



Impact of Economic Globalisation on Agricultural Value-Added: The African Region Experience

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Abstract

Globalisation has been a critical driver of economic growth in many nations. However, the agricultural sector has yet to realise its full potential in terms of agricultural value-added and the distribution of benefits to primary producers within value chains. Notably, the African region possesses a high potential for agricultural value-addition compared to other regions. This research examines the impact of economic globalisation on agricultural value-added within the African context. Using advanced statistical techniques, including panel data regression and multiple linear regression, the study assesses the influence of globalisation on agricultural value-added across 26 African countries from 2000 to 2021. The findings indicate that, while certain countries have benefitted significantly from economic globalisation, enhancing their agricultural value, the majority still require a greater focus on optimising agricultural value addition. Senegal exhibited the most pronounced impact on agricultural value addition, whereas Burkina Faso, Morocco, South Africa, Tunisia, and Uganda showed negligible impacts. Policies aimed at optimising fertiliser inputs, advancing technology, developing the technical knowledge, skills, and attitudes of the agricultural labour force, facilitating foreign market access for raw materials, and promoting sustainable agricultural practices could help enhance value addition and support the overall economic development of the African region. This research contributes to the knowledge-based economy by providing empirical insights into the factors driving agricultural value-added, underscoring the role of knowledge creation, diffusion, and application in boosting agricultural productivity and economic growth in the African region.

Keywords Agriculture value added · Economic globalisation · Fertilizer consumption · Employment in agriculture · Agricultural raw material export · Africa

Introduction

Economic globalisation has played a vital role in shaping the world economy over recent decades, fostering international migration, capital flows, and trade liberalisation while promoting economic freedom. Various metrics are employed

by countries to evaluate the degree of economic globalisation adoption, particularly its impact on agricultural value-addition. Economic globalisation represents the increasing interconnectedness of economies and markets worldwide, facilitated by advances in communication, transportation, and technology. Agriculture value-added, on the other hand, measures the net output of the agricultural sector, accounting for value-added contributions while deducting intermediate inputs, and encompassing activities such as agronomy, forestry, hunting, fishing, and livestock production [11, 28].

Previous research has highlighted employment in agriculture and fertiliser consumption as crucial determinants of economic globalisation and its impact on agricultural value-addition [1, 27, 28]. Employment in Agriculture refers to individuals of working age engaged in producing agricultural goods or services for monetary gain [28]. Agriculture remains a critical source of income for 86% of rural populations, offering employment to approximately 1.3 billion

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small-scale farmers and landless workers. Recent efforts by the South African government to support small-scale farmers aim to improve their livelihoods, income, and food security [20]. Similarly, fertiliser use in Ethiopia has positively influenced yield value and agricultural production [1]. The agricultural raw materials export can significantly impact a country's foreign currency inflows, stimulating economic growth by facilitating the acquisition of essential capital goods, technology, and manufactured goods. Additionally, countries with abundant natural resources suitable as raw materials can benefit from increased agricultural raw material exports, resulting in higher agricultural value-added as a proportion of GDP.

Economic globalisation plays a crucial role in enhancing agriculture value-added in Africa by increasing foreign currency flows, promoting agricultural productivity, reducing production costs, and ensuring food security. These benefits positively impact the agricultural sector, a major economic contributor in many South African countries. Furthermore, economic globalisation can improve market access and facilitate the adoption of new technologies and practices, fostering growth and development within the agricultural sector [4, 16].

The agricultural sector in Africa significantly contributes to poverty reduction in many emerging economies [24]. It provides food for the poor and aids poverty alleviation by boosting agricultural yields, enabling smallholders to produce sufficient crops to sustain their families [13]. Agriculture continues to play a strategic role in Africa's economic development, and enhancing agricultural value-added in Africa could effectively increase revenue at both farm and industry levels [27]. However, the impact of economic globalisation, fertiliser consumption, employment in agriculture, and agricultural raw material exports on agricultural value-added across 26 African countries has not been adequately studied. While several past studies have measured the impact of economic globalisation on food security, agricultural value addition, and agricultural inputs, a gap remains in the African region regarding these factors [13, 17].

This study aims to investigate the impact of economic globalisation on agricultural value-added in the African region, specifically examining the roles of fertiliser consumption, employment in agriculture, and agricultural raw material exports across 26 African countries from 2001 to 2021. The study addresses several research gaps, rendering it unique. Firstly, this research provides a comprehensive understanding of economic globalisation's impact on agricultural value-added in these 26 countries. Secondly, it applies a novel panel data regression approach, with the Multiple Linear Regression (MLR) model offering insights into how the impact of economic globalisation on

agricultural value-added varies across countries over time. Lastly, the selected variables and time frames in this study differ from those in previous research, offering a fresh perspective that helps fill gaps in the existing literature.

