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The effect of institutional quality on agricultural value added in East Africa

Biru Gelgo [a,*], Adeba Gemechu [a], Amsalu Bedemo [b]

[a] College of Agriculture and Veterinary Medicine, Jimma University, Ethiopia
[b] School of Policy Studies, Ethiopian Civil Service University, Ethiopia

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ABSTRACT

This study investigates the effect of institutional quality on agricultural value added in East Africa. It uses a panel dataset spanning from 2000 to 2020, taken from seven East African countries. The data obtained from the World Bank, Mo Ibrahim Foundation, and FAO databases were analyzed using the bias-corrected LSDV model. The results show that voice and accountability has a negative significant effect on regional agricultural value-added, while government effectiveness has a positive significant effect on regional agricultural value-added. Besides, higher per capita gross domestic product, a lower proportion of rural population, and a higher proportion of education expenditure appeared to have significant incremental effects on agricultural value-added. The results imply that institutional quality has a vital role in dictating the growth of agricultural value-added in East Africa. In this region, effective institutions increase agricultural value-added. Governments and other development practitioners should thus work to enhance the effectiveness of the related institutions in the region. Strengthening and improving the performance of such institutions is essential for a sustained increase in agricultural value-added. This would be more operational if combined with increased expenditure in education and the low size of the rural population.

1. Introduction

Economic literature has extensively discussed and depicted poverty as a major worldwide concern. Globally, the number of poor people has been steadily increasing. Over 70 million more individuals fell below the extreme poverty level in 2020, and more than 80 % of them lived in rural areas and worked in agriculture [1]. The agricultural sector has a significant role in reducing poverty in the majority of emerging economies [2]. For the underprivileged members of society, the sector serves two purposes. It provides food for the poor in one way and helps them escape poverty in another way. According to Gassner et al. [3], increasing agricultural yields is vital to enable smallholders to grow sufficient crops to feed their families. Once food needs are met, farmers sell a surplus, which helps them move out of poverty. In practice, however, this has often been less practical in most of the developing nations, particularly in Africa. On this continent, agriculture has continued to play a strategic role in the process of economic development. The sector has been the primary victim of political manipulation [1], which usually influences agricultural growth and the pace at which it can be translated into poverty reduction [4,5]. As such, without understanding the underlying political and economic institutions at work, the promising growth rates registered across Eastern African countries such as Ethiopia and Tanzania over the last decade are less likely to

* Corresponding author
E-mail address: birugelgo@gmail.com (B. Gelgo).

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be sufficiently translated into poverty reduction [6].

Theoretically, competitive market behavior was largely considered to explain production growth by classical economists [7]. Capital and labor were the key variables used to explain output growth, where capital is assumed to be freely available to all enterprises. Criticizing this, modern growth models include human capital in production processes and take externalities into account [8,9]. The endogenous growth theory makes an effort to address the primary flaws of the conventional growth theory by explaining the role of endogenous factors such as human capital stock and research and development activities as the main engines of economic growth. These theories, however, largely ignored the role of institutions in the growth process. North [10] argues that the cultivation of efficacious institutions is important for molding individual interests in an economy. Inadequate institutional quality impedes economic activities, as it permits economic actors to engage in redistributive politics that yield negligible economic benefits [11]. According to North [12], institutions of superior quality effectively foster an incentive structure that engenders increased economic growth. High-quality institutions possess the capacity to facilitate a country's assimilation of novel technologies [13].

In Africa, a number of continental frameworks and declarations have been developed in the last decade to address the rising continental food demand. The Agenda 2030 of the United Nations (UN) and Agenda 2063 of the African Union (AU) consist of several goals in relation to agricultural growth [14,15]. Promoting sustainable agricultural growth, ensuring food security, and eradicating poverty and hunger were some of the main focal areas. While the majority of these goals have been progressing, some others, including strengthening institutions, appear to be regressing [15]. According to Salami et al. [2], in Eastern Africa, institutional support for agricultural development has been inconsistent and inadequate, and weak administrative capacity has constrained governments' ability to effectively implement agricultural policies. These authors also note that regional per-worker average agricultural value added (AVA) falls quite below the world average. In this line, understanding the role of institutional performance on agricultural growth is vital for future agricultural policy design, and this, among others, has motivated the initiation of the current study.

Empirically, many studies attempt to examine the role of institutions in growth, relying on overall economic growth and cross-country evidence. Some of these studies contend that institutional quality has an impact on government policies, which in turn affect economic growth [16–18]. Some others attempt to link institutional quality indicators directly to economic growth [16,19–22], providing quite varying results. However, while these studies emphasize the importance of strong and better-performing institutions for economic growth, they are heavily biased towards general economic growth [20,22–25], with little attention paid to the agricultural sector exclusively. Nevertheless, given the fact that the economies of many poor countries heavily depend on agriculture, improving institutional quality that facilitates sectoral value addition would be of great importance for the overall development of these countries. Yet, the existing institution-growth nexus evidence is too broad to contextualize to many of these countries, particularly East Africa [for instance, 25, 26], and some studies include a large number of countries in the analyses [20,25], mainly to overcome the problem of small sample bias. Against this background, this study thus asks a specific research question, stated as: What is the effect of institutional quality on agricultural value-added in East Africa? To answer this question, the study uses a cross-sectional time series panel of datasets obtained from seven East African countries, spanning from 2000 to 2020.

The study contributes towards filling the stated gaps by using data drawn from relatively fewer countries and an estimator that accounts for such biases. Given the complex and country-specific nature of institutions, studies with a large number of panels would trade off the estimators' robustness with the overall qualities of the findings. Focusing on East Africa, the present study provides contextual findings employing the bias-corrected least squares dummy variable (LSDVC) estimator presented by Bruno [26]. Besides relying on the AVA model, augmented with alternative institutional quality indicators, the study provides timely information for the existing heterogeneous literature on the institution-growth nexus.

2. Theoretical and empirical literature

Classical economists place a strong emphasis on competitive market behavior when explaining output growth, overlooking the role of institutions. The classical growth models, pioneered by economists such as Adam Smith, Thomas Malthus, and David Ricardo, present accumulation and productive investment as the key forces behind economic growth [7]. They presume that productivity growth and technological progress are fully external and freely available to all nations. In the neoclassical tradition, Solow [27] uses capital, labor, and knowledge as key variables to explain output. The new classical growth models challenge the classical and neoclassical models as having supposedly ad hoc expectations and assumptions [28]. The neoclassical models are mostly limited in a dynamic setting as they do not assume externalities and state the role of factors such as education and institutions. Modern growth models include human capital in production processes and take externalities into account [8,9]. The new growth theory, also known as endogenous growth theory, makes an effort to address the primary flaws of conventional growth theories. It explains the role of endogenous factors such as human capital stock and research and development activities as the main engines of economic growth. However, the role that institutions play in shaping economic growth was largely ignored.

