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Integration into regional or global value chains and economic upgrading prospects: an analysis of the East African Community (EAC) bloc

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Abstract

The aim of the study was to assess the integration into regional or global value chains and economic upgrading prospects in the East African Community (EAC) bloc. We conducted a comparative analysis of participation in global value chain (GVC) among EAC member states and assessed the determinants of economic upgrading in the region using UNCTAD-Eora GVC Panel data from 2005 to 2018. The results show that Kenya, Tanzania and Uganda are relatively better integrated through two channels of GVC participation, namely foreign value added (FVA) and domestic value added. However, for indirect-value added channel, Kenya had the highest score, the rest member states had relatively lower mean scores. The overall results show that EAC's participation in GVC still resides in upstream low- and middle-value-added production activities, which limits its competitiveness compared to other regions. The empirical results show the positive and significant effect of domestic credit, foreign direct investment, quality of institutions and FVA on economic upgrading. However, a positive but insignificant association with economic upgrading was observed for human capital and GDP per capita. Infrastructure quality was negatively and significantly associated with economic upgrading. These results suggest that improving infrastructure connectivity and further strengthening institutional governance would reduce trade costs and promote greater investments, product and service diversification, leading to deeper economic upgrading in the region. At the policy level, the adoption of effective national and regional industrial policies would promote innovation and human capital development, attract foreign direct investment and help address market and coordination deficiencies in the region.

Keywords: Economic upgrading, Global value chain participation, Regional integration, East African Community (EAC), Foreign value added (FVA), Domestic value added (DVA), Indirect value added (DVX)

Introduction

Firms' participation in value chains, particularly regional and global value chains, is increasingly recognized as an effective approach to reducing trade costs, increasing competitiveness and promoting export growth in developing countries. Firms that have managed to integrate into value chains experience growth, technological upgrading, and maintain stability [1–4]. Regional arrangements such as those of regional blocs such as the East African Community (EAC) offer potential for organized production networks that span multiple countries and enable inter-firm governance structures that shape productive economies and drive international trade at global and regional levels [5–7]. Regional value chains (RVCs) represent cross-border organized value chain activities in the same region (at the regional level), for example within the East African Community (EAC) or in Africa as a region. On the other hand, the global value

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chain is based on the fragmentation of international production, where production is fragmented, and different phases of production activities are carried out in different countries [8]. There are various conditions that can influence the geographic scope of global value chains, including industry factors and market differences [9–11]. Likewise, organizational and technological abilities are important aspects to effectively participate in regional or global value chains [12, 13]. The benefits associated with participating in regional or global value chains are to improve the capabilities of companies through learning new skills, technologies and organizational strategies and management techniques through interaction with other actors along the chain, thereby enabling economic upgrading processes. Other benefits derived from the participation in RVCs and GVCs include improved productivity, higher output, added value, and more jobs creation [14]. Kummritz et al. [15] identify five (5) channels under which these benefits or spillovers can take place (i) Backward and forward links. Backward links are created through the purchase of international inputs that help to boost production and efficiency in downstream sectors by providing the necessary and high-quality inputs and knowledge transfer. Forward links, on the other hand, are the sale of local intermediates in RVCs or GVCs to international buyers, leading to production and efficiencies in upstream sectors through increased demand for high-quality inputs and allowing local suppliers to meet the required requirements. (ii) RVC or GVC participation can generate effects to external members (non-participants) leading to competition, more knowledge and technology spillovers, overall productivity and economic upgrading. (iii) Technology spillovers in RVC or GVC increase the efficiency of local businesses (firms) in the same sector or related downstream, or upstream sectors. (iv) The participation in RVCs or GVCs can promote and drive investments in infrastructure and increase local production and efficiencies in other sectors to enhance pro-competitive effects and also strengthen a country's ability to sustain participation in RVCs or GVCs over time. (v) RVCs or GVCs bring benefits to the labor market by shifting workers based on required skills. This allows for reskilling of workers based on demand for skilled workers as well as labor turnover, where the knowledge embodied in the workforce of the participating companies is transferred to other local companies.

Economic upgrading refers to "a move to higher value activities in production, to improved technology, knowledge and skills, and to increased benefits or profits deriving from participation in GVCs" [9]. There are four types under which economic upgrading is conceptualized, namely process ("improving technology and/or production systems"), product ("producing more sophisticated or complex products"), functional ("increasing the range of functions or changing the mix of activities to higher-value-added tasks") and chain upgrading ("moving from one industry to another"). However, according to Kowalski et al. [16] and Obasaju et al. [17] state that process upgrading captures domestic value-added content of exports and measures the level of productivity changes resulting from participation in global value chains compared to other types of upgrading. This study focuses on this type of upgrading.

