export}) = {} & \alpha_0 + \beta_1 \ln(\text{dist})_{it} + \beta_2 \ln(\text{contig})_{it} + \beta_3 \ln(\text{comlang})_{it} + \beta_4 \ln(\text{comcol})_{it} + \beta_5 \ln(\text{TCE})_{it} \\ & + \beta_6 \ln(\text{TCI})_{it} + \beta_7 \ln(\text{Tari})_{it} + \beta_8 \ln(\text{GDPM})_{it} + \beta_9 \ln(\text{GDPE})_{it} + \beta_{10} \ln(\text{tai\_imp})_{it} \\ & + \beta_{11} \ln(\text{tai\_exp})_{it} + \beta_{12} \ln(\text{reer})_{it} + \beta_{14} \ln(\text{Pat})_{it} + \beta_{15} \ln(\text{Intern})_{it} + + \varepsilon_{it}\end{aligned}$$

where; *export* is export competitiveness; *dist* is distance; *contig* is common border; *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 an import tariff; *Tai-imp* is the innovation index for importing country; *Tai-exp* is the innovation index of the exporting country; *reer* is real exchange rate; *EL* is electricity; *Pat* is patent rights; *Intern* is Internet usage and ε_{it} 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 of the original range of data. It keeps the relationship among the original data and it fits the data within a predetermined boundary (Vafaei *et al.*, 2018).

3.3 Measurement of variables

Competitiveness is a broad concept and there is no agreement on how to measure it precisely (Latruffe, 2010). However, export competitiveness was mainly measured using adapted measurement dimensions, items and scales in line with this dependent variable's components as reflected in the conceptual framework used in other studies (Utkulu and Seymen, 2004). The revealed comparative advantage index (RCAI) based on Balassa (1965) was used to measure the relative ability of a country to produce a good compared to its trading partner. This was to capture the level of specialization in international trade (Utkulu and Seymen,

2004). Intra-industry trade was measured based on the Grubel–Lloyd index to evaluate the simultaneous import and export of products of the same industry in line (Ruffin, 2015). Trade concentration was measured based on the Hirschmann–Herfindahl index to assess the degree of concentration or diversification of a country's export as applied by (Makonnen, 2012).

The components of technological innovation were measured based on (OECD, 2014). This focused on efficient communication and the ability of firms to patent their products as a way to meet the fixed and sunk costs. This consisted of Internet usage as a mechanism of bringing together different parties to interact online. It was measured in terms of accessibility, affordability, connectivity and availability of high-speed broad band networks. The patent rights were measured by the ability of firms to patent their products in line with (OECD, 2014). The innovation of both importing and exporting countries was measured in terms of their ability to compete in foreign markets based on the data on innovation indices as provided by the World Development Indicator.

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 (O'Brien *et al.*, 2016; Goedele *et al.*, 2013). The results in Figure 1 depict a fairly bell-shaped distribution of the 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 approximately lie on a straight line suggesting a linear and normal distribution.

We also applied the Jarque–Bera test (See Table 1) which is a theoretical and the skewness-kurtosis test (empirical) to test for normality. Jarque–Bera test is a goodness-of-fit test to

