Contributions of Agricultural Sub-sectors to Economic Growth in Tanzania Mainland: 2010-2018

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Abstract
*The study examined the contributions of agricultural sub-sectors to economic growth in Tanzania Mainland. The study used quarter-annual time series secondary data from 2010 to 2018, collected from National Bureau of statistics (NBS) office. Auto Distributive Lag (ARDL) technique was applied to estimate the long run dynamics and short run dynamics of the study variables. The findings revealed to be significant at the 5% level of significance hence giving strong evidence on the contribution of agricultural sub-sectors to economic growth in Tanzania Mainland.**" Furthermore, the empirical findings of the study revealed that agricultural sub-sectors (crops, livestock and fisheries), with the exception of forestry, had positive contributions to economic growth of Tanzania Mainland in both long run and short run. The study recommends that massive attention and investments be directed to the agricultural sub-sectors, especially forestry in order to boost more economic growth of Tanzania.*

Key words: *Agricultural Sub-Sectors, Autoregressive Distributed Lag (ARDL) Framework; Economic Growth (GDP)*
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1. Introduction

Agriculture plays a critical role in food and nutrition security, increasing incomes and employment and providing environmental services for most populations in developing countries **(FAO, 2014).** The agricultural sector is at the heart of the economies of the least developed countries (LDCs). It accounts for a large share of gross domestic product (GDP) (ranging from 30 to 60 percept in about two-thirds of them), employs a large proportion of the labour force (from 40 per cent to as much as 90 per cent in most cases), represents a major source of foreign exchange (from 25 per cent to as much as 95 per cent in three-quarters of the countries), supplies the bulk of basic food and provides

subsistence and other income to more than half of the LDCs' population (**FAO, 2002**).

Globally, the agricultural sector acts as a catalytic agent that accelerates the pace of structural transformation and diversification of the economy, enabling countries to fully utilize their factor endowment, depending less on foreign supply of agricultural products or raw materials for economic growth, development and sustainability. Apart from laying a solid foundation for the economy, it also serves as an import substituting sector, providing ready market for raw materials and intermediate goods (**Danso-Abbeam, Ehiakpor, & Aidoo, 2018**). Economic history provides us with sufficient evidence that agricultural revolution is a fundamental pre-condition for economic growth, especially in developing countries.

The agricultural sector has been playing an important role as a key driver for economic growth of Tanzania since independence and accounts for approximately 65% of the population who mainly depend on it, both directly and indirectly (**AfDB, 2016**) . The sector contributes about 27% of the country's GDP and about 24% of the total exports, and ensures food security in the country (**FYDP3, 2021**). These facts literally mean that about two-thirds of Tanzanians are working to produce only one-third of the country's GDP. It is the main source of food, employment, raw materials for industries and foreign exchange earnings. In light of that, the need to measure agricultural performance and the effect of agricultural sub-sectors' contribution to economic growth has become an increasingly demanding priority to government and development partners. For that reason, the potential contribution of agriculture to economic growth has been an on-going subject of controversy among development economists. Many of the issues facing the agricultural sector exceed national boundaries, becoming a concern of the global problem (**Awokuse & Xie, 2015**).

The agricultural sector is the backbone of Tanzania Mainland's economy and comprises several sub-sectors, namely crops, livestock, forestry, fishing and agricultural support services. A report by **BOT (2021)** shows that agricultural sub-sectors in Tanzania Mainland grew by 4.9 per cent in 2020, higher than 4.4 per cent in 2019 due to sufficient rains. According to **BOT (2021)** , the crops sub-activity grew by 5 per cent in 2020 from 4.4 per cent in 2019. Livestock growth remained at 5 per cent in 2020 as in the preceding year, while forestry grew by 3.2 per cent from 4.8 per cent. The fishing sub-activity registered an annual growth of 6.7 per cent in 2020, higher than 1.6 per cent registered in 2019).