This research addresses multiple factors and time periods, enriching the knowledge base by addressing gaps in the literature in three key ways. Firstly, it contributes to the knowledge-based economy by providing empirical evidence on how global economic integration, alongside the dissemination of agricultural knowledge and technology can drive sustainable economic growth. Secondly, the study not only fills a gap in the literature but also provides actionable insights for policymakers and stakeholders aiming to enhance agricultural productivity through informed, knowledge-driven strategies. The outcomes could thus be valuable for policymakers and investors seeking to foster sustainable development in the food and agriculture industry across the continent. Thirdly, the research explores the separate impacts of economic globalisation on value-added and income levels, helping policymakers and stakeholders understand the trade-offs associated with global integration and informing strategies to maximise globalisation's benefits while minimising its adverse effects.

The subsequent sections of this study are organised as follows: the findings from previous studies; the Data and Methodology section outlines data sources and analytical techniques used; the Results and Discussion section provides an in-depth analysis of the findings; and the Conclusion summarises the study and suggests implications for future research.

Materials and Methods

This study utilised secondary data sources from the World Bank, with the full dataset provided in Supplementary Materials S1. Specifically, a panel dataset of 26 countries, primarily from the African continent, spanning 22 years (2000–2021), was analysed using panel regression. The research objective was to investigate the impact of fertiliser consumption, employment in agriculture, and agricultural raw materials export on agricultural value-addition in the African region. Stata statistical software was employed to examine the impact of these variables. Table 1 outlines the data sources and variables used in this study.

To explore the impact of the above variables on AVA, the study developed a panel regression model (Eq. 1). Additionally, a multiple linear regression (MLR) model (Eq. 2) was formulated to analyse the effects of fertiliser consumption, employment in agriculture, and agricultural raw materials export on AVA across different African countries.

Table 1 Data sources and variables. Source: Compiled by authors

Variable	Definition	Measure	Source
AVA	Agriculture, forestry, and fishing, value added	(% of GDP)	The World Bank https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS
FC	Fertiliser consumption	(Kilograms per hectare of arable land)	The World Bank https://data.worldbank.org/indicator/AG.CON.FERT.ZS
EA	Employment in agriculture	(% of total employment) (modelled ILO estimate)	The World Bank https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS
ARME	Agricultural raw materials exports	(% of merchandise exports)	The World Bank https://data.worldbank.org/indicator/TX.VAL.AGRI.ZS.UN

$$AVA_{it} = \beta_0 + \beta_1 (FC_{it}) + \beta_2 (EA_{it}) + \beta_3 (ARME_{it}) + \varepsilon_{it} \quad (1)$$

$$AVA_i = \alpha_0 + \alpha_1 (FC_i) + \alpha_2 (EA_i) + \alpha_3 (ARME_i) + \varepsilon_i \quad (2)$$

In Eq. 1, the AVA_{it} represents the value of the dependent variable at time t , and i counties and ε_{it} defines the residual error term for time t . The coefficients β_0 , β_1 , β_2 , and β_3 represent the intercept and slopes of the regression line, which describe the impact of the independent variables on the dependent variable AVA_{it} . Equation 2, representing the multiple linear regression equation (MLR), features agricultural value-addition as the dependent variable and ε as the residual error term. The coefficients α_0 , α_1 , α_2 , and α_3 describe the intercept and slopes of the regression line, indicating the impact of the independent variables on the dependent variable agricultural value-addition. Model selection was based on assumptions of no perfect multicollinearity, homoscedasticity, autocorrelation, and stationarity in the dataset.

Panel regression and MLR models were employed as analytical techniques. Two specification tests were conducted to identify the appropriate model: the Random Effects (RE), Fixed Effects (FE), or Pooled Ordinary Least Squares (OLS) model. The Hausman test was utilised to evaluate the suitability of RE and FE models, while the Breusch-Pagan test was used to select the best model between Pooled OLS and RE models. Additionally, robust standard errors were used to address heteroscedasticity. Past studies suggest that with large sample sizes, the effects of normality and collinearity issues are significantly minimised [15]. Visualisations and linear fits for the fertiliser consumption, employment in agriculture, and agricultural raw materials export variables were created to explore trends in the impact of these independent variables on agricultural value-addition across individual countries.