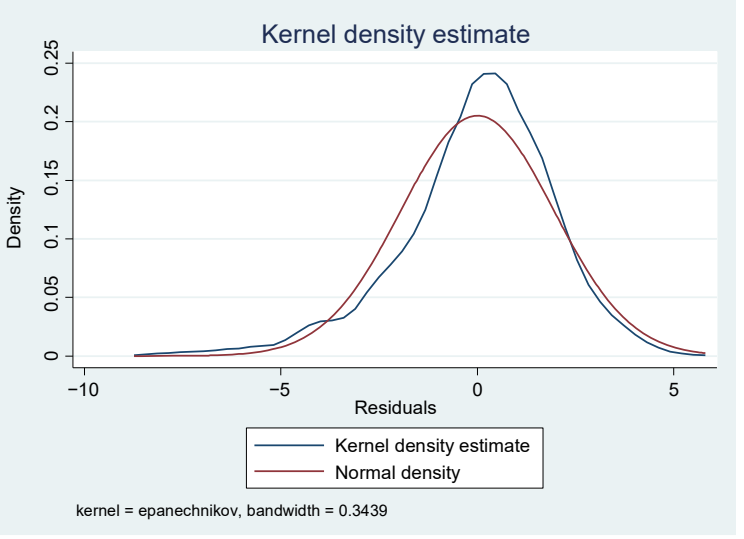

Figure 1.
Normal distribution

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 close to 0 as you would expect for a normal distribution. Therefore, this is an indication that the data are normally distributed.

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 was 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.

Additionally, we carried out the logistics regression diagnostic test for model specification using a Link Test in line with (Murteira and 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 the predictors to rebuild the

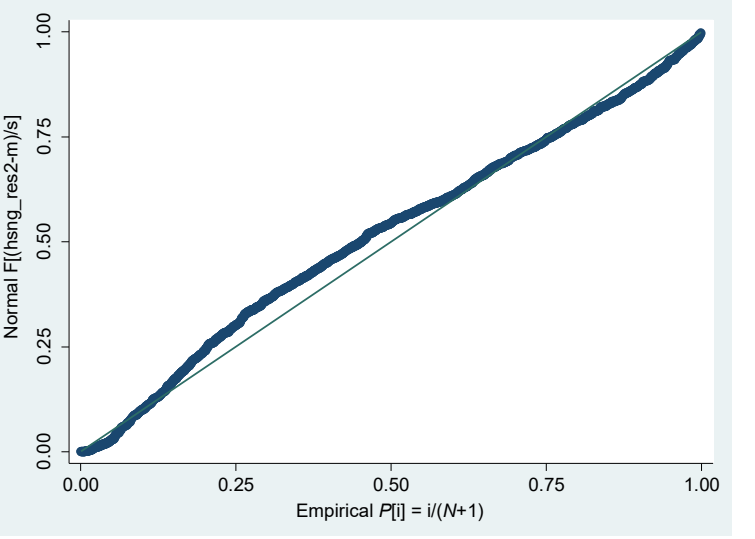

Figure 2.
Showing the q-q plot

Variable	Pr(Skewness)	Pr(Kurtosis)	Adj $\chi^2(2)$	Prob > χ^2
Competitiveness	0.0000	0.0000	72.72	0.0000
Transport cost exp	0.0000	0.0000	13.24	0.0000
Transport cost imp	0.0000	0.0000	4.82	0.0000
Tariff	0.0000	0.0204	13.24	0.0000
GDP imp	0.0000	0.0000	63.55	0.0000
GDP exp	0.0000	0.0001	7.87	0.0000
Real exchange rate	0.0000	0.0036	39.51	0.0000
Innovation for import	0.0622	0.0000	12.40	0.0000
Innovation for export	0.0000	0.3098	71.28	0.0000
Internet usage	0.0000	0.0000	67.10	0.0000
Patent	0.0000	0.0000	53.93	0.0000

Source(s): Own analysis

Table 1.
Jarque–Bera test

Variable	VIF	1/VIF
Internet Usage	4.13	0.242288
GDP exp	3.84	0.260474
Tariff	3.27	0.305817
Transport cost exp	2.13	0.470159
Contig	2.09	0.479101
Distance	2.07	0.483634
Patent	1.82	0.549396
Transport cost imp	1.75	0.5707
Innovation for export	1.59	0.629035
GDP imp	1.56	0.639584
Common colony	1.46	0.685949
Innovation for import	1.43	0.699025
Common language	1.27	0.787514
Mean VIF	2.18	

Source(s): Own analysis

Table 2. Variation inflation factor

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 misspecified. 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 0.623, meaning that the model had no specification errors and the variable (_hat) was significant since the p-value of 0.033 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.