One of the proposed ways to increase the domestic value added of exports in low-income countries is to create an environment that attracts both domestic and foreign direct investment (FDI). Several previous studies have shown that the specific conditions of the host country and the existence of regional integration programs can play an important role in attracting investments worldwide [7, 18–20]. In particular, foreign direct investment plays a crucial role in the industrialization process by facilitating access to capital, technology and new managerial skills, and enabling the integration of local economies with international markets through export trade [21–23]. The interaction of domestic companies with multinational companies (MNEs) increases the likelihood of their participation in global value chains. [24] state that interaction is possible through four channels: (i) supplier connections in a GVC network, (ii) strategic alliances with multinational companies, (iii) direct export and (iv) foreign direct investment. Their empirical study in India shows that local firms in partnerships or joint ventures with multinationals are 30% better able to engage in direct exports than local firms without such interactions. However, the existence of a favorable policy environment and efficient institutions are some of the prerequisites for attracting activities of MNEs in low-income countries, which can help generate spillover effects on the local economy through local integration. A weak institutional environment creates an institutional void that poses a challenge for developing countries and directly affects MNEs' decisions to invest in a given area. Institutional void is defined as the "absences or shortcomings of the institutions that help markets to operate effectively" [25, 26]. Efficient institutions are important for facilitating market transactions [27], minimizing risks [28], enabling firms to withstand shocks in the form of political instability, violence, macro-economic volatility, and even war [28, 29]. While one of the goals of the EAC bloc is to foster regional integration and trade ties between member states, one of the ways to accelerate investment growth is to address institutional voids in the region. This

would help promote deeper regional integration and increased participation in global trade.

However, few studies have been conducted to assess regional integration and economic upgrading processes in Africa, the available studies include Allard et al. [5, 30] and Obasaju et al. [17]. These studies have demonstrated the positive link between trade integration and economic upgrading across few regional blocs such as ECOWAS, EAC, and SACU. The present study examines the status of participation in regional or global value chains and it examines the determinants of economic upgrading within one bloc, the East African Community (EAC). Regional blocs such as the EAC offers an opportunity to member states to increase their exports share through cross-border production chain and global trade [30]. This is due to preferential trade agreements and the removal of trade barriers between member states, creating opportunities to participate in production networks, attracting foreign direct investment (FDIs) and integrating suppliers into the regional value chains, leading to innovation, competitiveness and trade growth. The experiences from East Asia, North America and Eastern Europe show that investment and trade agreements led to the rise of production networks and increased participation in global value chains [16].

The East African Community (EAC) is a regional bloc bringing together seven countries, namely Tanzania, Rwanda, Burundi, Kenya, Uganda, South Sudan and the Democratic Republic of Congo (DRC). The former EAC collapsed in 1977. The revived EAC came into force on July 7, 2000, with the first member states of Tanzania, Kenya and Uganda. Rwanda and Burundi joined the EAC in 2007, South Sudan joined in 2016 and the Democratic Republic of Congo (DRC) joined in 2022. The EAC aims to coordinate economic and other policies by creating favorable conditions for achieving the community's goals, which focus on promoting trade and deepening integration between member states for mutual benefits. The elimination of cross-border trade barriers by regional blocs enables participation in regional and global value chains as they expose manufacturers and traders to international markets and foreign competitors, which in turn encourages technology transfer and other spillovers important to both integrated and not integrated firms in regional and global value chains [31].

Therefore, participation in regional value chains and global value chains have become increasingly important channels to enable greater integration into the regional bloc and participation in trade with the rest of the world. Lessons from Southeast Asia show that where the deepest regional integration agreements are found, the average proportion of intra-regional GVC participation is highest [1]. However, this does not happen in all countries, as some low-income countries are excluded from participating in the global value chain due to limited access to finance, high transaction costs, inability to meet new market demands, insufficient skilled labor force, lack of technology, under investment and infrastructural challenges [32]. This study assesses the extent of participation of EAC member states into regional or global value chains and whether their participation helps firms or countries to upgrade within regional and global value chains. According to [33], this is important to increase competitiveness in higher value-added jobs, which increases domestic labor productivity and skills, and thus creates more employment opportunities. Therefore, this paper serves the following specific purposes which are to:

- Conduct a comparative analysis of GVC participation among East African Community (EAC) member states
- Examine the relationship between domestic private credit and economic upgrading in EAC
- Examine the relationship between foreign direct investment and economic upgrading in EAC
- Examine the relationship between quality institutions and economic upgrading in EAC
- Examine the relationship between infrastructure quality and economic upgrading in EAC

The remainder of the paper is as follows: "Literature review" section presents a literature review; "Research methodology and data sources" section presents research methodology; "Results and discussions" section presents study results and discussion, and "Empirical results" section provides conclusion and implications.

Literature review
Theoretical literature review
The eclectic paradigm
This theory was developed by Dunning [34]. The theory provides an overview of the factors responsible for the growth of MNE activities around the world. The theory posits that firms' internationalization and value-added activities depend on three conditions (a) unique and sustained ownership of specific advantages compared to other firms (Ownership Advantages-"O"), (b) the extent to which the entity finds it useful to add its "O" benefits rather than sell them to other foreign entities (internalization benefits-"I"); and (c) the extent to which firms are interested in establishing, or exploiting their- "O" advantages in a foreign location (location advantages-"L"). The theory was later expanded to cover internalization theory, specifically asset-based and transaction-based property advantages [35], the FDI effects and the investment

development path [36, 37], strategic alliances [38, 39], asset acquiring FDI [40, 41], e-commerce [42] and relational assets [40, 41]. Other important works are Dunning [35] and Dunning and Lundan [43] who have identified four motives for foreign direct investment, namely (a) market-seeking (market-driven motive), (b) efficiency-seeking (minimizing costs at different locations); (c) strategic assets-seeking (technological advantages); and (d) resource-seeking (proximity to resources). The eclectic paradigm framework is a theoretical model important to explain the role, channels and motives for foreign direct investment in integrating into regional or global value chains and the consequent impact on economic upgrading in regional blocs such as EAC.