The agricultural sector does not only contribute to Tanzania Mainland's GDP, but also it is a source of livelihood for 65.5 per cent of total population. The agricultural sector provides raw materials to agro-based industries. A report about the Tanzania's GDP by **URT (2020)** shows that the GDP growth rate was 4.0 percent in 2013-2014, which slightly increased to 4.2 percent in the year 2014-2015. In 2018, based on the new series base year 2015, real GDP grew by 7.0 percent, compared to 6.8 percent recorded in 2017. In 2018, the real growth of agriculture (including crops, livestock, forestry; fishing and agriculture support services) was 5.3 percent, compared to 5.9 percent in 2017. The crop sub-activity recorded a growth of 5.0 percent in 2018, compared to 6.4 percent in 2017 and accounted for 16.2 percent of GDP. In addition, the growth rate of the livestock sub-activity maintained a growth of 4.9 percent as was in 2017 and contributed 7.6 percent of overall GDP in 2018.

Various policies and programmes have been suggested for Tanzania to achieve higher levels of economic growth like the vision 2025 and the Five-Year Development Plan 2016/2017 to 2020/2021 to transform Tanzania into a semi-industrialized and middle-income economy by the current government as well as Agenda 2063 and Agenda 2030. These include key targets by 2020: Real growth rate of 7.6%; GDP share of 24.9%; share of total exports of 24.9% and share in total employment. The performance of the agricultural sector, though improved, remains far short of Vision 2025 set targets and objectives. Notwithstanding Government's enormous efforts to reposition the agricultural sector to its prime place, the sector still delays in achieving some of its development objectives. In Tanzania few studies have been conducted; the majority of the studies concentrated mostly on the contribution of agriculture as an aggregate sector together with other sectors like industry and services to the economy (Enu**, 2014; Chandio et al., 2016; Umaru & Zubairu, 2012; Hossain, 2016; Raza et al., 2010; Chongela, 2015 and Shoka**) rather than on magnitude of potential contribution of each agricultural sub-sector to economic growth. Therefore, this study investigated which agricultural sub-sector contributes significantly to economic growth in Tanzania Mainland.

2. Literature Review

2.1 Empirical Literature Review

Mtaturu (2020) assessed the role of agricultural sub-sectors in contributing to economic growth of Tanzania. Specifically, the study analysed time series data from 1971 to 2013. The study employed OLS and Newey-West methods to empirically analyse the contributive effect of crop, livestock and fishery sub-

sectors to economic growth. The study revealed that all the agricultural sub-sectors included in the study had positive influence on economic growth in Tanzania.

Nyamekye, Tian, & Cheng (2021) examined the impact of the agricultural sector on the economic GDP growth of Ghana using time series data from 1984 to 2018. The co-integration test results showed non-existence of long-run relationships existing between the overall GDP and agricultural output. In its set-up, the error correction method estimated the long-run relationship between economic growth and agricultural output as well as fluctuation in the short-run. Based on the basic regression model, agricultural output exhibited a significantly positive impact on the overall GDP growth of the country. Similarly, the industrial and service sector also contributed positively to overall GDP growth. The results indicated the need to promote value added agricultural export expansion policies to achieve high economic GDP growth.

Raza, Ali, & Mehboob (2012) researched on the role of agriculture in the economic growth of Pakistan by using time series data from 1980 to 2010 through simple regression analysis. Results revealed that agricultural sub-sectors contributed positively and significantly to economic growth of Pakistan. Crops and livestock were found to have a huge portion of aggregate agriculture share of 91%, while fisheries and forestry had minimal contribution.

Rahman & Hossain (2015) investigated the relationship between agriculture and economic growth in Bangladesh from 1973 to 2011. The study employed the Vector Auto Regressive (VAR) approach. Empirical results revealed a long run relationship between agriculture and economic growth. The VAR results confirmed that changes in agricultural GDP responded more critically to economic growth, suggesting that boosting the agricultural sector would effectively stimulate economic growth in Bangladesh.