According to North [10], societies need effective, impersonal contract enforcement because of personal ties, voluntaristic constraints, and ostracism. The cultivation of efficacious institutions is thus of utmost importance in molding individual interests in the economy that dictates aggregate growth. In the agricultural sector, as the process of AVA becomes more complex, the need for legal and stronger institutions increases to overcome information asymmetry and protect parties' engaged in the production process. Actors in the value chain can be protected against the risk of opportunism through institutional arrangements [29]. According to Lin et al. [30], institutions facilitate contractual agreements at different stages along a value chain. It creates an enabling environment for a country's agricultural competitiveness, as good governance is critical to expanding demand bases. Furthermore, processed agricultural products need quality standards, which can be enforced through quality institutions. Countries with lower institutional quality may not be able to fulfill these requirements and would earn low incomes [31]. In general, institutions shape incentive frameworks prevalent within a given society, potentially augmenting or impeding economic pursuits therein. Inadequate institutional quality impedes economic activities, as it permits economic actors to engage in redistributive politics that yield negligible economic benefits [11]. Due to this, the process of AVA could be under serious threat under a poor governance situation [32]. Institutions of superior quality are effective in fostering incentive structures in economies via the reduction of uncertainty [12]. It possesses the capacity to facilitate a country's assimilation of novel technologies, a crucial factor in advancing a country's developmental trajectory. The induced innovation hypothesis treats institutions and technology as endogenous responses to the forces of factor supply and product demand in the production process [33]. This theory argues that institutions are key factors in agriculture's productivity and value-added.

Empirically, several studies attempt to explain the role of institutions in output growth, though they have been largely within the framework of overall economic growth. A critical review by Evans and Ferguson [34] noted that democracies are necessary for the maintenance of economic growth while political instability is harmful, owing to its effect on investors' confidence. They argue that democracy and growth reinforce each other. Once a higher level of democratic capital has been achieved, democracy reinforces growth. Economic institutions are generated through political processes and are subject to change via political institutions. The study further noted that in Africa, democracy has not been able to effectively deliver public goods policies as politics remains fragmented along regional and ethnic lines.

According to Heshmati and Kim [35], democracy has a positive effect on economic growth. The authors argue that the availability of credit guarantees and increased inflows of foreign direct investment support the positive impact of democracy on economic growth. Credit guarantees largely explain the positive link between democracy and economic growth. Inflows of foreign direct investment were found to have a weaker effect in less democratic countries than in non-democratic ones. The study aimed to investigate the relationship between economic growth and democracy. They used static and dynamic models on a panel dataset running over a period of 1980–2014 for 144 countries.

Swinnen [36] showed that, relatively, a poorer farmer benefits more from democratization compared to a richer farmer. They underscored that political considerations are crucial in agricultural policy analysis since almost all agricultural policies are subject to lobbying and pressure from interest groups. Decision-makers would also influence society for both economic and political reasons. According to Allcott et al. [37], in Latin America, political and institutional factors are the key determinants of the size and structure of rural public expenditures, which in turn influence agriculture's gross domestic product (GDP). The study aimed at examining the effects of the size and composition of rural expenditures on agricultural GDP on this continent. The authors used fixed effect (FE), random effect (RE), quasi-fixed effect, general method of moments (GMM)-system estimator, and 3SLS models on a 1985–2001 panel dataset of 15 Latin American countries.

A study by Gjerde [19] underscores the importance of institutions for economic growth in developing and developed economies. He investigated the role that institutions play in economic growth by handling the adverse effects of inequality by constructing three alternative institutional threshold indexes using principal component analysis (PCA). The threshold indices were higher among the developed countries compared to those of the developing countries. When institutions are below the estimated threshold level, inequality has a negative effect on growth. When institutions develop beyond that level, growth is noted to take place easily.

Conflict and corruption control have been shown to have a significant impact on agricultural productivity in Sub-Saharan Africa (SSA), whereas government effectiveness does not [38]. The lower indexes of these indicators were linked to lower performance in agricultural productivity. According to Ehighebolo and Braimah [16], political institutions have a negative effect on economic growth in Nigeria. The study aimed at exploring the role of political institutions on the economic performance of Nigeria using descriptive statistics on a dataset extended over a period of 1999–2018. Noting that political institutions in Nigeria are inefficient, they argue that democracy is not sufficient to achieve sustained economic growth and thus should be complemented with strong rules that restrain the predominance of politicians' private interests at the expense of the citizens' will. The study used descriptive statistics and was thus methodologically less robust.

Another study by Wandeda et al. [21] claims that governance indicators, including political stability and absence of violence, regulatory quality, voice and accountability, corruption control, government effectiveness, and rule of law, have positive effects on economic growth in SSA. Similar findings were presented by AlShiab et al. [39] in their studies across East Asia and Central Asia, the Pacific, Europe, and North American countries. The authors showed that all six of the World Bank's governance indicators positively affect economic growth in these countries. Both studies employed similar analytical methods. Similarly, a study by Beyene [20] showed quite different results in SSA. Apart from regulatory quality, and voice and accountability, which have positive effects on economic growth, the remaining governance indicators showed negative effects, contradicting the findings of Wandeda et al. [21] and AlShiab et al. [39]. Besides, Beyene [20] noted that in SSA, better performance in the control of corruption, government effectiveness, and the rule of law had significantly negative effects on economic growth. Regulatory quality influences economic growth positively and significantly.

Wandeda et al. [21] note that exclusively in Eastern Africa, the coefficient of voice and accountability and political stability and absence of violence on economic growth turns negative and non-significant, while regulatory quality, rule of law, and government effectiveness turn non-significant, with their signs remaining consistent as reported for SSA. Wandeda et al. [21] incorporated data obtained from 35 SSA countries for the period between 2006 and 2018, while Beyene [20] included data obtained from 22 SSA countries spanning from 2002 to 2020 in the analysis. Both studies applied similar models. However, none of them takes note of the link between institutions and agricultural growth. Similarly, Garedow [22] studied the effects of political institutions, including the level of democracy, political violence, regime durability, and accountability, on economic growth in Ethiopia. Democracy had no effect on growth in the short run, whereas political violence had a significant negative effect. In the long run, both the democracy index and accountability negatively influenced real GDP per capita.

In general, the effectiveness of political and economic institutions depends on the political will of the government [22,40]. Many elements of economic growth are argued to be dependent on governance and institutions [34]. However, effective institutions may take very different forms across countries and regions. As such, region-specific studies are relevant, and in general, studies in this area are notably biased towards general economic growth, while little has been known regarding the effects of such institutions on the growth of AVA, particularly in East Africa.

3. Methods

3.1. Data sources and measurement of variables

This study was undertaken in East Africa. The region has been historically tied through many socio-economic and political set-ups [41], which explains why it was chosen for this study. It is among the most violent and has a weak governance system globally [42], with agriculture-dominated economies [43], that further justify the selection of the region as a unit of analysis. In this study, seven countries, namely Burundi, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda, are purposefully selected based on the availability of data. The study purely depends on secondary data that falls within the range of 2000–2020. The dependent variable is AVA measured in 2015 constant USD, while the explanatory variables fall under two broad categories: institutional quality indicators and control variables.