Institutional theory

Previous studies have recognized the role of institutions in reducing insecurity and building stable economic and social relationships. In a seminal work by North [44] and Williamson [45] on the theory of institutional economics, institutions can remedy market imperfections and thus provide a means of increasing the efficiency of market structures. Institutions represents legal, political, economic and administrative systems and institutional costs determine the level of attractiveness of a location. As such, places that allow for easier adaptation are considered more attractive and less costly [46]. The differences in legal, political, economic and administrative systems will have different implications on organizations and players. Therefore, problems related to institutional void can have different impacts on MNEs activities and business practices in general. This suggests that the quality of institutions is crucial not only for increasing the efficiency of market structures, but also for attracting investments and promoting integrating into regional value chains and boosting economic upgrading in regions like EAC.

Uppsala model

This model was initially developed by researchers in Sweden [47, 48]. The earlier premise of the model was that the firm's internationalization improves over time as the firm increases its exposure to the foreign market by increasing its presence over time and increasing knowledge of the market. However, the theory was later developed further by Johnson and Vahlne [49] where the concept of network is put at the center. Network theory responds well to internationalization and globalization demands, where trust building and learning are important building blocks in network formation [3]. The assumptions of the Uppsala model are important to explain the participation of East African SMEs in regional value chains through the establishment of networks. This may allow SMEs to mobilize resources and become more competitive. The Uppsala model is useful to explain the regional integration process in the context of the regional value chain in regional blocs like EAC.

International new venture theory

This theory was developed by [24] and explains the internationalization process of firms. According to the theory, the age of firms and rapid changes in the international business environment are critical aspects in the early stages of the internationalization process of firms. The theory posits that changes in technology, mobility of human capital, increased access to finance and exposure to international business encourage cooperation between countries, leading to trade ties and development. The assumptions of this theory are important to explain the integration of traders into regional and global value chains in regional blocs like EAC.

Empirical literature review

Regional integration initiatives such as of the EAC can play a crucial role in promoting local firms' participation in regional and global value chains. This is due to the potential that exists in connecting companies within the bloc based on comparative advantages and existing opportunities, facilitating economic upgrading [17]. Several previous studies have shown that economic upgrading allows actors such as farmers, processors, traders and workers to improve their competitiveness, leading to increased trade and export growth in a global market. However, Kowalski et al. [16] and Obasaju et al. [17] have shown that process upgrading is embedded in the domestic value-added content of exports and captures more changes in productivity levels in regional or global value chains compared to other types of upgrading. This means that a stronger focus on local content in terms of domestic value creation (increased local resource use and productivity increase) is important for participation in regional or global value chains. Opportunities offered within regional blocs such as trade liberalization through preferential trade agreements, lowering of trade costs, and harmonization of trade policies and practices offer potentials for the participation in regional or global value chains and the path to economic upgrading, one of the sources of competitiveness in trade [3, 50, 51]. However, in order for economic upgrading (domestic value creation) to take place within the framework of regional bloc such as the EAC, the following factors are discussed in the literature:

Countries need to attract both local and foreign direct investment (FDIs) in various economic sectors. FDI brings skills and technologies that help to engage in the production of new and more sophisticated goods, leading to the competitiveness of domestic manufacturers

in the regional bloc. In addition, FDIs and the activities of multinational companies in host countries serve as a channel for integrating SMEs into global markets, thereby increasing also their exports [51, 52]. Similarly, FDIs coming within the regional bloc fosters business networks, and forward and backward links with local firms, contributing to smoother technological spillover due to low technology gaps [53]. However, FDI decisions are influenced by a number of factors including the following:

i. Exchange rate effects. The expected exchange rate fluctuations can influence investment decisions abroad. Froot and Stein [54] and Blonigen [55] find that imperfect capital markets, reflected in lower internal costs than borrowing from external sources, can increase a firm's foreign investment. This means that currency appreciation leads to increased corporate assets and provides the company with cheaper means of investing compared to counterpart companies abroad that experience currency devaluation.

ii. Institutions Previous studies have shown that the quality of institutions is likely to be an important determinant of FDI activity, particularly for less developed countries [20]. Institutional voids, reflected in poor legal protection of assets, poorly functioning markets, the existence of corruption and a lack of investment in strategic infrastructure, reduce trust in institutions and increase the cost of doing business, which in turn deter FDIs.

iii. Trade openness. Trade liberalization has been linked to foreign direct investment inflows and improved export performance. Neumayer and Soysa [56], Kakar and Khilji [57] and Liargovas et al. [58] found that trade openness has a positive impact on FDI inflows. This suggests that trade openness, as implemented by a regional bloc such as the EAC, can have an impact on the attractiveness of FDI in the region.

iv. Real Gross Domestic Product (GDP). Fugazza Fugazza [59] reported on the positive impact of real GDP and other factors on countries' exports. His study found that real GDP has a positive impact on export growth. This means that the increasing level of GDP indicates that the economy has a favorable environment for investment and therefore greater participation in the regional value chain, leading to economic upgrading.