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 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, minimum value of 0 and 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 interment usage. This variance creates an unpredictable trade environment which affects the export competitiveness of firms. Low variability was revealed in patent rights, innovation in exporting countries and innovation in importing countries. This reflects what is happening in export trade in the EAC.

Competitiveness	Coef	Robust Std. Err	$p > z$	[95% conf.	Interval]
_hat	1.2888	0.6054	0.033	0.1023	2.4754
_hatsq	−0.0666	0.1355	0.623	−0.3322	0.1989
_cons	−0.3103	0.6733	0.645	−1.6298	1.0093

Source(s): Own analysis

Table 3. Model link-test

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
Innovation for import	3.5355	0.3090	2.9720	4.1026
Innovation for export	3.2950	0.1754	2.8959	3.6109
Internet usage	1.8125	1.0098	−0.3567	3.2189
Patent	3.3435	1.4944	0	5.3706

Source(s): Own analysis

Table 4. Descriptive

Low variability would imply that technological innovation is important in determining the export competitiveness of firms in EAC.

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, the patent right is significantly and negatively related to export competitiveness ($r = -0.148$*, at $p < 0.05$). Internet usage has a significant positive relationship with export competitiveness ($r = 0.321$* at $p < 0.05$). Innovation in importing country and innovation in exporting country also has a significant positive relationship with export competitiveness ($r = 0.087$* and $r = 0.194$* at $p < 0.05$).

4.4 Regression results

The GDP of countries is a proxy for production and size of the economy in EAC and for imports, it is for demand. The results in Table 6 show the importer and exporter GDP are statistically significant in line with export competitiveness. The p-value of the importer GDP is less than 0.05 (p-value = 0.002) but negative which means that a 1% increase in the importer GDP tends to reduce exports from other countries by about 0.2691. This means that exports from EAC to other countries will reduce and lead to a decrease in the export competitiveness of EAC countries. Hence, further innovations by EAC countries are needed to increase the demand for their exports in foreign countries with higher importer GDP. Likewise, the p-value of the exporter GDP is less than 0.05 (p-value = 0.000) and it shows that a 1% increase in the exporter GDP leads to an increase in exports by about 0.4022. This shows that the exporter GDP has a significant effect on the exports of EAC. That is, EAC countries should intensify innovations such as technology, R&D to increase productivity and further the competitiveness of their exports. Also, distance, common border and Real exchange rate have a significant effect on export competitiveness in EAC. Common colony and transport

Table 5. Correction

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Competitiveness (1)	1.000														
Distance (2)	−0.184*	1.000													
Contig (3)	0.256*	−0.691*	1.000												
Common language (4)	0.049*	−0.288*	0.270*	1.000											
Common colony (5)	0.187*	−0.381*	0.414*	0.350*	1.000										
Transport cost exp (6)	0.298*	−0.011	0.006	0.989*	0.104*	1.000									
Transport cost imp (7)	−0.463*	−0.010	−0.042	0.079*	−0.181	−0.555*	1.000								
Tariff (8)	0.124*	0.053*	0.075*	−0.039	0.110*	0.071*	−0.299*	1.000							
GDP imp (9)	−0.010	−0.016	−0.019	0.041	−0.014	0.039	−0.087*	−0.110*	1.000						
GDP exp (10)	0.524*	0.022	0.072*	0.038	0.233*	0.213*	−0.389*	0.167*	0.209*	1.000					
Real exchange rate (11)	0.012	0.005	0.003	0.009	0.005	−0.039	0.167*	−0.182*	−0.261*	−0.003	1.000				
Innovation for import (12)	*0.087**	−0.018	0.034	−0.031	0.046*	0.026	−0.178*	0.267*	0.286*	−0.005	−0.144*	1.000			
Innovation for export (13)	*0.194**	0.001	0.009	0.060*	0.175*	0.094*	−0.087*	−0.135*	0.229*	0.554*	0.048*	0.064*	1.000		
Internet Usage (14)	*0.321**	0.000	0.026	0.069*	0.114*	0.115*	−0.126*	0.368*	−0.150*	0.588*	0.123*	−0.147*	0.419*	1.000	
Patent (15)	*−0.148**	−0.062*	−0.072*	−0.037	−0.089*	0.113*	0.313*	−0.290*	−0.102*	−0.448*	−0.023	0.055*	−0.161*	−0.256*	1.000