Chongela (2015) estimated the contribution of the agricultural sector to the Tanzanian economy. The study focused on time series data from 1981 to 2010 in Tanzania Mainland. The Mean Model and Multiple Regression Model approaches were employed. The findings revealed that agriculture is the key contributor to the national economy by accounting for 26%. The findings also revealed that the contribution of the crops sub-sector (18.93%) is higher than the contributions of all the other agricultural sub-sectors in Tanzania.

Enu (2014) determined the impact of the agricultural sector on Ghana's economic growth and of the other agricultural subsectors on Ghana's economic growth. The study used time series data from 1996 to 2006 and employed OLS

technique to estimate the respective impact of agriculture, services and industry on GDP growth. The findings revealed that agricultural output had a significantly positive impact on Ghana's growth as the crops subsector (cocoa) was identified to be highly vital to economic growth and development in Ghana.

Ismail & Kabuga (2016) studied the impact of agricultural output on economic growth in Nigeria by using annual time series data from 1986 to 2015 and an ARDL bounds test for co-integration. The findings of the study, in the short run, showed that agricultural output was positively related to economic growth. The finding also provides strong positive and statistically significant evidence of a long run relationship between agricultural output and economic growth.

Umaru & Zubairu, (2012) investigated the contributions of the agricultural sector and the petroleum sector to economic growth and development of the Nigerian economy from 1960 to 2010. The Augmented Dickey-Fuller technique and Chow breakpoint test for the presence of structural break in the economy were employed. The findings showed that the agricultural sector was contributing higher than the petroleum sector, though they both had positive impact on economic growth and development of the economy.

Chandio, Yuansheng, & Magsi (2016) analysed the sector-wise share in agricultural GDP in Pakistan by using secondary data from 1998 to 2015.The Ordinary Least Square (OLS) method was applied to estimate the model parameters. The study findings showed that the agricultural sub-sectors contributed positively and significantly to the agricultural GDP of Pakistan. However, the forestry sub-sector share was considered very poor compared with other sub-sectors.

Chandio et al. (2015) analysed the contribution of agricultural sub-sectors growth rate to the agricultural GDP growth rate of Pakistan by using secondary data from 2001 to 2015 using Ordinary Least Square (OLS) method. The findings showed a positive and significant contribution of the agricultural sub-sectors to GDP growth rate. However, the contributions of the growth rates of fishery and forestry sub-sectors were considered poor as compared with other sub-sectors.

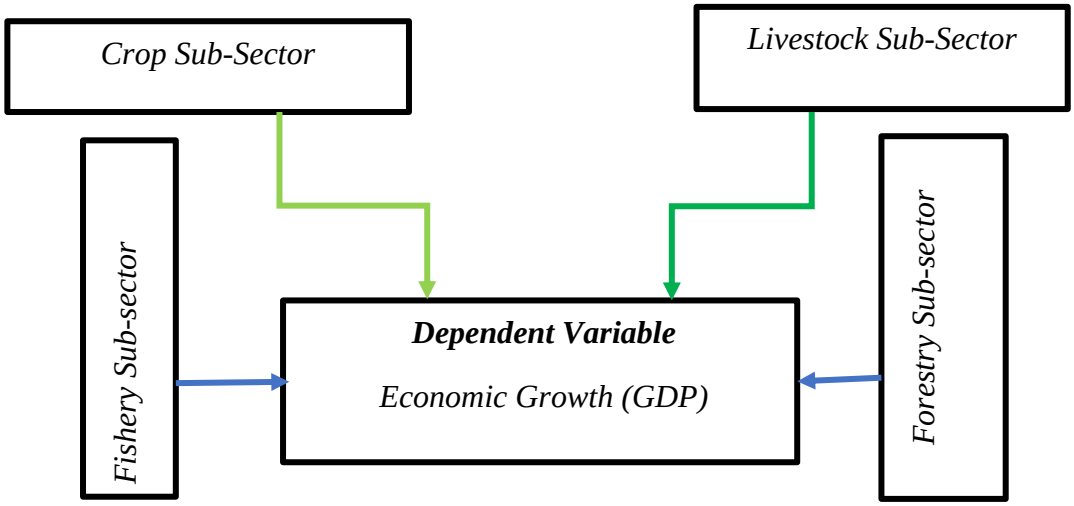
It is evident from previous studies that numerous researchers had investigated contribution of agriculture in aggregate to economic growth, such as **Enu (2014), Chandio et al. (2016), Umaru & Zubairu (2012) and Chongela (2015).** All these studies made useful contributions to understand the linkages between the agricultural sector and economic growth, but in aggregate manners. This study focused on sectorial contributions by investigating the potential contribution of