- Labor Force or human capital. The presence of quality and effective human resources is one of the prerequisites for the achieving of economic upgrading in the context of a regional bloc like the EAC. The low quality of human resource due to shortage of people with the relevant expertise is one of the reasons for the low absorption capacity and competitiveness of SMEs [60]. This means that the quality of the education provided must match the demands of the labor market. Quality and human resources would imply more specialization in manufacturing activities than in primary activities within the value chains as well engaging in capital intensive production, especially when skilled labor and capital complement each other in the production process [61, 62]. Keji [63] shows that a country's level of human capital is positively related to economic growth. In this sense, economic upgrading among EAC member states will be possible if the people with the necessary skills and experience are there.

- Access to Finance. Financial challenges have been identified in the previous studies as a barrier to SMEs participation and integration into global value chains due to high interest rates, extensive collateral requirements and cumbersome loan application processes ([60, 3]. The availability of finance strengthens SMEs' ability to integrate into global value chains and prospects for economic upgrading.

- Governance and quality of institutions. Governance and the quality of institutions is an important factor for promoting participation in regional or global value chains and economic upgrading. This is reflected in respect for the rule of law, protection of property rights, independence of the judiciary, transparency and dealing with corruption. These factors serve as hallmarks of business growth and development. According to [64] and Kummritz et al. [15] bureaucracy, corruption, lack of intellectual property rights protection and contract enforcement discourage investments and prevent foreign investors from realizing their full competitive advantages.

- Quality of infrastructure. Previous studies indicate that infrastructure quality is one of the most important requirements for trade facilitation. Trade growth and development are hampered in many African countries by poor infrastructure and lack of connectivity. The unreliable and slow land transport system in Africa has reduced participation in global electronics and fruits and vegetable value chains [65–67]. The quality of the infrastructure can be expected to influence participation in the global value chain and increased economic upgrading.

GDP per capita. GDP per capita indicates the standard of living of people in the country. The higher the standard

of living, the better the purchasing power and therefore better opportunities for economic upgrading.

Therefore, this study tests the following hypotheses:

i.   Hypothesis (H_1): There is a positive relationship between domestic private credit and economic upgrading in EAC region

ii. Hypothesis (H_2): There is a positive relationship between foreign direct investment and economic upgrading in EAC

iii. Hypothesis (H_3): There is the positive relationship between quality institutions and economic upgrading in EAC

iv. Hypothesis (H_4): There is a positive relationship between infrastructure quality and economic upgrading in EAC

Research methodology and data sources

(a) We use descriptive analysis to conduct a comparative analysis of GVC participation among East African Community (EAC) member states using data from the UNCTAD-Eora Global Value Chain (GVC) database, a time series data from 2005 to 2018 using the 25-sector version. Since the EAC was revived on July 7, 2000. Therefore, this study assesses five EAC countries, namely Tanzania, Kenya, Uganda, Burundi and Rwanda, which were present in the 2000s. South Sudan was not included in this analysis as it only joined the EAC in 2016. However, South Sudan is a major trading partner of the other EAC members and sources most of its imports from the EAC [68].

The key GVC participation indicators are:

i.   Foreign Value Added (FVA). This is a measure of the "share of a country's exports that consist of inputs that have been produced in other countries" [69]. This metric captures the extent to which a country's exports include foreign-created value added and GVC participation to downstream companies and industries.

ii. Domestic Value Added (DVA) are the "value added in exports who's the outputs are produced by domestic industries." It includes the domestic value added that was previously exported and the re-imports that are used to manufacture intermediate goods.

iii. Indirect Value Added (DVX) refers to value added embodied in other countries' exports, upstream contributions from DVA of other industries. It is based on the amount of the intermediate inputs

that is sent to a third country in the form of end products.

(b) We examine the relationship between economic upgrading and explanatory variables in EAC, the panel data model is specified as follows:

$$
\begin{aligned}
\text{LDVA}it =\ & \beta 0 + \beta 1\text{LFDI}it + \beta 2\text{LHCA}it \\
& + \beta 3\text{LDOC}it + \beta 4\text{QI}it + \beta 5\text{LQS}it \\
& + \beta 6\text{LFVA}it + \beta 7\text{LGDPCA}it \\
& + \nu i + \mu t + \varepsilon it
\end{aligned}
\tag{1}
$$

where Subscript i represents the country, t denotes the period, νi indicates the cross-section country-specific fixed effect, and t indicates the period fixed effect. εit is a random error term. L represents the natural logarithm of the relevant variables.

- LDVA is the natural logarithm of domestic value added in exports (a measure of economic upgrading in GVCs). It is captured by domestic value added embodied in exports divided by population. This is a forward integration in global value chains which implies the domestic value added of a product that enter themselves into the exports of other countries [5]. DVA data was sourced from UNCTAD Global Eora GVC database and population data from Penn Tables.

- LFDI (Natural logarithm of FDI inflows measured as a percentage of GDP from World Development Indicators-WDI).

- LHCA (Natural logarithm of human capital as measured by government spending on education as a percentage of GDP (World Development Indicators-WDI).

- LDOC (Natural logarithm of domestic credit to the private sector as a percentage of GDP). The data come from WDI. Domestic credit provided to the private sector is one of the indicators of the development of financial institutions in a country in terms of facilitating access to capital for investments.

- QI is the quality index which captures the quality of institutions as measured by the existing legal system and protection of property rights in EAC member states. The data were sourced from the index of economic freedom published by Heritage Foundation.

- LQS (Natural logarithm of the quality of infrastructure measured by the individuals using the internet (as a percentage of population) which is used as a (narrow) proxy for the quality of infrastructure was sourced from WDI. The use of the Internet in areas

Table 1 A descriptive statistics of the export share of the East African Community (EAC) member states.