Note(s): *, * indicate that correlation is significant at the 0.05 and 0.01 levels, respectively (two-tailed)
Source(s): Own analysis

Competitiveness	Coef	Robust Std. Err	$p > z$	[95% conf. Interval]	
Distance	−0.0242	0.0080	*0.002*	−0.0399	−0.0086
Contig	0.1559	0.0201	*0.000*	0.1164	0.1953
Common language	0.0113	0.0129	0.379	−0.0139	0.0366
Common colony	−0.0460	0.0139	*0.001*	−0.0733	−0.0188
Transport cost exp	−0.0035	0.0097	0.716	−0.0225	0.0155
Transport cost imp	−0.3657	0.0369	*0.000*	−0.4382	−0.2933
Tariff	−0.0119	0.0075	0.114	−0.0267	0.0028
GDP imp	−0.2691	0.0442	*0.000*	−0.3557	−0.1824
GDP exp	0.4022	0.0283	*0.000*	0.3468	0.4576
Real exchange rate	0.1273	0.0510	*0.013*	0.0273	0.2272
Innovation for import	0.0830	0.0209	*0.000*	0.0421	0.1239
Innovation for export	0.1119	0.0375	*0.003*	−0.1853	−0.0385
Internet usage	0.0098	0.0115	0.394	−0.0128	0.0324
Patent	0.0273	0.0053	*0.000*	0.0169	0.0377
_cons	3.0707	0.3221	0.000	2.4394	3.7020

R-squared = 0.4570

Table 6. Regression mode 2 (H2)

Note(s): *, * indicate that correlation is significant at the 0.05 and 0.01 levels, respectively (two-tailed)
Source(s): Own analysis

costs to import have a significant but negative effect on export competitiveness. While common language and transport costs to export do not affect the export competitiveness of firms in the EAC.

Results in Table 6 show that Internet usage, patent rights, innovation in the importing country and innovation in the export country predict 45.7% of the variance in export competitiveness (R-squared = 0.4570). Patent with $\beta = 0.0273^{**}$, innovation in the importing country with 0.0830^{**} and Innovation in the export country with $\beta = 0.1119^{**}$ is the only innovation indicators that significantly contribute to export competitiveness in EAC. At this level of analysis, Internet usage has no significant 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 innovation indicators in the export country, import country and patent rights had a significant and positive effect on export competitiveness.

The results further reveal that the overall time required to transport goods along the main transport corridors that link the ports of Dar Es Salaam and Mombasa has reduced due to the improvement of transport infrastructure. A survey by Eberhard-ruiz and Calabrese (2017) indicates that a single customs territory (SCT) was implemented to speed up the clearance of goods at the entry ports. In addition, NTBs have been reduced and several one-stop border posts were established to reduce the border crossing time. Also, the number of weighbridges was reduced which has resulted in the reduction in days taken to deliver containers, for instance from 20 days to 10 days between Mombasa and Kampala. The EAC Doing Business Report (2019) shows that all the EAC states have managed to reduce the time needed to export and import by developing and implementing the electronic document submission and processing certificate of origin, allowing faster delivery of consignments and reduction in trade costs. For example, Uganda reduced the time for export documentary compliance and border compliance by allowing for electronic document submission and processing of certificates of origin and by further developing the one-stop border posts. Rwanda made trading across borders easier by removing the mandatory pre-shipment inspection for imported products. Tanzania made trading across borders easier by upgrading

infrastructure at the port of Dar Es Salaam. Kenya speeded up trade by implementing an electronic cargo tracking system and linking this system to the Kenya Revenue Authority's electronic data interchange system for customs clearance. Burundi made trading across borders easier by eliminating the requirement for a pre-shipment inspection and clean report of findings.