Results

The agriculture value added for 26 countries is presented in Fig. 1, which utilises Tableau visualisations, providing a geographical representation of these countries along with their average agricultural value-addition values over 21 years. The visualisation reveals that Niger had the highest average agricultural value-addition of 36.73, while Tunisia had the lowest at 8.93, resulting in a significant difference of 27.8 between the highest and lowest values. Additionally, Algeria, Morocco, and Egypt, Arab Rep., recorded comparatively low average agricultural value-addition values of 9.90, 12.13, and 12.89, respectively. Notably, there was a difference of 3.56 between Uganda and Kenya regarding average agricultural value-addition values, with Mali's average agricultural value-addition of 16.6 being higher compared to Côte d'Ivoire.

Figures 2, 3, 4 and 5 provide a comprehensive overview of the agricultural value-addition, fertiliser consumption, employment in agriculture, and agricultural raw materials export variables among African countries. Figure 2 highlights that Zambia has the highest median agricultural value-addition, while South Africa has the lowest. Burkina Faso, Ghana, and Togo also display high median values compared to Mauritius, Namibia, and Senegal, which show the lowest values. In Fig. 3, Egypt, Arab Rep., has the highest fertiliser consumption value, while Senegal and Mauritius exhibit a significant difference in their median fertiliser consumption values. Countries like Uganda, Niger Cameroon, and Namibia demonstrate less variation in fertiliser consumption.

In Fig. 4, Zambia has the lowest median value for economic globalisation, while Burundi, Mozambique, and Madagascar exhibit relatively high median values. Figure 5 shows that Benin has the highest agricultural raw materials export, while Algeria, Mauritius, Tunisia, and Zambia have low median values for this variable. These graphs provide valuable insights into the distribution of agricultural value-addition, fertiliser consumption, employment in agriculture and agricultural raw materials export variables across African countries.

Table 2 presents the significant coefficient values for fertiliser consumption, employment in agriculture, and agricultural raw materials export across the African region, offering insights into the nuanced dynamics of agricultural value-addition in individual countries. Notably, Senegal emerges as a key influencer on agricultural value-addition, with all three variables showing statistically significant impacts at the 5% level. Conversely, countries such as Burkina Faso, Morocco, Tunisia, and Uganda do not exhibit significant impacts on agricultural value-addition across the examined