Institutional quality indicates the ability of the government to formulate and effectively implement sound policies, the method by which governments are elected, and the capacity of citizens to participate in and critique institutions that regulate economic and social interactions. The World Bank constructs a series of six governance indicators using Kaufmann et al. [44] methodology. The indicator scores are constructed with the help of the unobserved components model (UCM) applied to data obtained from surveys of various stakeholders. The UCM model helps to translate unobserved governance into observable data. The aggregate governance scores drawn this way have the same units as a standard normal random variable, ranging approximately from −2.5 (worst) to 2.5 (best). These indicators have been widely used in previous literature to explain general economic growth [20,25,45] and are used in this study to explain AVA. Similarly, the aggregate governance quality data provided by the Mo Ibrahim Foundation is also considered. The Foundation collects data provided by external sources, which it then normalizes using the min-max normalization method, allowing all scores to be in common units spanning from 0 (worst) to 100 (best) [46]. Based on the prior studies [20,25,45], improved institutional quality is expected to enhance AVA. Good governance helps to make sure that some complementary services are effectively delivered during the agricultural value-adding process.

Along with institutional quality, other variables, including gross fixed capital formation (GFCF), arable land, education expenditure, rural population, GDP, foreign direct investment (FDI), and year dummies, are considered based on theories and prior empirical studies. Land and human capital are among the most widely expounded output growth attributes since the beginning of the classical growth model [8,9,27,47]. According to Ben Jebli and Ben Youssef [48], larger agricultural land increases production, allowing AVA to rise. Larger farms encourage the use of modern farm technologies, which in turn influences AVA. This is supported by Sinha [49], who claims that arable land has a long-term beneficial and consistent impact on AVA growth. In this study, land is measured as a proportion of land that is arable. Human capital is widely noted to be an important growth attribute, proxied with different indicators subject to the availability of the data. Beyene [20] proxied by school enrollment, while Cole and Chawdhry [50] proxied by human capital investment. In the current study, human capital is proxied with education expenditure, presented as a proportion of gross national income. According to Badri et al. [51], education improves labor productivity. It allows one to understand, predict, recognize, and address business needs. Improved education boosts AVA as educated labor takes advantage of various opportunities in the process of AVA [52]. Following Allcott et al. [37], GDP is also considered an attribute of AVA. According to Singariya and Sinha [53], the share of the agricultural sector and real GDP growth move in opposite directions. Nevertheless, as GDP rises, the nominal expenditure in

Table 1
Data sources, description, and hypotheses.

Variable	Description	Hypothesis	Source
Dependent Variable			
AVA	The level of agricultural value added in 2015 constant USD	–	World Bank
Independent variables			
VA	Voice and accountability scores: 2.5 (worst) to +2.5 (best)	+ve	World Bank
PV	Political violence scores: 2.5 (worst) to +2.5 (best)	+ve	World Bank
GE	Government effectiveness scores: 2.5 (worst) to +2.5 (best)	+ve	World Bank
RQ	Regulatory quality scores: 2.5 (worst) to +2.5 (best)	+ve	World Bank
RL	Rule of law scores: 2.5 (worst) to +2.5 (best)	+ve	World Bank
CC	Control of corruption scores: 2.5 (worst) to +2.5 (best)	+ve	World Bank
GOV	Mo-Ibrahim's governance scores: 0 (worst) to 100 (best)	+ve	Mo Ibrahim foundation
GFCF	Gross fixed capital formation as a % of GDP	+ve	World Bank
Land	Area of arable land as a % of land area	+ve	FAO
Educ	Education expenditure as a % of GNI	+ve	World Bank
Pop	Rural population as a % of total population	-ve	World Bank
GDP	Per capita GDP (constant 2015 USD)	+ve	FAO
FDI	Net inflow of FDI as a % of GDP	+ve	World Bank
Dy7, Dy8 and Dy9	Year dummies representing the years 2007, 2008, and 2009's economic crises respectively	-ve	World Bank

agriculture increases, which then enhances AVA by providing better infrastructure and inputs for those engaged in AVA. Countries with higher levels of economic development are thus expected to participate more in AVA [54]. In this study, GDP is measured in per capita constant 2015 USD. Following Cole and Chawdhry [50] and Osabohien et al. [55], GFCF is considered a potential AVA attribute. It has a positive influence on AVA in developing countries [51]. A larger GFCF improves farm infrastructure by encouraging the use of machines and equipment that support the production process in agriculture, enhancing value addition. Rural populations are controlled in an AVA model following Muyanga and Jayne [56]. A larger population provides a larger market base, which encourages competition and induces innovations as well as technological advancements [57]. FDI is deemed a growth attribute, following Omeje et al. [58]. The rationale behind the use of FDI is that it increases AVA through improvements in managerial skills and the advancement of production technologies [59]. We also considered year dummies that indicate global economic shocks ranging from 2007 to 2009 to predict the growth of AVA, as noted by Kose et al. [60]. Descriptions of the employed variables are briefly presented in Table 1.

3.2. Model specification

Several studies use simple linear relationships to explain the effect of institutional performance on output growth [25,38,50]. However, this model receives criticism as it assumes a smooth and continuous curve. A recent theoretical output growth model by Nawaz et al. [45], based on Steger [61], considers institutions as distortionary measures in the production process. Steger [61] uses a CES production function to explain the role of distortions in the production process as presented in Equation (1).

$$y(t) = (1-\rho)\left[Ak(t) + Bk(t)^{\beta}\right] \tag{1}$$

Where *A, B,* and β $(0 < \beta < 1)$ denote constant technology parameters, and y denotes gross output. The distortion index ρ, according to Steger [61], falls between *0* and *1*, with the lowest value representing the best institutional quality index.

Olmstead and Rhode [33] note that agriculture mostly employs non-reproducible inputs that are subject to diminishing returns and cannot easily fit into such a growth model. Instead, Cobb-Douglas type production functions are widely used, making effective relationships non-linear while preserving the linear model. The growth of AVA is, of course, rooted in the growth of agricultural outputs, sharing many similar attributes. According to Lu and Dudensing [62], AVA is the agricultural outputs handling and processing income returned to the people who work, own, or invest in the farming industries. As such, the agro-processing industries growth, for instance, stimulates both the growth of agricultural outputs and their value addition. This could be the reason why many AVA models are drawn from agricultural growth models [51,59,63]. Some studies use simple linear relationships to model AVA [48,52,64], while others, for instance Epaphra and Mwakalasya [59] use a log-log function, arguing that such a model reduces the severity of the regressors heterogeneity. For the present study, we primarily rely on the works of Anwana et al. [32], Nawaz et al. [45], and Chomen [25], as the models used in these study are able to estimate a log-linear relationship between AVA and institutional quality [32], while preserving a log-log relationship among other control variables [51,59]. Based on this, we draw the following AVA model (Equation (2)).

$$y_{it} = \theta + \beta I_{it} + \vartheta X_{it} + \varepsilon_{it} \tag{2}$$

Where y_{it} is the log of AVA in the country *i* at year *t*, *I* is a measure of the institutional quality, *X* is a log-transformed vector of control variables outlined earlier, ε_{it} is the error term, and $\theta, \beta,$ and ϑ are parameters to be estimated. In the above equation, the error term has two orthogonal components: the FE, μ_i and the idiosyncratic shock, ν_{it} presented as follows (Equation (3)):

$$\varepsilon_{it} = \mu_i + \nu_{it} \tag{3}$$

Where $E[\mu_i] = E[\nu_{it}] = E[\mu_i \, \nu_{it}] = 0$.