Results further show that the application of patents has a positive and significant impact on the export competitiveness of goods in the EAC over the period under study. This means that an improvement in the application of patents by a unit will lead to an increase in export competitiveness by about 0.0273 export firms. The export firms will become more productive and competitive when they apply for patents on their products. Overall, the results suggest that export firms will be more competitive in foreign markets when they can patent their products.

The results also show that the innovation in the export country has a positive and significant impact on the export competitiveness of goods in the EAC over the period under study. This means that an improvement in the technological innovation in the export country by a unit will lead to an increase in export competitiveness by about 0.1119 of export firms. The export firms will become more productive and competitive when technological innovation in the country improves. Overall, the results suggest that export firms will be more competitive in foreign markets when they apply modern technologies in their export processes.

The results also show that the innovation in the importing country has a positive and significant impact on the export competitiveness of goods in the EAC over the period under study. This means that an improvement in the technological innovation in the importing country by a unit will lead to an increase in export competitiveness by about 0.0830 export firms. The export firms will become more productive and competitive when technological innovation in the importing country improves. Overall, the results suggest that export firms will be more competitive in the foreign markets when technological innovations in the foreign markets improve.

5. Discussion

Results show that technological innovation by firms in the importing country has a positive and significant impact on the export competitiveness of products in the EAC. Export firms become more productive and competitive when they increase their level of productivity. This could imply that technological innovations through research and development in the importing country influence productivity and export competitiveness in the export sectors in EAC. Technological innovation improves the quality of the products that increase the demand for the goods compared to others in the foreign markets. This is in line with empirical literature which suggests that there is a link between importation, exportation and innovation. Fassio (2018) shows, that the foreign demand effect of exporting activities affects firms' strategies by increasing the potential output. The study concludes 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 toward efficiency since it is very sensitive to the increase of the volume sold. Şeker (2012) suggest that reforms that increase the global engagement of firms through both importing and exporting are likely to increase trade. The study concludes that there is complementarity between imports, exports and innovation. Damijan and Kostevc (2015) suggest that firms learn from import links, which enables them to innovate products and processes and then start exporting. They argue that there is stronger sequencing running from imports through innovations to export and to further innovation. They conclude that the import links are important for smaller firms by enabling them to learn in terms of production processes as well as improving their product characteristics. Jhingan (2012) shows, that innovations in the importing country will lead to an increase in the price of

importable products because the output reduces while there is an increase in the exportable products because the price reduces due to an increase in the output.

Results show that technological innovation by firms in the exporting country has a positive and significant impact on the export competitiveness of products in the EAC. Export firms become more productive and competitive when they increase their level of productivity. This could imply that firms that carry out innovations through research and development to improve their productivity increase their export competitiveness as compared to those firms that do not carry out innovation. Technological innovation improves the quality of the products that increase the demand for the goods compared to others in the foreign markets. It reduces both the average cost of production and the transaction cost which results in reduced final prices of goods in the foreign markets. This makes the exporting firms more competitive in the foreign markets by producing more sophisticated products that may lot loos value so easily. This is consistent with empirical literature for instance; Uyar and Oralhan (2017) find that with the increasingly competitive environment, firms must carry out technological innovation that makes a difference to their customers. And conclude that Innovation increases the efficiency; productivity and profitability that make firms enter new markets by increasing their competitiveness. Melitz and Redding (2014) show that 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 infrastructures such as transportation, customs administration, telecommunication networks, electricity and infrastructural services. Márquez-Ramos and Martínez-Zarzoso (2010) find that technological innovation is a substitute for distance in developing countries because better information lowers the effect of distance in international trade. They conclude that for the countries classified as technological leaders and potential leaders, the effect of technological innovations on exports is always positive, which effect is magnified by technological improvements. Tekin and Hancioglu (2017) argue that with globalization, technological development is crucial in accelerating development and trade in developing countries. They conclude that the share of exports in world trade for developing countries has been increasing due to the increase in innovative initiatives and activities.