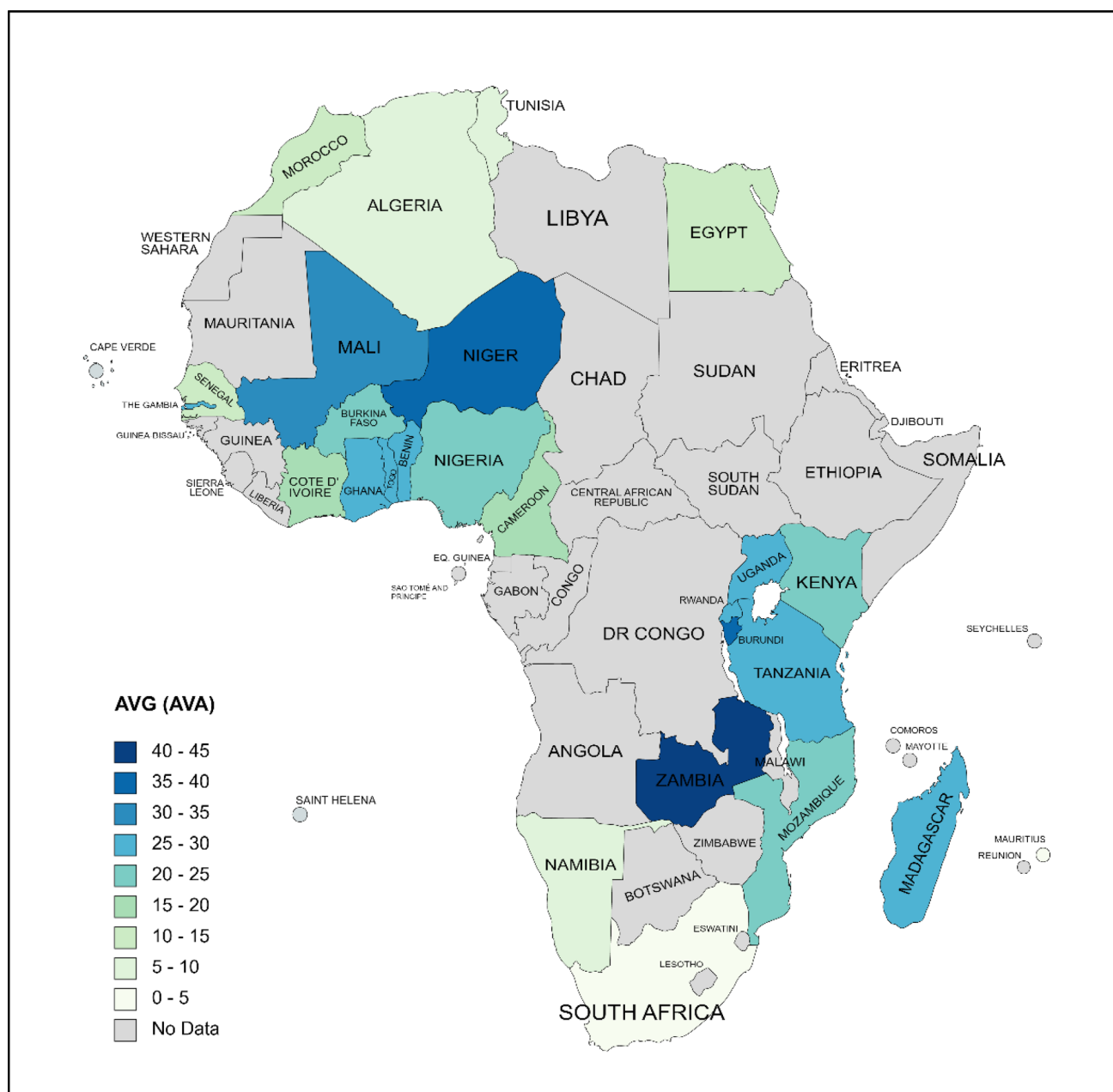


Fig. 1 Average values of agricultural value-added on the African Continent. Source: Authors' creation.

variables, suggesting potential areas for further investigation or alternative strategies to enhance agricultural productivity.

Fertiliser Consumption

The analysis reveals a significant negative impact of fertiliser consumption in six countries: Benin, Burundi, Kenya, Madagascar, Mali, and Zambia, indicating potential inefficiencies or adverse effects from fertiliser use. Conversely, positive impacts are observed in countries such as Cameroon, Egypt, and Rwanda, suggesting effective fertiliser utilisation to enhance productivity.

Employment in Agriculture

Eleven countries demonstrate a significant positive impact of employment in agriculture on agricultural value-added, underscoring the importance of labour in enhancing agricultural value-added. However, Kenya and Benin show a significant negative impact, indicating possible issues with labour productivity or the need for improved resource allocation and training.