Considering the dynamic nature of AVA growth, Equation (2) can be reframed as follows (Equation (4)):

$$y_{it} = \theta + \varphi y_{i,t-1} + \beta I_{it} + \vartheta X_{it} + \varepsilon_{it} \tag{4}$$

The coefficient of the lagged y_{it} is represented by φ. In the current study, the stochastic version of the growth-institution relationship, along with the other control variables, is generally constructed as follows (Equation (5)).

$$lnAVA_{it} = \beta_0 + \beta_1 IQ_{it} + \beta_2 lnGFCF_{it} + \beta_3 lnLand_{it} + \beta_4 lnEduc_{it} + \beta_5 lnPop_{it} + \beta_6 lnGDP_{it} + \beta_7 lnFDI_{it} + \beta_8 Dy7 + \beta_9 Dy8 + \beta_{10} Dy9 + \varepsilon_{it} \tag{5}$$

The dynamic expression of Equation (5) then takes the following form (Equation (6)):

$$lnAVA_{it} = \beta_0 + \beta_1 lnAVA_{i,t-1} + \beta_2 IQ_{it} + \beta_3 lnGFCF_{it} + \beta_4 lnLand_{it} + \beta_5 lnEduc_{it} + \beta_6 lnPop_{it} + \beta_7 lnGDP_{it} + \beta_8 lnFDI_{it} + \beta_9 Dy7 + \beta_{10} Dy8 + \beta_{11} Dy9 + \varepsilon_{it} \tag{6}$$

Where Ln is the natural log operator, *IQ* is the institutional quality indicator, including *VA, PV, GE, RQ, RL,* and *CC*. *AVA*, *GFCF*, *Land*, *Educ*, *Pop*, *GDP*, *FDI*, and *Dy7 - Dy9* areas explained earlier (Table 1). The parameter represented by β_0 is a constant, and those represented by β1 - β11 are coefficients of explanatory variables, whereas *t* is the time operator, ε is the error term, and *i* is the country indicator.

In the above relationship, the use of appropriate estimation techniques is important to obtain robust estimates. However, time-series cross-sectional data is likely to have complex and non-spherical error structures [65]. Statistical issues such as heteroscedasticity and serial/autocorrelation may exist in the model and have an impact on the estimates [66]. Controlling for these statistical issues, several models appear to be candidates: the LSDVC, Arellano and Bond's (1991) GMM-DIF estimator, and Blundell and Bond's (1998) GMM-SYS estimator. However, in a panel data model specification with a small number of cross-sectional units, GMM and GMM-SYS estimators can be severely biased [26]. In such cases, though the use of small samples in macro-panels is very common, GMM estimators would not be consistent. The bias-corrected LSDV estimator (LSDVC) is recommended in this case [26]. Bun and Kiviet [67] showed that the bias approximation in the LSDVC is capable of accounting for more than 90 % of the actual bias that may arise due to small samples. This bias-correction procedure is robust to heteroskedasticity and autocorrelation [26]. Given the error term (ε_{it}) in Equation 7, heteroskedasticity exists when the error variance is not constant. That is, var $(\varepsilon_{it}|X_{it}) = \delta^2_{it}$. A serial correlation exists if the errors in two different time periods (t and s) are correlated [68]. That is, corr $(\varepsilon_{it}, \varepsilon_{is}) \neq 0$ for all $t \neq s$. An efficient estimator can be obtained through re-weighting the data, which helps to control for both heteroskedasticity and auto/serial correlation. To get rid of fixed effects (μ_i), the LSDVC estimation procedure computes the N vector of fixed-effect estimates. This estimate uses the mean of the vectors from both the response and explanatory variables, leading to bootstrapped errors (ε_{it}) that are robust to both heteroskedasticity and serial correlation as a draw from $N(0, \delta^2)$ [26]. The procedure, however, is not feasible on unbalanced panels. Bruno [26] extends this to allow estimation with small N and unbalanced panel data by employing estimators from Anderson and Hsiao [69] (*AH*), Arellano and Bond (1991) (*AB)*, and Blundell and Bond [70] (*BB*).

The *AH* makes use of two *IV* estimators that use the second lag of the dependent variable, either differenced or in levels, as an instrument for the differenced one-time lagged dependent variable [69]. The AB utilizes a GMM estimator for the first-differenced model, which is more effective than the AH since it relies on more internal instruments [69]. The first-differenced IV or GMM estimators may have small-sample bias as a result of poor instruments when dealing with highly persistent but small-sample data. A system GMM estimator with first-differenced instruments for the equation in levels and instruments in levels for the first-differenced equation is used by BB [70]. Given the small sample size of the data in the current study and the existing alternative models, we opt to rely on Bruno [26]'s LSDVC method. For a very small cross-sectional dimension, the LSDVC estimator is preferred [26,71,72]. With less persistence in the data considered for this study, the estimator was initialized with the Arellano and Bond (1991) GMM and then relied on the first recursive correction of the bias of the FE estimator. Additionally, the statistical significances of the LSDVC coefficients were all corroborated using bootstrapped standard errors with 200 iterations [see 27] to overcome poor approximations of asymptotic standard errors that arise as a result of small samples [67].

3.3. *Unit root tests*

Prior to model estimation, the presence of key statistical issues in the dataset must be inspected. Panel data unit roots are among these issues. As explained in the earlier section, the LSDVC calls for GMM estimators that use first-differenced variables to remove panel-specific fixed effects [26]. Unit root tests are thus relevant to getting rid of spurious regression while using this model. To make it simple, consider the following typical model [73]:

$$\Delta y_{it} = \theta + \rho_i y_{it-1} + u_{it} \quad i = 1, 2, ... N \quad t = 1, 2, ..., T$$

In a single equation case, one could be interested in testing a null hypothesis of $\rho_1 < 0$ against the alternative hypothesis $\rho_1 < 0$. Instead

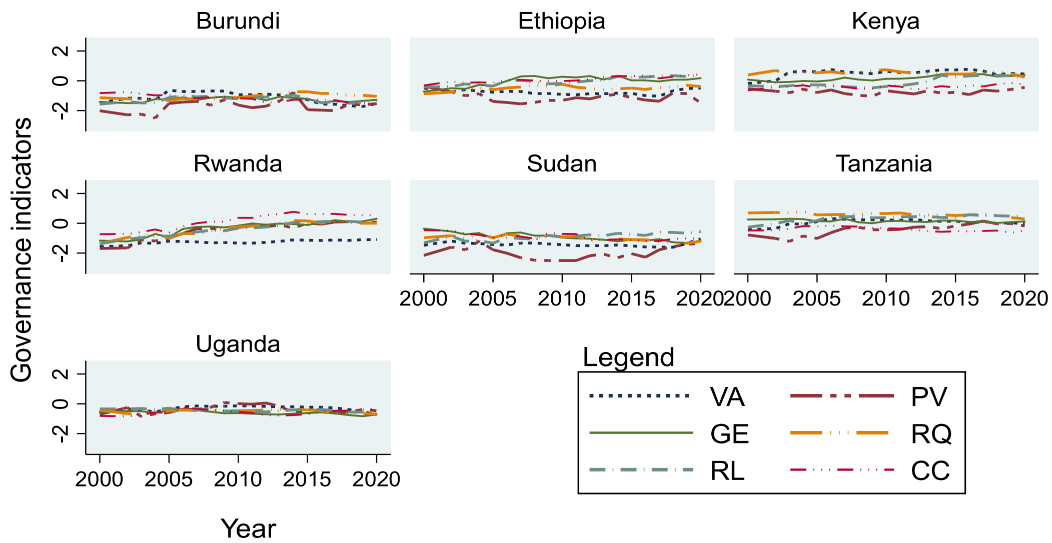

Fig. 1. Trends of institutional quality indicators.

of this, in the panel data case of the current study's type, the hypothesis we are interested in is testing a null hypothesis of $\rho_i < 0$ against the alternative hypothesis $\rho_i < 0$ for $i = 1, 2, \ldots, N$.