Foreign Value Added (FVA)

Item	Burundi	Kenya	Rwanda	Uganda	Tanzania
Mean	55941.32	897601.7	44312.74	106109.5	410907.5
Median	60857.98	917496.9	52547.13	117187.8	472816.5
Maximum	85708.19	1242339	63443.64	140648.3	558444.2
Minimum	25384.00	472123.3	16241.20	45711.53	163509.9
St. Deviation	16598.82	206566.4	17612.09	29788.47	135765.7
Skewness	− 0.4025	− 0.4632	− 0.4746	− 0.7929	− 0.5808
Kurtosis	2.5114	2.7120	1.5515	2.3721	1.8568
Jarque— Bera	0.38	0.76	0.42	0.42	0.46
Domestic value added (DVA)					
Mean	128531.4	4459949	123600.3	694719.4	969528.3
Median	144265.7	4659579	131600.3	741417.8	977589.4
Maximum	195588.9	5787217	176161.9	1020364	1281763
Minimum	50962.18	2398999	65911.82	330676.4	667709.5
St. Deviation	44165.27	1017292	36914.48	201384.9	185848.5
Skewness	− 0.5148	− 0.6458	− 0.2464	− 0.3733	0.0906
Kurtosis	2.0371	2.3663	1.7156	2.2971	2.0284
Jarque— Bera	0.56	0.55	0.57	0.74	0.75
Indirect value added (DVX)					
Mean	55941.32	1557936	55395.59	200689.5	310498.3
Median	60857.98	1621183	57864.70	218254.3	321330.7
Maximum	85708.19	2035450	72539.48	241939.9	410649.9
Minimum	25384.00	831038.8	35084.86	108532.4	206588.2
St. Deviation	16598.82	352082.3	12299.35	40136.59	65873.33
Skewness	− 0.4025	− 0.6037	− 0.3721	− 1.1921	− 0.0701
Kurtosis	2.51149	2.4964	1.8560	3.2424	1.7579
Jarque— Bera	0.77	0.61	0.58	0.18	0.63

Source: own analysis based on UNCTAD-Eora GVC database data

such as information and communication technologies play a key role in reducing transport and logistics costs.

- LFVA (Natural logarithm of the foreign value added embodied in exports (i.e., backward integration into GVCs). FVA data were sourced from the UNCTAD Global Eora GVC database.
- GDPCA is the natural logarithm of the GDP per capita. Data were sourced from Penn Tables.

Results and discussions

A comparative analysis of GVC integration among East African Community (EAC) member states was conducted using three decomposition of exports (measure of GVC participation), namely foreign value added (FVA), domestic value added (DVA) and indirect value added (DVX). All variables are normally distributed.

i. *Foreign Value Added (FVA)* The results of FVA in Table 1 show that Kenya, Tanzania and Uganda recorded the highest levels of FVA over the study period. The mean was USD 897601.7 (SD=206566.4), mean USD 410907.5 (SD=135765.7) and mean USD 106109.5 (SD=29788.47) respectively. Rwanda and Burundi recorded lower values with mean value of USD 55941.32 (SD=16598.82) and mean value of USD 44312.74 (SD=17612.09), respectively. This shows that the EAC member states get some of their inputs from other countries, which are used in the sectors of agriculture, food, and beverages, mining, quarrying, and petroleum products, manufacturing, transport and tourism, private services, public administration, education, and health etc. to produce finished goods (Table 2). The results suggest
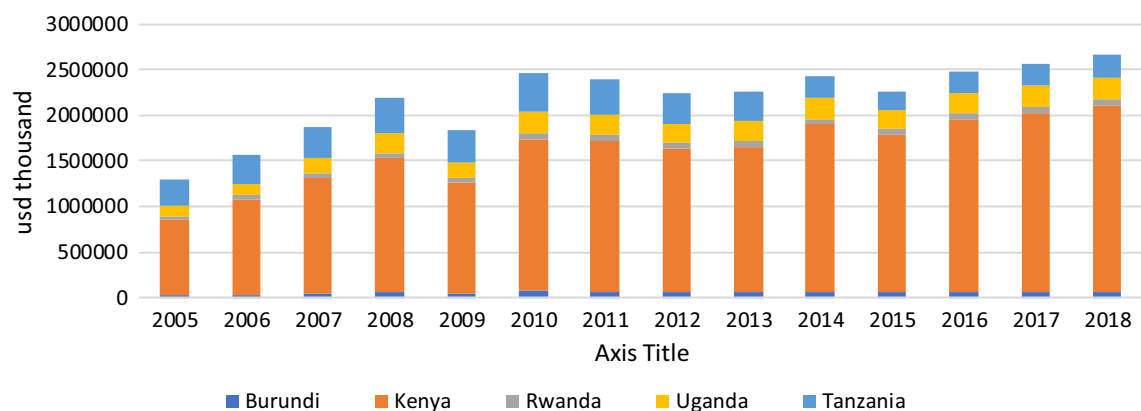
Table 2 Foreign value added (FVA) for selected EAC countries