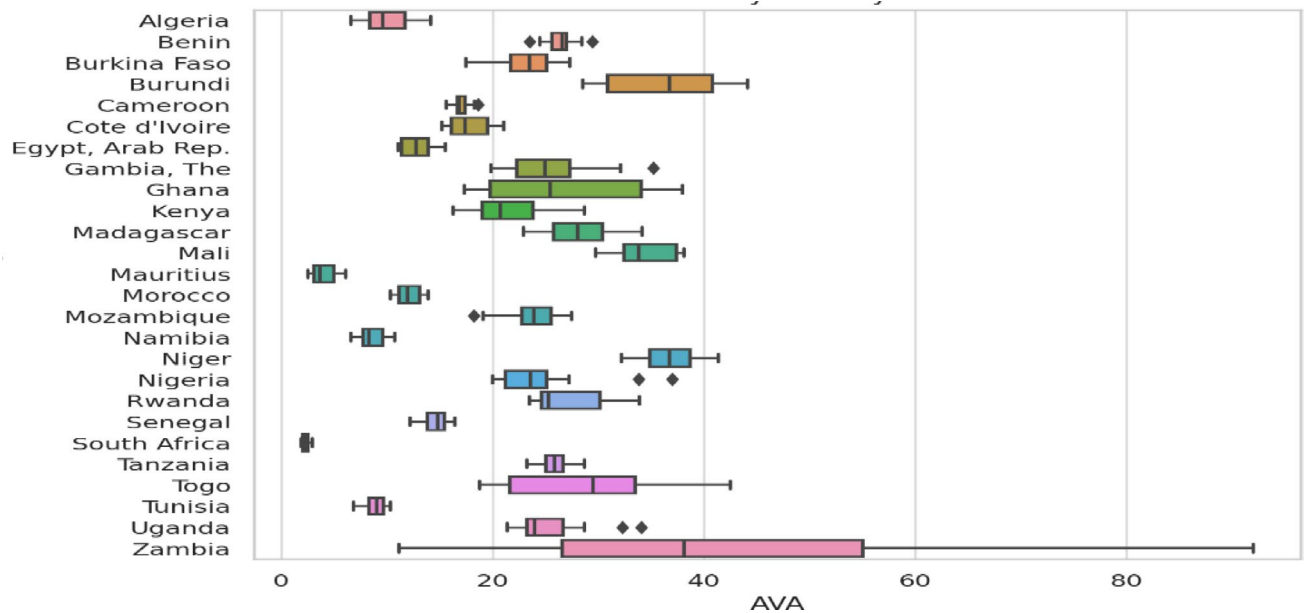


Fig. 2 Boxplot of agricultural value added

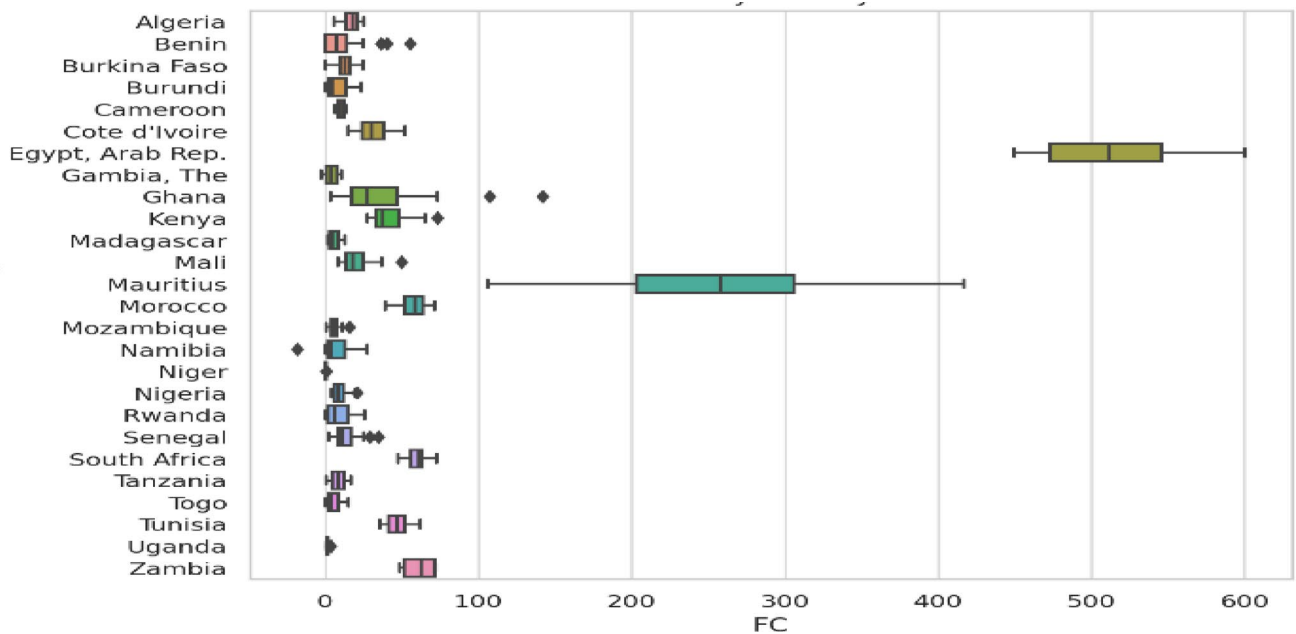


Fig. 3 Boxplot of fertiliser consumption

Agricultural Raw Material Export

Countries like Egypt and Namibia, exhibit positive impacts from agricultural raw material export, highlighting the benefits of integrating into global markets. Negative impacts, however, are seen in The Gambia and Nigeria, suggesting challenges in export practices or an over-reliance on raw materials without sufficient value addition.

Comprehensive Influences

Some countries such as Algeria and Senegal, significantly influence agricultural value-addition through both fertiliser consumption and agricultural raw materials export, underscoring the dual importance of effective fertiliser use and export integration. Significant impacts from both employment in agriculture and agricultural raw materials export are observed in Egypt, Ghana, Namibia, Senegal, and Togo,