4. Results

4.1. Descriptive statistics

The descriptive statistics results are presented in Appendix A. The results show that in Eastern Africa, average VA, PV, GE, RQ, RL, and CC were about −0.936, −1.198, −0.759, −0.701, −0.751, and −0.782, respectively. The regional average GOV score was about 47.365, less than half of the overall governance performance. The average AVA was about $10900 million. On average, the regional average GFCF, arable land, education expenditure, and rural population were about 19.41 %, 23.242 %, 3.516 %, and 78.535 %, respectively. The regional average per capita real GDP was about $919.051, while the average FDI was about 2.284 %. Furthermore, the trends of change in institutional quality over the period 2000–2020 are presented graphically in Fig. 1. The trends show that there were variations in institutional quality scores across countries over time for each indicator.

The trends of change in AVA are similarly presented in Fig. 2. As demonstrated in the figure, rising trends in AVA are observed across most countries. In Burundi and Sudan, however, relatively horizontal trends with few fluctuations in AVA trends are revealed. Smoothly rising trends are witnessed in Ethiopia, Rwanda, Uganda, and Tanzania. A similar trend with modest fluctuations is exhibited in Kenya. Graphically, it seems that the 2007–2009 economic crises have translated into Kenya's AVA. Little fluctuation is experienced in Tanzania and Uganda during the same periods.

4.2. Principal component analysis

PCA is a statistical procedure that is widely used for data reduction. In this study, PCA is performed mainly to construct a composite governance index (CGI). It is a linear combination of the component indices constructed as: $CGI_i = \sum_{K=1}^{K} w_k x_{ki}$. The combination weight (w) is obtained through PCA and computed for k candidate indices (X_{ki}) where $k = 1, \ldots, K$ with N observations ($i = 1, \ldots, N$) [32]. The attached weights ($w_1, \ldots, w_k$) are normalized such that $||w||_2^2 = \sum_{K=1}^{K} w_k^2 = 1$ [74]. Furthermore, the variances of the principal components are demonstrated through eigenvectors. All components combined contain the same information as the original variables, but the important information is partitioned over the components, with earlier components containing more information than later ones. The first component (Comp 1) has the maximal overall variance, while the last component has the smallest variance. In this study, Comp. 1 is the most important component in explaining the variations of the CGI (Eigenvalue >1). This component explains about 72 % of the CGI variations. In the first component, government effectiveness is the most important dimension of the regional institutional quality indicators. The results generally imply that not all governance components, of course, are equally important to explain the variations in overall governance quality. Treating the indicators exclusively is thus important, besides aggregated analysis. Furthermore, the results are presented in Table 2.

4.3. Econometric results

4.3.1. Unit root test results

The traditional (first generation) panel data unit root tests are not valid for panel data that involves cross-sectional dependence [75]. In this study, however, cross-sectional dependence is not a serious issue (Table 6). As such, we used a first-generation panel data unit root test, and the results are presented in Table 3. Lag selection was motivated by the order of autocorrelation (see Table 6). The results indicated that the incorporated variables are a mix of $I(0)$ and $I(1)$, regardless of whether only constant or constant and trend is considered. This implies that OLS-based test statistics are invalid, supporting the use of dynamic panel data models to get rid of spurious regression (for instance, LSDVC).

4.3.2. Effects of institutional quality on agricultural value added

The econometric results of the effects of institutional factors on AVA are presented in Table 4 and Table 5. In Table 4, the effect of the composite institutional quality on AVA is presented. The results reported in this table were estimated using two independent models. In the first model, the effect of institutional quality was estimated considering the CGI constructed from the World Governance scores. To corroborate the robustness of the findings, the same model was estimated by replacing CGI with Mo Ibrahim's overall governance scores (GOV). In both models, no significant association is reported between the composite institutional quality and AVA at all conventional significance levels. Nevertheless, while the aggregated scores could give a good overview of the institutional environment for a country, it would be difficult to draw a general conclusion considering the heterogeneous nature of governance, which tends to be weak in some dimensions and strong in others. Disaggregating institutional quality and re-estimating the model is thus important.

In Table 5, the results of the disaggregated institutional quality indicators on AVA are presented. The World Bank's provided governance data is used in this case as it involves a relatively extended time period that can be efficiently estimated using the LSDVC model. Besides, the alternative, Mo Ibrahim's disaggregated data, is not easily comparable to the World Bank's related data. In the estimation strategy, six different models were estimated, considering each governance indicator exclusively to reduce potential collinearity (*Appendix B*) among the various dimensions of institutional quality. The VA, PV, and GE are considered in Model 1, Model

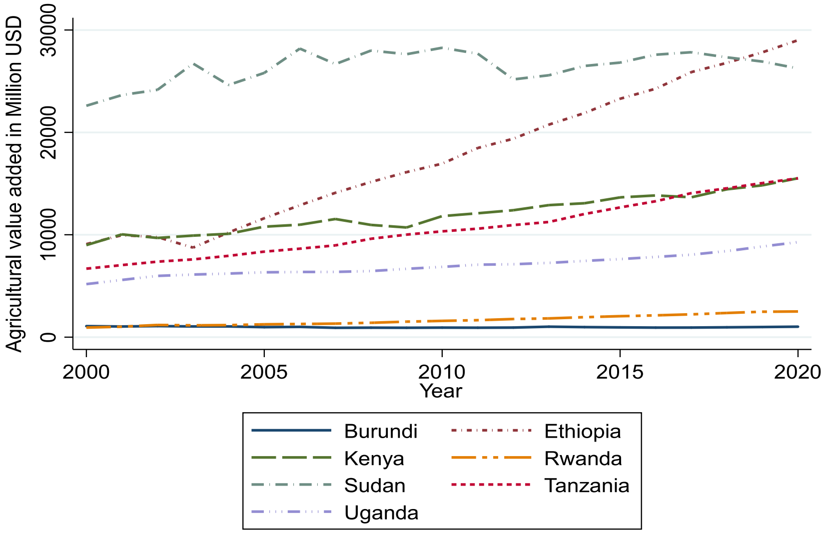

Fig. 2. Trends of agricultural value added.

Table 2
The principal components factor loadings.