agriculture sub-sectors to economic growth by determining the effects of agricultural sub-sectors on economic growth in Mainland Tanzania. Few studies had been conducted on the agricultural sub-sector's contribution to economic growth, but they used different methods, and hence different results, compared to this study, were obtained such as **Chandio et al. (2015), Mtaturu (2020),** and **Nyamekye, Tian, & Cheng (2021).**

2.2 Conceptual Framework

The conceptual framework of this paper shows the relationship between variables under study. Economic growth is the dependent variable while crops, livestock, fisheries, and forestry sub-sector were treated as independent variables of the study (see Figure 1).

Figure1: Conceptual Framework



Source: Researcher's construction from literature review

3. Research Methodology

3.1 Research Design

This study used time series data on real gross domestic product (GDP), and gross value added of crops, livestock, forestry and fishery sub-sectors spanning from the first quarter of 2010 to the fourth quarter of 2018. The study used quantitative approaches to study the targeted population over a long period of time. The quarter time series data on real gross domestic product (GDP) and agricultural sub-sectors from 2010 to 2018 with 36 observations for each variable obtained

from the National Bureau of Statistics (NBS) in Tanzania were analysed by using descriptive statistics and inferential statistics.

3.2 Variables under Study and their Measurements

Table1: Variables and their measurements

Type of variable	Variable Name	Level of Measurement	Unit of Measurement
Dependent	GDP	Ratio scale	Million TZS
Independent	Crops	Ratio scale	Million TZS
	Livestock	Ratio scale	Million TZS
	Forestry	Ratio scale	Million TZS
	Fisheries	Ratio scale	Million TZS

Source: Author's construction

3.2.1 Test for Stationary (Unit Root Test)

Augmented Dickey Fuller (ADF) was applied to test for data stationarity. Data are checked for their stationarity properties in order to avoid production of spurious results (Nkoro & Uko, 2016; **Kamitewoko, 2022)**.

3.2.2 The Autoregressive Distributed Lag (ARDL) Framework

The study used the ARDL framework to estimate both the long run and short run contributions of agricultural sub-sectors on Tanzania Mainland's economic growth. ARDL co-integration technique was preferable in this study because it deals with variables that are integrated at different orders, I (0), I (1) or at a combination of both **(Nkoro & Uko,2016 ; Kamitewoko, 2022).**

Furthermore, the ARDL is extremely useful because it allows the study to describe the existence of an equilibrium or relationship in terms of long run multipliers and short run dynamics without losing information (Nkoro & Uko,2016).

The basic general ARDL model is given by equation 1 below:

$$\Delta Yt = \alpha_{0y} + \sum_{i=1}^{p} b_{iy} \Delta Y_{t-1} + \sum_{i=1}^{q} c_{iy} \Delta X_{t-1} + \lambda_{1y} Y_{t-1} + \lambda_{2y} X_{t-1} + \varepsilon_{1t} \quad \ldots\ldots (1)$$

Where: Δ is the difference operator, Yt is the dependent variable, X_t is the independent variable, p and q are the optimal la lengths, and ε_{1t} is the serially independent random errors with mean zero and finite covariance matrix.

3.2.3 ARDL Lag Length Selection

The ARDL lag length selection was employed because of the important it plays during the process of analysis of the data for formulation of the model since

multivariate co-integration analysis is sensitive to lag length **(Kamitewoko, 2022).** The optimal lag-length incorporated into the models of the study was based on an automatic selection determined by the lowest value specified by Akaike Information Criterion (AIC) in its selection because of the significance it plays in the sample size of not more than 60 observations (Nkoro & Uko,2016).