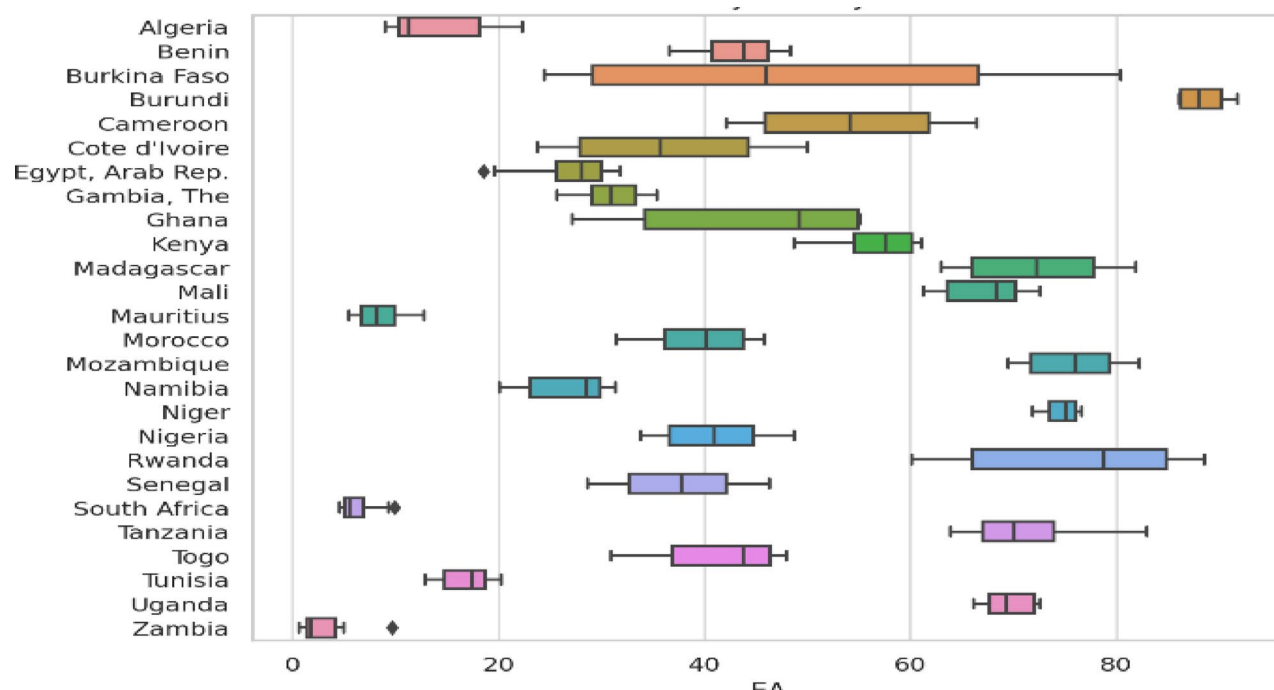


Fig. 4 Boxplot of employment in agriculture

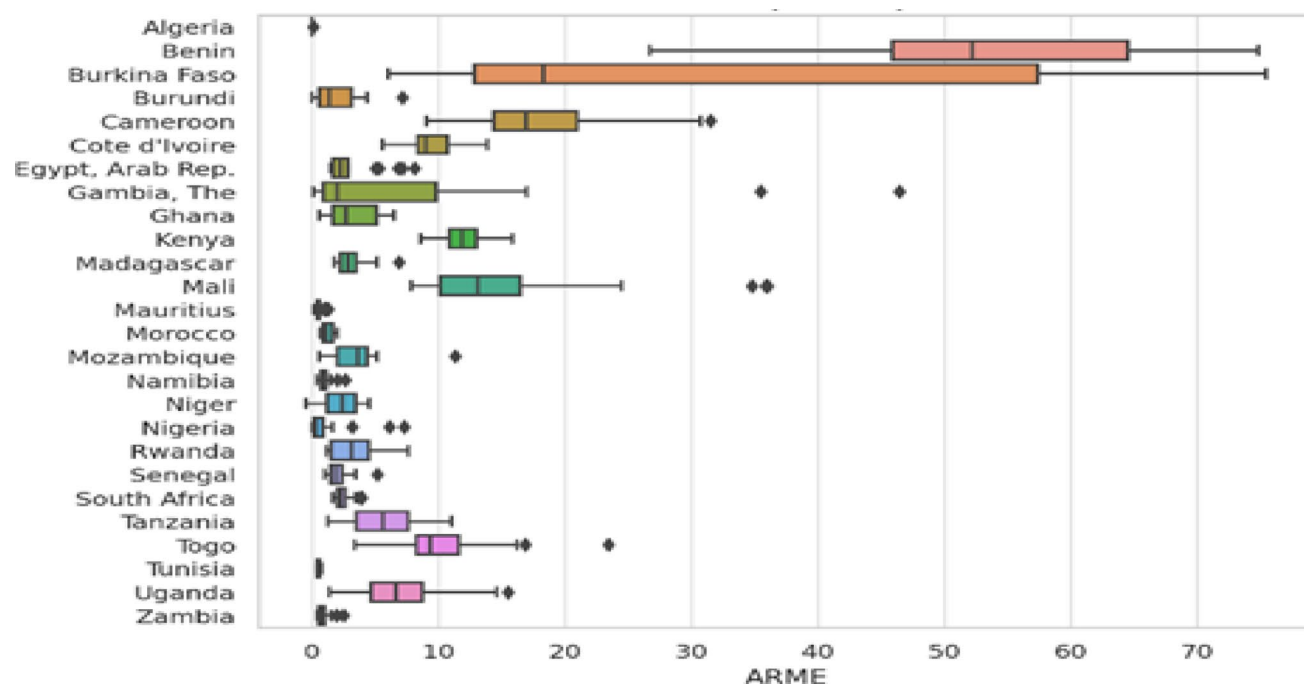


Fig. 5 Boxplot of agricultural raw material export

emphasising the importance of labour and export activities in these economies.