Sector	FVA (Tanzania)	FVA (Uganda)	FVA (Rwanda)	FVA (Burundi)	FVA (Kenya)
Agriculture	0.156	0.0583	0.0335	0.0267	
Fishing	0.334	0.123	0.232	0.18	0.0642
Mining and quarrying	0.457	0.154	0.356	0.387	0.153
Food and beverages	0.728	0.148	0.13	0.091	0.133
Textiles and wearing apparel	0.661	0.242	0.309	0.269	0.155
Wood and paper	0.673	0.206	0.213	0.152	0.281
Petroleum, chemical and nonmetallic mineral products	0.718	0.269	0.241	0.153	0.291
Metal products	0.77	0.242	0.291	0.194	0.399
Electrical and machinery	0.869	0.255	0.253	0.144	0.0948
Transport equipment	0.891	0.307	0.328	0.209	
Other manufacturing	0.785	0.238	0.316	0.254	0.173
Recycling	0.702	0.249	0.739	0.616	
Electricity, gas and water	0.45	0.105	0.232	0.201	0.0948
Construction	0.516	0.121	0.117	0.0948	0.254
Maintenance and repair	0.585	0.111	0.375	0.421	
Wholesale trade	0.345	0.0755	0.115	0.108	0.144
Retail Trade	0.3	0.0531	0.08	0.0908	
Hotels and restaurants	0.445	0.0907	0.118	0.123	0.119
Transport	0.578	0.144	0.186	0.157	0.183
Post and telecommunications	0.267	0.0711	0.0956	0.0896	0.0725
Financial intermediation and BUSINESS activities	0.132	0.0417	0.0486	0.0305	0.0606
Public administration	0.455	0.107	0.128	0.0968	0.143
Education, health and other services	0.302	0.0711	0.0793	0.0597	0.0544
Private households	0.502	0.135	0.446	0.459	
Others	0.354	0.108	0.357	0.423	0.0737
Re-export and re-import	0.999		0.99	0.981	0.481

Source: UNCTAD-Eora Global Value Chain (GVC) database

GVC integration into downstream activities of the value chain (backward integration). This approach is associated with rising incomes in developing countries due to skills and knowledge improvements and other economic spillover effects [70]

ii. *Domestic Value Added (DVA)* In relation to the DVA, this captures forward integration and shows the extent to which a country is integrated in upstream value chain activities. Kenya had the highest mean value of USD 4459949

Fig. 1 Author's elaboration based on UNCTAD-Eora Global Value Chain (GVC) data

(SD=1017292), followed by Tanzania with a mean value of USD 969528.3 (SD=185848.5). The relatively higher DVA for Kenya can historically be linked to its stronger industrial base since the dissolution of the former EAC, since then Kenya has continued to attract investments and expand its investment within the EAC. Similarly, other countries such as Tanzania, Uganda, Rwanda, and Burundi have continued to implement macroeconomic stability policies, and encourage foreign direct investment. These measures have helped to expand domestic value addition levels in the region. Domestic value addition remains crucial in the process of economic structural transformation in low-income countries as it leads to higher productivity, innovation, and increased competitiveness, one of the fundamental determinants of long-term sustainable growth [71, 72]. However, the DVA of the EAC member states is still at a minimum level compared to other regions of the world, for example based on the [73] on the competitive industrial performance (CIP) index, which captures manufacturing capacity and export of finished products, technological deepening and upgrading, Burundi occupies the lowest position in the EAC (145th position with an index of 0.001). Kenya ranks first in EAC (115 with index 0.009).

iii. *Indirect Value Added (DVX)*. In terms of DVX, Kenya recorded a mean value of USD 1557936 (SD=352082.3), and the mean value for Tanzania was USD 310498.3 (SD=65873.33) and for Uganda mean value of USD 200689.5 (SD=40136.59). Rwanda and Burundi had mean values of USD 1557936 (SD=2035450) and USD 55941.32 (SD=85708.19), respectively. Kenya, had the high-

est DVX value among the other EAC member states, followed by Tanzania (Fig. 1). This indicates that Kenya's participation in GVC and its integration with EAC member states and the rest of the world is geared toward the upstream production of commodities or inputs used in the production of other commodities in other countries. DVX shows the country's share of value-added exports embodied as intermediate inputs in other countries', capturing exports that measure the domestic sector "contribution to other counties" exports indicating GVC participation through an upstream sector [74]. However, while countries' DVX position in the EAC may indicate GVC integration, participation in the upstream production means that the country supplies into the production and exports of downstream producers, in the African context, these could be raw-materials and other inputs, with little opportunity for upgrading, which in turn may affect the competitiveness in global trade. This means that EAC member states must take measures that facilitate greater integration into regional and global trade which will result in higher economic upgrading.

Empirical results

The descriptive statistics of the variables used in the empirical analysis are given in Table 3. The mean of foreign direct investment (LFDI) and foreign value added (LFVA) averaged at 18.7966 and 11.8101, respectively. These were the relatively higher scores compared to quality of infrastructure (LQS) and domestic value added (LDVA), which had the lowest mean scores at 1.3168 and −3.7835, respectively. In terms of correlation, most