Variable	Comp. 1	Comp. 2	Comp. 3	Comp. 4	Comp. 5	Comp. 6
VA	0.635	0.731	0.099	−0.056	0.218	0.024
PV	0.902	−0.010	0.374	0.144	−0.134	−0.089
GE	0.934	−0.145	−0.247	−0.078	0.072	−0.188
RQ	0.890	0.230	−0.275	0.234	−0.128	0.089
RL	0.928	−0.081	0.027	−0.315	−0.154	0.093
CC	0.760	−0.592	0.066	0.081	0.226	0.098
Eigenvalue	4.320	0.965	0.292	0.191	0.162	0.070
Proportion	0.720	0.161	0.049	0.032	0.027	0.012

Table 3
Unit root test results.

Variables	At level				At 1st difference			
	Constant		Constant and trend		Constant		Constant and trend	
	Inverse $\chi2$	$p > \chi2$	Inverse $\chi2$	$p > \chi2$	Inverse $\chi2$	$p > \chi2$	Inverse $\chi2$	$p > \chi2$
VA	43.908***	0.000	33.270***	0.003	33.270***	0.003	–	–
PV	32.513***	0.003	17.197	0.246	17.197	0.246	154.254***	0.000
GE	23.288*	0.056	28.146**	0.014	28.146**	0.014	–	–
RQ	14.154	0.438	21.191*	0.097	21.191*	0.097	135.386***	0.000
RL	14.128	0.440	41.033***	0.000	41.033***	0.000	–	–
CC	16.947	0.259	20.917	0.104	20.917	0.104	96.628***	0.000
Ln(AVA)	12.560	0.562	25.343**	0.031	25.343**	0.031	–	–
Ln(GFCF)	12.893	0.535	11.929	0.612	11.929	0.612	68.979***	0.000
Ln(Land)	68.890***	0.000	47.767***	0.000	47.767***	0.000	–	–
Ln(Educ)	51.094***	0.000	11.571	0.641	11.571	0.641	86.631***	0.000
Ln(Pop)	50.525***	0.000	70.658***	0.000	70.658***	0.000	–	–
Ln(GDP)	18.967	0.166	8.207	0.878	8.207	0.878	72.997***	0.000
Ln(FDI)	56.166***	0.000	22.749*	0.065	22.749*	0.065	151.867***	0.000

Note: ***, **, and * show significance levels at 1 %, 5 %, and 10 %, respectively.

2, and Model 3, respectively, while RQ, RL, and CC are considered in Model 4, Model 5, and Model 6, respectively. Similar control variables are included in all cases. The results show that voice and accountability and government effectiveness had significant effects on AVA. Voice and accountability influenced AVA negatively, while government effectiveness had a positive effect. The result

Table 4
The effects of composite institutional quality on agricultural value-added.

Variables	Model 1			Model 2		
	Coefficient	Standard error	$p > z$	Coefficient	Standard error	$p > z$
CGI	0.005	0.011	0.620	–	–	–
GOV	–	–	–	−0.004	0.003	0.177
Ln(AVA)_1	0.746***	0.066	0.000	0.621***	0.125	0.000
Ln(GFCF)	−0.011	0.027	0.677	−0.036	0.042	0.391
Ln(Land)	−0.052	0.053	0.330	−0.006	0.331	0.986
Ln(Educ)	0.051**	0.022	0.021	−0.096	0.073	0.191
Ln(Pop)	−0.446**	0.215	0.038	−0.932**	0.473	0.049
Ln(GDP)	0.246***	0.069	0.000	0.269**	0.108	0.013
Ln(FDI)	−0.001	0.004	0.719	0.005*	0.003	0.062
DY7	−0.025*	0.014	0.071	–	–	–
DY8	−0.006	0.015	0.693	0.012	0.010	0.220
Dy9	−0.012	0.015	0.425	0.019	0.014	0.180
Panels	7			7		
Obs.	131			56		
Av. period	18.71			8		

Note: Bias correction was initialized by Arellano and Bond estimators, with bias correction up to order O(1/NT). ***, **, and * show significance levels at 1 %, 5 %, and 10 %, respectively.

Table 5
The effects of institutional quality on agricultural value-added.

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
VA	−0.046** (0.020)	–	–	–	–	–
PV	–	−0.013 (0.013)	–	–	–	–
GE	–	–	0.061***(0.023)	–	–	–
RQ	–	–	–	0.011 (0.023)	–	–
RL	–	–	–	–	0.004 (0.024)	–
CC	–	–	–	–	–	0.009 (0.022)
Ln(AVA)_1	0.723***(0.063)	0.755***(0.068)	0.681***(0.065)	0.746***(0.066)	0.739***(0.069)	0.738***(0.068)
Ln(GFCF)	−0.027 (0.027)	−0.012 (0.027)	−0.012 (0.026)	−0.011 (0.027)	−0.008 (0.029)	−0.010 (0.027)
Ln(Land)	−0.078 (0.054)	−0.049 (0.054)	−0.007 (0.055)	−0.052 (0.053)	−0.049 (0.055)	−0.046 (0.057)
Ln(Educ)	0.053** (0.022)	0.049** (0.022)	0.045** (0.022)	0.051** (0.022)	0.050** (0.023)	0.051** (0.022)
Ln(Pop)	−0.425**(0.196)	−0.404**(0.202)	−0.591***(0.20)	−0.446** (0.215)	−0.409* (0.209)	−0.434** (0.218)
Ln(GDP)	0.304***(0.069)	0.249***(0.070)	0.257***(0.068)	0.246***(0.069)	0.251***(0.070)	0.250***(0.070)
Ln(FDI)	0.001 (0.003)	0.001 (0.004)	−0.004 (0.003)	−0.001 (0.004)	−0.001 (0.004)	−0.001 (0.003)
Year_dy7	−0.022 (0.013)	−0.026* (0.013)	−0.032** (0.013)	−0.025* (0.014)	−0.026* (0.014)	−0.027** (0.014)
Year_dy8	−0.005 (0.014)	−0.007 (0.014)	−0.011 (0.014)	−0.006 (0.015)	−0.007 (0.015)	−0.007 (0.015)
Year_dy9	−0.007 (0.015)	−0.010 (0.015)	−0.014 (0.014)	−0.012 (0.015)	−0.011 (0.015)	−0.012 (0.015)
Panels	7	7	7	7	7	7
Obs.	131	131	131	131	131	131
Av. period	18.71	18.71	18.71	18.71	18.71	18.71

Note: Standard errors are presented in parenthesis. Bias correction was initialized by Arellano and Bond estimators, with Bias correction up to order O (1/NT). ***, **, and * show significance levels at 1 %, 5 %, and 10 %, respectively.

Table 6
The error structure diagnosis.