Further details regarding the study's findings for the African region are provided in the appendices. Supplementary Materials S2 shows the average agricultural value-addition values for different continents, emphasising Africa's higher

mean agricultural value-addition. Supplementary Materials S3 presents descriptive statistics for agricultural value-addition, fertiliser consumption, employment in agriculture, and agricultural raw materials export for the African region, based on data collected from 26 countries between 2000 and 2021. Supplementary Materials S4 illustrates the outcomes

Table 2 Significant coefficients values for African region

Countries	Agricultural value-addition		
	Fertiliser consumption	Employment in agriculture	Agricultural raw materials export
Algeria	0.1197**		43.0519***
Benin	-0.0262*	-0.3306***	
Burkina Faso			
Burundi	-0.3125***	1.6016***	
Cameroon	0.2272**	0.0688**	
Cote d'Ivoire	0.1339***		
Egypt Arab Rep.		0.1899***	0.4005***
The Gambia, the			-0.0972*
Ghana		0.5576***	1.1843*
Kenya	-0.1432***	-0.7441***	
Madagascar	-0.4222***		
Mali	-0.1455**	-0.8795***	
Mauritius		0.4335***	
Morocco			
Mozambique	0.2412*		
Namibia		0.2481**	1.4336**
Niger	-4.7842*		1.5374**
Nigeria			-0.3294*
Rwanda		0.4182***	
Senegal	0.0765**	0.1413**	-0.7171**
South Africa	0.2931***	0.1849**	
Tanzania	0.2931***	0.1849**	
Togo		0.9818***	-0.3359*
Tunisia			
Uganda			
Zambia	-1.7682***		

MLR denotes multiple linear regression

*Significant at 10%

** Significant at 5%

***Significant 1% significance level

of three models (Fixed Effects, Random Effects, and MLR) applied to data from African countries. Finally, Supplementary Materials S5 includes a graph displaying the dependent variable over time, accounting for outliers in certain nations.

The integration of panel data and country-specific time-series analyses provides a comprehensive understanding of factors influencing agricultural value-addition in Africa. These findings highlight the importance of tailored policy interventions to enhance agricultural productivity in Africa. By optimising inputs, improving labour productivity, and enhancing export practices, African nations can harness their agricultural potential, contributing to economic development.

Discussion

The impact of economic globalisation on agricultural value added varies considerably across different regions and countries. This study found that certain variables, such as fertilizer consumption, employment in agriculture, and agricultural raw material export, have significant effects in some contexts but are inconsequential in others.

Regional Impact of Economic Globalization

Our analysis shows that total agricultural exports have a substantial impact on agricultural value added in South Africa and Ghana, reflecting an increasing trend in agricultural exports in these countries [14]. These findings highlight the importance of considering regional differences when examining the relationship between economic globalisation and agricultural value added, as the contextual factors shaping this relationship can vary significantly [10, 22].

Impact of Specific Variables

The fertilizer subsidy programme in Ghana has positively influenced the quantity of fertilizer used by farmers, potentially boosting agricultural productivity [2]. However, the employment implications of South Africa's agricultural sector are mixed. Despite significant potential, certain factors limit its impact on job creation [25]. In most low and lower-middle-income countries, including many African nations, employment in agriculture has a high level of impact on agricultural value added [26]. However, in South Africa, none of the variables (fertiliser consumption, employment in agriculture, and agricultural raw materials export) significantly impacted agriculture value added, which aligns with previous research. Conversely, agricultural raw material export had a considerable impact on agriculture value added, while fertilizer consumption was insignificant in Ghana.

Broader Economic Implications

In Nigeria, agricultural value added positively influences the economy both in the short and long term. However, its overall impact on economic growth is relatively insignificant, suggesting that other factors may play a more substantial role in driving economic growth [5]. A negative association exists between agricultural value added and current account balances in Nigeria, highlighting the complex dynamics at play [3]. Nevertheless, there is a significant correlation between agricultural exports and economic growth, indicating the potential for leveraging agricultural exports to stimulate economic growth [5].

The relationship between agricultural exports and economic growth is subject to significant variations and contextual factors across different regions and countries [19]. While the agricultural sector in African countries hold promise for elevating economic growth through value addition, continued improvements are imperative, especially in countries such as South Africa [21]. The impact of specific variables, such as fertilizer consumption, agricultural raw material export, and employment in agriculture, on agricultural value added necessitates tailored policy interventions that account for contextual factors and address specific challenges faced by each region to promote agricultural productivity and enhance the sector's contribution to economic growth.