Table 3 Descriptive statistics and correlation of variables

Item	LDVA	LDOC	LGDPCA	LHCA	LQS	QI	LFDI	LFVA
Mean	− 3.78356	2.7321	6.3987	1.3483	1.3168	4.7421	18.7966	11.8101
Minimum	− 4.9734	1.5344	5.0219	0.2462	− 0.6122	3.1100	10.3607	9.5115
Maximum	− 2.1558	4.8504	7.4922	1.9927	3.2188	1.2527	6.3200	14.0325
St. deviation	0.8152	0.5075	0.6109	0.4015	1.0368	0.2227	0.9080	1.3404
LDVA								
LDOC	0.2274							
LGDPCA	0.3242	0.1827						
LHCA	0.1767	0.0582	0.6225					
LQS	0.4259	0.3471	0.2468	0.3261				
LQI	0.2405	0.2161	0.4363	0.1856	0.4875			
LFDI	0.3556	− 0.0828	0.8129	0.4958	0.4922	0.3828		
LFVA	0.5816	0.3429	0.3070	0.4287	0.5300	0.2859	0.6241	

Source: data analysis

Table 4 Tests for panel data estimation techniques

Estimation	Test and hypotheses	Results		
Test for multi-collinearity	Variance inflation factor (VIF)	Variable	VIF	1/VIF
		LGDPCA	8.15	0.0985
		LFVA	5.16	0.1937
		LQS	3.80	0.2635
		QI	2.67	0.3748
		LHCA	2.28	0.4395
		LFDI	2.13	0.4694
		LDOC	1.87	0.5339
		Mean VIF	4.01	
Breusch-Pagan Lagrange multiplier (LM)	xttest0 command in STATA 12. H_0=Null Hypothesis**:** No panel effect.	$Chibar^2 (01) = 674.24$ Prob > F= 0.000		
Hausman Test: selection between fixed or random effects	xtreg + Hausman commands in STATA 12. H_0: Random effect model is appropriate H_1: Fixed effect model is appropriate	P.value>x^2=0.000	P.value>x^2=> 0.05, therefore fixed effect is appropriate.	
Tests for serial correlation	Wooldridge Test H_0: no first order autocorrelation	$F (1, 4) = 0.860$	Prob > F = 0.4061	
Test for heteroskedasticity	Modified Wald Test H_0: Sigma(i)^2=sigma^2 for all i	$x^2(5) = 102.12$	Prob= 0.0000	

variables are fairly positively correlated. In terms of correlation between variables, there is a strong correlation between GDP per capita and FDI (0.81). This could

Table 5 Regression model estimations

Regressors	Fixed effects estimation (ordinary least square− OLS) I		Fixed Effects Estimation with Driscoll and Kraay standard errors II	
	Coefficient	P. value	Coefficient	P. value
LDOC	0.1506 (0.0716)	0.040**	0.1506 (0.0442)	0.005**
LGDPCA	0.0828 (0.1533)	0.591	0.0828 (0.0550)	0.157
LHCA	0.0480 (0.1240)	0.700	0.0480 (0.1133)	0.679
LQS	− 0.1986 (0.0471)	0.000***	− 0.1986 (0.03029)	0.000***
QI	0.1486 (0.0847)	0.085*	0.1486 (0.0749)	0.069*
LFDI (− 1)	0.0295 (0.0198)	0.142	0.0295 (0.0165)	0.098*
LFVA (− 1)	0.4850 (0.1243)	0.000 ***	0.4850 (0.0885)	0.000***
C	− 10.9621	0.000***	− 10.9621 (1.0754)	0.000***
	R^2	0.69	R^2	0.85
	Adjusted R^2	0.68	Adjusted R^2	0.83
	F (4, 58)	37.12	F (7, 13)	29.48
	P. Val> F	0.000	P. Val> F	0.000

*** , **,*Denote significant at the 1%, 5% and 10% level, respectively. Values in () denotes standard errors

mean that the increasing FDI inflows into EAC respond to the improving GDP per capita in the region, but also FDI contributes to improving GDP per capita. Similarly, domestic value added (LDVA) recorded a strong relationship with foreign value added (LFVA) (0.58).

We performed the panel data estimation tests. The variance inflation factor (VIF) results show that all variables have values less than 10, indicating that there is no multicollinearity problem in the data (Table 4). Similarly, we performed a Breusch-Pagan-Lagrange Multiplier (LM) to investigate the existence of panel effects. The results demonstrate the presence of panel effects, confirming the need for a fixed or random effects model. The Hausman test was performed to compare between the fixed effect and random effect models. The results showed that the fixed effects model is more appropriate. Further analysis was performed to detect serial correlation, a null hypothesis is rejected as the p.value is 0.4061, indicating the lack of serial correlation between the residuals. However, when a heteroscedasticity test was performed, the results show that the null hypothesis is rejected (p.value < 0.05), and it can be concluded that the residuals are not homogeneous. Therefore, the estimates of the standard errors for coefficients, and hence their t-values, are unlikely to be correct.

The empirical results of panel data estimation for fixed effects estimation (ordinary least squares OLS)

and fixed effects estimation with Driscoll and Kraay standard errors are presented in Table 5 as a remedial measure. According to Mehmood [75], heteroscedasticity or serial correlation in a fixed effects model can be addressed by applying fixed effects regression with Driscoll and Kraay standard error estimation. While the results of fixed effects estimation (ordinary least squares) and fixed effects estimation with Driscoll and Kraay standard errors are similar in terms of the variable coefficients, there are slightly more variables that had significant values in the second model (Table 5). The results of fixed effects estimation with Driscoll and Kraay standard errors show that the estimated coefficient of the domestic credit (DOC) is positive and significant suggesting that an increase in domestic credit has a positive effect on economic upgrading (LDVA).