Models	Group-wise hetero.		Cross sectional depend.		Auto-corr.	
	$\chi2$ – value	$p > \chi2$	*Test stat.*	$p > t$	*F*-value	$p > F$
Model 1	103.15***	0.000	0.663	0.5076	24.152***	0.0027
Model 2	81.16***	0.000	1.063	0.2878	18.844***	0.0049
Model 3	88.47***	0.000	0.920	0.3575	12.202**	0.0129
Model 4	82.42***	0.000	1.143	0.2531	19.982***	0.0042
Model 5	75.68***	0.000	0.709	0.4783	17.985***	0.0054
Model 6	103.15***	0.000	0.923	0.923	15.116***	0.0081

Note: *** and ** show significance levels at 1 % and 5 %, respectively.

indicates that for a one standard deviation improvement in voice and accountability scores, the AVA decreases by about 4.71 %,[1] ceteris paribus. The result is statistically significant at 5 % significance level, showing that in East Africa, democratic voice and accountability is less important for the growth of value added in agriculture. Regarding government effectiveness, the results showed that for a one standard deviation improvement in government effectiveness, AVA increases by about 6.29 %,[2] ceteris paribus. This result is statistically significant at 1 % significance level, underlying the importance of effective governance for the growth of AVA in East Africa. Furthermore, among the control variables, education expenditure and real GDP positively and significantly influenced AVA in all the models. The results of education expenditure and real GDP in all cases are statistically significant at 5 % and 1 %, respectively. Population size influenced AVA negatively and significantly in all the models. Except in Model 5, where the result is statistically significant at 10 % probability level, in all the remaining models, the results are statistically significant at 5 % probability level. Overall, the results are in line with the findings of several related studies [20,22,25,59].

4.3.3. The error structure analysis

The error structure analysis results showed the presence of FE (see *Appendix C)* in all the models. In dynamic panel data modeling, when the selection of individuals in the panel is not random, the inclusion of a fixed effect is appropriate [76]. This supports the use of the LSDVC model as opposed to alternative models such as GLS. However, the FE model could perform poorly if the idiosyncratic errors are not normally distributed, and this must be checked [77]. The likelihood ratio test and the modified Wald tests for group-wise heteroskedasticity show the presence of panel-level heteroskedasticity in the residuals. The Pesaran test of cross-sectional independence showed that all the models are free of cross-sectional dependence.[3] Similarly, using a Wald test, the presence of first-order autocorrelation was confirmed in the models. The error structure is then deduced to be panel heteroskedastic and auto-correlated, implying that the employed models must take into account these statistical issues. The LSDVC model estimates retain robustness to heteroskedasticity and serial correlation [26]. The results are presented in Table 6.

5. Discussion

This study investigates the effect of institutional quality on agricultural value added in East Africa. The results indicate that composite institutional quality has no significant effect on agricultural value addition. This implies that overall institutional quality is not strong enough to bring about a substantial change in regional AVA. This might have happened due to the region's weak governance structure [42]. In all governance dimensions, the regional average governance scores are negative, quite below theoretical averages (*Appendix A*). Besides, in this region, agribusiness is mostly a rural phenomenon which is more likely to rely on informal institutions. Formal institutional quality, through which governance scores have been generated, would thus have little implication for the growth of AVA. Nevertheless, as these findings come from an aggregate governance perspective, it is still useful to consider the results drawn from the disaggregated institutional indicators. Yet, the results are in line with the findings of Anwana et al. [32], which present a non-significant but positive effect of governance on AVA in Nigeria. It is, however, contrary to the findings of Beyene [20], which indicate the presence of a significant effect of composite institutional quality on output growth. The later study incorporates a large number of countries (42 SSA countries) in the study, while the former study is based on a single country, likely contributing to varying results.

In a disaggregated setting, improved performance in terms of voice and accountability has a discouraging implication for regional AVA. This implies that in East Africa, improved voice and accountability performance is less important for the growth of value addition in the agricultural sector. Such results would happen when efforts to strengthen governance would favor formal institutions, generating weaker informal institutions that rural people mostly rely on. Given this fact and the earlier explanations that informal institutions are more important for AVA in this region, it is logical to suspect that the negative coefficient is related to stronger formal governance that is associated with weaker informal institutions and therefore lower AVA. It is also reasonable to expect that voice and accountability could have an effect similar to the Kuznets [78] curve. That is, as voice and accountability performance increase, it disrupts sectoral value addition. However, once it reaches a certain turning point that the countries in the region have yet to achieve, the effect will become positive. The result is generally in line with the findings of several prior related studies [22,32,79]. Anwana et al. [32] note that governance is negatively correlated with AVA in the short run, considering a Nigerian case. Others underscore that improvements in governance systems and quality institutions have negative implications for output growth in the SSA [20].

Government effectiveness, on the other hand, encourages regional AVA. This suggests that the presence of quality public and civil services that are politically independent and a government that is effective in policy formulation, credible, and committed to the implementation of such policies is crucial for accelerated agricultural growth in this region. Effective governance helps to effectively implement growth policies in the agricultural sector that induce agricultural value addition. In this sector, as the process of AVA becomes more complex, the need for stronger institutions increases to overcome information asymmetry and protect parties' interests in the value addition process. Due to this, countries with lower institutional quality would earn low incomes from value addition [31]. According to Lin et al. [30], institutions facilitate contractual agreements at different stages along a value chain. It creates an enabling environment for a country's agricultural competitiveness and value addition, as good governance is critical to expanding demand

[1] The coefficient is interprated accounting for the log transformation of the dependent variable.

[2] The coefficient is interprated accounting for the log transformation of the dependent variable.

[3] The models with the World Bank's and Mo Ibrahim's composite institutional quality indicators also showed that cross-sectional dependence is not a problem across these models. The former confirm this with pr = 0.5076 and the later with pr = 1.6644.

bases. The result is consistent with the findings of Abera et al. [80], who report a positive effect of government effectiveness on output growth in East Africa. Contradictory findings were reported by Beyene [20], asserting that government effectiveness negatively influences output growth in SSA due to inadequate governance improvements in this region.

Among the control factors, larger expenditures in education and per capita GDP enhanced regional AVA. Higher government expenditure on education has a significant positive implication for the growth of AVA [51]. Educating humans is a lucrative investment that has an effective role in flourishing the hidden talents that help to make effective decisions that support value addition in agriculture [51]. At the micro-level, improved farmer knowledge through education encourages value addition at the farm level, boosting overall AVA [52]. Similarly, countries with higher levels of economic development tend to participate more in value addition [54]. This supports the findings of the current study that an improvement in the level of GDP is supportive of agricultural value addition. Furthermore, a larger number of rural populations discourage AVA. According to Salehi-isfahani [81], population growth in rural areas is associated with low productivity in Africa due to the continent's lower labor absorption capacity. This goes against the theoretical backing that argues for the positive impact of a larger population size on AVA through better market opportunities. This is in line with the population-led output expansion hypothesis of Furuoka [57].