Policy Implications

Numerous challenges facing agriculture in sub-Saharan Africa have been discussed in past literature [2, 7, 18]. Four broad classes of problems and constraints including issues with rural infrastructure, technology, harmful economic policies, and institutional arrangements, underscoring the need for a more proactive role for the state to address these challenges [9]. Additionally, efforts by organisations such as the Comprehensive Africa Agriculture Development Programme (CAADP) and the Alliance for a Green Revolution in Africa (AGRA) have been highlighted, emphasising the importance of understanding current agricultural policy-making processes and the political economy motivations that underlie them [6, 18].

Based on current research findings, several policy implications can be recommended for African countries to promote sustainable economic growth and development in the agriculture sector.

First, policies should be designed to encourage the balanced use of fertilisers in agriculture, as this has been found to positively impact agricultural production and value-addition. However, excessive use of fertilisers may have negative environmental impacts and threaten long-term sustainability. Thus, policies should aim to balance fertilizer use to optimise agricultural value added while minimising environmental effects. This can be achieved through subsidies and incentives to encourage farmers to adopt fertiliser use, as well as investment in research and development to improve its efficiency and effectiveness.

Second, policies should promote employment in the agriculture sector, particularly among youth and women [8]. This can be achieved through targeted investments in skills development and education, as well as providing access to finance, markets, and infrastructure to support small-scale farmers and agribusinesses. The quality of human resources should be prioritised over the sheer number of workers,

focusing on knowledge and technical inputs to maximise value addition [12].

Third, policies should encourage the export of agricultural raw materials in value added form to increase value-addition and create more jobs in the agriculture sector. This can be accomplished by implementing policies that promote the development of agro-processing industries, providing access to finance, technology, and infrastructure, and facilitating market access for value-added products.

Lastly, African countries can learn from policies implemented in other regions that have successfully promoted sustainable economic growth and development in the agriculture sector. For example, policies that promote public-private partnerships, value chain development, and the adoption of new technologies and innovations have been successful elsewhere and can be adapted to the African context. Policymakers must recognise the diversity of African countries and tailor policies to suit each country's specific needs and contexts.

Conclusions

The African continent demonstrates the highest average value for agricultural value added compared to other continents. Various researchers have identified specific variables influencing agricultural value added [23, 26]. This study aims to analyse the effects of fertiliser consumption, employment in agriculture, and agricultural raw material export on agriculture value added in the African region. Utilising a RE model and employing multiple linear regression, the researchers investigated both regional and country-specific implications for agricultural value added.

The statistical findings reveal that employment in agriculture positively influences agricultural value added at significance levels of 5% and 1% while fertilizer consumption and agricultural raw material export significantly negatively impact agricultural value added at a 1% significance level. Specifically, in Senegal, all selected variables significantly affect agricultural value added. However, Burkina Faso, Morocco, South Africa, Tunisia, and Uganda show insignificant effects on agricultural value added. Nonetheless, other countries exhibit at least one or two variables that significantly impact this sector. These insights provide valuable information on the underlying mechanisms influencing agricultural value added and offer policy recommendations to optimise benefits while mitigating drawbacks.

The study's implications for policymakers suggest promoting employment in agriculture to positively impact agricultural value added while addressing fertilizer consumption and agricultural raw material exports to mitigate adverse effects on the sector. Governments may need to introduce

subsidy schemes to promote fertilizer use in farmlands, particularly in regions affected by poverty. Moreover, policymakers can learn from successful policies implemented in other regions and tailor them to each country's specific needs and contexts.

Despite its contributions, the study has limitations worth acknowledging. Due to data availability, the analysis was limited to a maximum of 26 countries in the African continent and the time period between 2000 and 2021. Omitted variable bias may exist, and the exclusion of certain variables due to data limitations could influence the results. Incorporating more recent data could enhance accuracy and relevance. Additionally, the study's results may lack generalisability to other contexts, given the specific sample and methodology employed.

In conclusion, with appropriate policies in place, the agriculture sector in Africa can drive economic growth, job creation, and improved food security for the continent's growing population. By promoting sustainable practices and addressing key challenges such as fertilizer consumption, employment in agriculture, and agricultural raw material exports, policymakers can ensure the sector's continued growth and contribution to Africa's development.

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Author Contributions KW and RJ conceptualised the study. KW and RJ contributed to the design and conduction of the study. KW and RJ undertook data analysis and interpreted the data. KW and RJ drafted the first manuscript. All authors critically reviewed, edited, and approved the final manuscript.

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Data Availability All data are fully available without restriction. All relevant data are provided with the supporting information file.

Declarations

Conflict of Interest The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Ethical Approval This study was approved by the Sri Lanka Institute of Information Technology, Sri Lanka (PVC/RI/EC/2023/07).

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