The estimated coefficient of GDP per capita (GDPCA is positive but insignificant. This is consistent with what was found by Obasaju et al. [17] in EAC and is partly reflected in low GDP per capita and low levels of economic transformation in some member states. Similarly, human capital (LHCA) has a positive but insignificant effect on economic upgrading. This means that more policies need to be focused on human capital development in the EAC to foster the knowledge, experience and skills of the workforce that are important to the process of economic upgrading. However, infrastructure quality, showed the negative and significant association with economic upgrading. The proxy for the infrastructure used was the number of people using the internet (as a percentage of the population), which is used as a (narrow) proxy for the quality of the infrastructure. Findings can be related to the low internet accessibility in the EAC region, which complicates the connection between rural and urban areas, especially because rural areas host agriculture, fisheries and livestock sectors but face low value-adding activities.

On the other hand, the quality of the institutions showed a positive and significant correlation with the economic upgrading at a significance level of 10%. This can be reflected in various measures taken by EAC member states to strengthen institutions and improve governance, including improving the legal systems, anti-corruption and protection of property rights. Foreign direct investment (FDI) also shows a weak positive significant effect on economic upgrading at a significant level of 10%, suggesting that it has played an important role in domestic value creation initiatives in the region. These results are similar to those of Obasaju et al. [17]. In addition, foreign value-added share (FVA) shows a robust positive impact on economic upgrading. This indicates that inputs imported from other countries were important in the domestic value-added processes (economic upgrading) in the EAC region. Previous studies show that FVA (backward participation in GVC) and DVA (forward participation in GVC) complement each other and FVA is a source of competitiveness in low-income countries due to technological spillovers [76, 77]. The benefits of imports vary depending on the type of goods being imported. For example, importing goods that differ from the country's exports generates diverse external knowledge and leads to incremental innovation, allowing more sophisticated goods to be manufactured in developing countries [78, 79]. However, EAC participation in GVC still resides in upstream low- and mid-value-added production activities, which affect it as a region in terms of its competitiveness with the rest of the world. According to the [68], African countries have had little participation in regional and global value chains, and where participation was relatively improved it has been in primary commodities and mineral ores, but the report highlights that EAC countries are making strides, particularly in textiles and clothing, supermarkets, and the automotive industry.

Conclusion and policy implications

The aim of the study was to assess the integration into regional or global value chains and economic upgrading prospects in the East African Community (EAC) bloc. We conducted a comparative analysis of GVC participation among EAC member states using UNCTAD-Eora Global Value Chain (GVC) data from 2005 to 2018. The comparative analysis was conducted using three channels of GVC participation, namely foreign value added (FVA), domestic value added (DVA) and indirect value added (DVX). In terms of FVA, the results show that Kenya, Tanzania and Uganda recorded the highest FVA values, while Rwanda and Burundi had relatively lower mean values. The results suggest that EAC member states source some of the inputs used in production from other countries, indicating GVC integration into downstream activities in the value chain (backward integration). Backward integration has benefits in that it enhances the skills and knowledge of the labor force, leads to a technological upgrading that increases income, and creates other economic spillovers in the EAC. Similarly, Kenya had the highest position among EAC member states with DVA, followed by Tanzania while Burundi occupies the lowest position in the EAC region. However, generally the DVA of the EAC member states is still at a minimal level compared to other world regions. For example, according to [73] on the competitive industrial performance (CIP) index, which captures manufacturing capacity and

export of finished products, technological deepening and upgrading, Kenya ranks 115th out of 152 countries, while Tanzania and Uganda rank 123rd and 128th positions, respectively, compared to 52nd position for South Africa. For DVX, Kenya recorded the highest DVX among the other EAC member states, other countries had relatively lower DVX values. While countries with a higher DVX score may indicate GVC integration, such a score may mean that participation is focused on upstream manufacturing activities, where the country supplies inputs to downstream manufacturers. This has been the situation in many low-income African countries which supplies inputs with little potential for economic upgrading, limiting their competitiveness in global trade.

Regarding the determinants of economic upgrading in EAC. The empirical results of fixed effects show a positive effect of the FVA on economic upgrading means inputs imported from other countries are important in the economic upgrading processes in the EAC region. However, EAC participation in GVC still resides in upstream low and mid-value-added production activities, which undermine it as a region in terms of its competitiveness with the rest of the world. Domestic credit (DOC) has a positive and significant effect on economic upgrading (LDVA). This means more needs to be done to improve access to domestic credit in EAC. Human capital (LHCA) and GDP per capita (LGDPCA) recorded positive but insignificant relationship with economic upgrading. This means that the knowledge, experience and skills of the workforce in the EAC need to be strengthened. Similarly, the quality of institutions showed a positive and significant association with economic upgrading. This indicates that there is progress in strengthening institutions in the EAC. However, more needs to be done to increase transparency and introduce anti-corruption measures to attract more investment to the region. In addition, FDI showed a weak positive association with economic modernization. According to [80], foreign direct investment flows in Africa have helped increase the value of agricultural products and improve the export quality of African products in world trade. These results suggest that more needs to be done to improve infrastructure and strengthen governance in institutions to foster economic upgrading. At the policy level, the adoption of effective national and regional industrial policies would promote innovation and human capital development, attract foreign direct investment (FDIs) and address market and coordination deficiencies.

Author contributions
FL involved in writing, data analysis, editing and finalizing the manuscript. The author read and approved the final manuscript.

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Declarations

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The author declares that they have no conflict of interest.

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