The results generally indicate that the effect of institutional quality on AVA depends on the dimension of the institution considered. It implies that improving institutional quality is not a guarantee of enhanced agricultural value addition. Although a majority of the institutional quality indicators seem not to be strong enough to pose substantial effects on AVA, some of them are vital to enhancing agricultural value addition [54]. The findings further imply that efforts towards improving overall governance quality would not bring about a substantial change in agricultural value addition. Understanding the different dimensions of institutional qualities is vital to supporting value addition in the agricultural sector. In this study, the positive effect of the institution on AVAhas theoretical backing from North [10], while evidence with no effect would lend no support to this theory. The study's contributions in this regard, however, are not without drawbacks, as, for instance, it entirely depends on secondary data, sharing the limitations related to the use of such data. A potential limitation is that the governance data is an aggregation of subjective institutional quality perceptions. The extent to which perception data adequately captures the relevant reality is questionable. Besides, most developing economies depend on agriculture, where the majority of the labor force is located in rural areas where farmers practice farming. In these economies, it is likely that informal institutions have a strong impact on farming activities, including AVA. Nevertheless, none of the institutional quality proxies used in this study reflects this. Future studies would consider this, particularly when dealing with agriculture-related institutions. Given the importance of quality institutions, heterogeneity of the effects of formal institutions on AVA would imply the need to go further to understand the role that informal institutions would play in shaping AVA. The competition that may arise between formal and informal institutions would be investigated while considering their impacts on AVA. Furthermore, our results do not imply that institutional quality is the only factor that matters in AVA. We, however, do not account for the potential interactions of a wide array of agricultural policies that matter in agricultural value addition, and this could also be considered in future related studies. Finally, the current study considered a shorter time period, limited by a lack of sufficiently long time series data to undertake commendable country-specific time series analysis. Although the biases that may arise in this regard were attempted through model selection, future studies would still make use of more advanced panel data models by employing data over a relatively extended period of time to examine the robustness of the current findings.

6. Conclusion and policy implications

The results indicate that institutional quality plays an important role in dictating the growth of agricultural value-added in East Africa. This is, however, not true under aggregated institutional setups. The overall institutional performance is not strong enough to sufficiently translate into a higher AVA. When disaggregated, voice and accountability influences agricultural value-added negatively, while government effectiveness has a positive effect. Effective governance is thus deduced to be the most important institutional dimension to enhance the growth of agricultural value-added in this region. The presence of quality public and civil services that are politically independent, effective policy formulation and implementation, as well as credibility and commitment to such policies, are deemed important to increasing regional agricultural value added. The findings generally imply that not all institutions with better quality have positive implications for the growth of agricultural value added in this region. The effects are rather sensitive to the dimensions of the institutions under consideration. As such, blindly thriving to enhance institutional quality is not sufficient to realize better growth in agricultural value added. Nevertheless, to accelerate regional agricultural growth, governments and other development partners should be selective of the type of institution they target and consider effective implementation of the existing related institutions in this region. This needs to be well aligned with increasing investment in education and efforts to hold the share of the rural population at a low level.

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Data availability Statement

The employed data is publicly available and can be obtained at: https://data.worldbank.org/, http://mo.ibrahim.foundation/iiag/, and https://www.fao.org/faostat/en/.

Additional information

No additional information is available for this paper.

CRediT authorship contribution statement

Biru Gelgo: Conceptualization, Data curation, Formal analysis, Methodology, Software, Writing – original draft. **Adeba Gemechu:** Supervision, Validation, Writing – review & editing. **Amsalu Bedemo:** Supervision, Validation, Writing – review & editing.

Declaration of competing 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.

Appendix A. Descriptive statistics

	Burundi	Ethiopia	Kenya	Rwanda	Sudan	Tanzania	Uganda	Overall
VA	−1.132	−1.24	−0.292	−1.25	−1.712	−0.621	−0.303	−0.936
	(0.363)	(0.117)	(0.172)	(0.13)	(0.1)	(0.142)	(0.167)	(0.534)
PV	−1.71	−1.505	−1.216	−0.466	−2.128	−0.99	−0.375	−1.198
	(0.399)	(0.223)	(0.113)	(0.569)	(0.3)	(0.274)	(0.268)	(0.681)
GE	−1.267	−0.681	−0.545	−0.291	−1.358	−0.568	−0.606	−0.759
	(0.144)	(0.227)	(0.136)	(0.469)	(0.192)	(0.066)	(0.112)	(0.432)
RQ	−1.054	−1.037	−0.294	−0.357	−1.415	−0.248	−0.501	−0.701
	(0.176)	(0.116)	(0.082)	(0.455)	(0.128)	(0.082)	(0.102)	(0.473)
RL	−1.256	−0.678	−0.75	−0.384	−1.325	−0.428	−0.433	−0.751
	(0.196)	(0.192)	(0.236)	(0.465)	(0.17)	(0.159)	(0.089)	(0.436)
CC	−1.187	−0.61	−0.968	0.159	−1.334	−0.971	−0.564	−0.782
	(0.228)	(0.148)	(0.09)	(0.523)	(0.167)	(0.107)	(0.18)	(0.524)
GOV	39.633	43.744	57.189	58.7	29.967	53.033	49.289	47.365
	(1.404)	(2.368)	(0.851)	(0.77)	(2.031)	(0.485)	(0.344)	(9.701)
AVA ($mill.)	981	17720	12000	1658	26380	10600	7005	10900
	(54.368)	(6710)	(1859)	(493.4)	(1582)	(2766)	(1060)	(8840)
GFCF (%)	11.259	25.103	17.853	18.227	11.947	28.946	22.474	19.401
	(2.773)	(12.987)	(3.376)	(5.169)	(3.179)	(8.658)	(2.854)	(8.908)
Land (%)	41.307	12.59	9.688	45.199	9.109	12.654	32.145	23.242
	(4.545)	(1.572)	(0.555)	(2.515)	(1.677)	(1.969)	(2.747)	(14.877)
Educ (%)	4.543	3.081	5.399	3.61	1.932	3.528	2.519	3.516
	(1.14)	(0.428)	(0.614)	(0.403)	(0.385)	(0.369)	(0.737)	(1.259)
Pop (%)	89.235	82.342	76.291	83.151	66.6	71.689	80.435	78.535
	(1.691)	(2.241)	(2.499)	(0.532)	(0.835)	(4.122)	(3.163)	(7.474)
GDP ($mill.)	295.036	478.396	1366.39	591.09	2160.866	799.744	741.832	919.051
	(13.742)	(189.032)	(160.621)	(165.357)	(151.356)	(158.056)	(141.096)	(614.862)
FDI (%)	0.556	2.903	0.901	1.911	3.084	3.134	3.497	2.284
	(1.221)	(1.665)	(0.865)	(1.293)	(1.347)	(1.279)	(1.274)	(1.673)

Note: Standard deviations are presented in brackets and the averages are presented outside the brackets.

Appendix B. Correlation matrix of institutional quality

Variables	VA	PV	GE	RQ	RL	CC
VA	1.000					
PV	0.564	1.000				
GE	0.479	0.747	1.000			
RQ	0.667	0.740	0.822	1.000		
RL	0.519	0.815	0.867	0.754	1.000	
CC	0.104	0.689	0.770	0.522	0.704	1.000

Appendix C. Test results on the presence of FE and RE in the models

(continued on next page)

(*continued*)

	F – test for the presence of FE		B – P LM test for the presence of RE	
Models	F – value	$p > F$	$\chi2$ – value	$p > \chi2$
	F – test for the presence of FE		B – P LM test for the presence of RE	
Models	F – value	$p > F$	$\chi2$ – value	$p > \chi2$
Model 1	960.48***	0.000	0.00	1.000
Model 2	905.91***	0.000	0.00	1.000
Model 3	986.32***	0.000	0.00	1.000
Model 4	724.55***	0.000	0.00	1.000
Model 5	992.50***	0.000	0.00	1.000
Model 6	948.64***	0.000	0.00	1.000

Note: *** shows significance at 1 %.

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