The findings support the economic complexity theory (Gill, 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 emergence of novelty. The theory emphasizes the application of technical knowledge is necessary for production to meet the needs of both the domestic market and foreign market. This is supported by Vergara (2019) who indicates that productive capabilities proxied by the Economic Complexity Index (ECI) are positively correlated with the intensive and extensive margins of export and product quality. This shows how different sectors and entities' interactions in the economy drive productivity and export competitiveness in the EAC. The findings also render support to the New-New Trade Theory (Melitz, 2003) which focuses on how complementarities between importing and exporting may increase a firm's productivity, the reinforcing link between trade and innovation, and reduction in production costs which result in increased export competitiveness. This is because the increased profits accruing to firms through exportation allow them to undertake innovations to increase their productivity as the resources involved in the innovations are both locally available and imported.

A patent is an exclusive right granted by the government for an invention either a product or process, which helps inventors to prevent others from taking advantage of their ideas or inventions. Results show that patent protection had a positive and significant impact on the export competitiveness of firms in the EAC over the period under study. This implies that an increase in patent rights protection innovation leads to an increase in the exportation of firms resulting in increased export competitiveness of firms in the EAC. Export firms become more productive and competitive when they adopt patent rights protection. This is in line with

Aghion *et al.* (2018) who found out that patenting robustly increases more with demand for initially more productive firms. They conclude that an export demand increase has a more positive effect on innovation in high productivity firms but a negative effect in low productivity firms due to high competition for the product in the foreign market.

The East African Countries mainly export primary products that are open to imitation, the application of patent rights protection would simply make them competitive in foreign markets as they could easily protect their products in the markets. The protection of Intellectual property rights and anti-counterfeit issues remain a challenge for individual countries in the EAC although efforts are being made at the regional level to implement the TRIPS agreement to promote the issues of copyrights in the region. Each country in the EAC has different legal approaches to the treatment of patent rights on products, for instance only Kenya expressly deals with patent rights in its national legislation, in Uganda, the issue remains unaddressed and Tanzania has the complexity of dealing with two IP rights systems: one for mainland Tanzania and the other for Zanzibar. This finding supports the economic complexity theory (Gill, 2013) which emphasizes that countries with high ECI usually rich countries, will specialize in the production and export of products with high product complexity index (PCI) while countries with low PCI mainly poor countries, will specialize in low PCI products. The theory indicates that the export basket of high PCI is homogenous as compared to the export basket of low PCI. Because of this, the high PCI firms can be able to patent their product as compared to low PCI firms due to the possibility and level of imitation of the products.

6. Conclusion and implications

This study was conducted to investigate the effect of export logistics components on the export competitiveness of firms in the 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 exports 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.*, 2014). To achieve the purpose of the study, four 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 a balanced panel data of export firms in EAC between 2007 and 2018. The study provides evidence that technological innovation indicators that include; Internet usage, patent rights protection, innovation in the exporting country and innovation in the importing country, the exporting country have an impact on the export competitiveness of firms in the EAC. An improvement in technological innovation reduces the average trade costs and increases productivity and diversity of export products in the EAC. Specifically, results show that innovation in the importing country, innovation in the export country and patent rights protection of exports are positive and significant predictors of export competitiveness whereas Internet usage does not influence 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-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 four innovation indicators on export competitiveness. The study makes a contribution to the growing body of literature and debates on the concept of competitiveness by bringing out how technological innovation interacts and contributes to the Economic Complexity Theory by reducing transaction costs, increasing productivity and product

diversity, and resulting in increased export competitiveness. 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 affects export competitiveness.

The findings of this study have several 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 technological innovation both in the import and export countries to improve the export competitiveness. In addition, the EAC partner states need to take deeper reforms as regards structural transformation 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 checkpoints, 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 on 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 the 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 Internet usage had no significant 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 innovative indicators on export competitiveness probably the results could be different.

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