3.2.4 ARDL Bound Test Approach to Co-integration

The bounds test for co-integration within ARDL procedure was adopted so as to investigate the presence of long run relationship between variables under the study. If one co-integrating vector is identified, the ARDL model of the co-integrating vector is re-parameterized into ECM and results from the co-integrating vector of ARDL model give both long run multipliers and short run dynamics of the variables in a single model (Nkoro & Uko,2016).

3.2.5 Residual Diagnostic for ECM

After running the ECM, the study diagnosed the residuals in order to prove for overall goodness of fit of the ARDL models such as Serial Correlation, Heteroscedasticity, Normality by using Breusch Godfrey test, Breusch Pagan Langrange Multiplier test and Jarque-Bera test respectively.

3.3 Model Specification for the of Study Analysis

The model used for analysis was expressed as in equation 2 below:

$$GDP_t = \beta o + \beta_1 CoP_t + \beta_2 LiveS_t + \beta_3 FiSh_t + \beta_4 FoR_t + \mu_t \quad \text{.....(2)}$$

Where: GDP_t is the crops gross value added

CoP_t, LiveS , $FiSh_t$ and FoR_t are the gross value added for crops, livestock, fisheries and forestry respectively, while β_0 β_1 , β_2 , β_3 and β_4 are coefficients of explanatory variables.

4. Results and Discussion of Findings

4.1 Descriptive Statistics

The findings in **Table 1** show 36 observations for each variable under the study. All the variables in **Table 1** indicated to normally skewed except Crops (-.125) and Fishery (.879) which was negatively and positively skewed respectively. Also, the findings showed that, the variables GDP (2.223374), Crops (1.99), Livestock (2.349) and Forestry (1.894) indicated platykurtic implying flattened curves, with lower values below sample mean of the series. The kurtosis of Fishery (2.668) showed a clearly mesokurtic (normal curve), with values around their sample mean, unlike other variables.

Table 1: Descriptive Statistics of Variables in million TZS

Variables	Mean	Minimum	Maximum	Std. Dev.	Skewness	Kurtosis
GDP	2.26e+07	1.64e+07	3.14e+07	3,864,644	.3673434	2.223374
Crops	3,146,500	1,472,559	4,987,378	1,023,803	-.1245505	1.988689
Livestock	1,719,607	1,258,629	2,319,268	281,210.5	.3068426	2.348693
Forestry	707,008.6	591,604.7	853,236.2	76,926.88	.1958735	1.893599
Fishery	532,994.8	443,451.9	717,972	77,270.08	8793482	2.667559
Observations	36	36	36	36	36	35

Source: Author's Calculation from STATA 15 output

4.2 Tests for Stationarity (Unit Root Tests)

According to the findings in **Table 2,** the variable crops was found to be stationary at level I (0) without doing any differencing, while the remaining variables (GDP, Livestock, Forestry and Fishery) were found to be non-stationary at level I(0) but became stationary at I(1) after being differenced.

Table 2: Summary of Unit Root Tests (ADF) for the Study Variables

Variable	ADF-Test Statistc (at Level)	Critical Value (5%)	P-Value (at level)	ADFTest Statistc (at 1st dif.)	Critical Value (at 1st dif.)	P-Value(At 1st dif.)
DGP	-0.856	-2.972	0.8020	-10.385	-3.564	0.0000**
Crops	-6.601	-2.972	0.0000**	-	-	-
Livestock	-2.629	-2.972	0.0872	-5.429	-3.564	0.0000**
Forestry	-0.479	-2.972	0.8960	-8.449	-3.564	0.0000**
Fishery	-2.349	-2.972	0.1567	-8.100	-3.564	0.0000**

Source: Author's compilation from STATA 15 output

Note: The asterisks (**) denote significance at the 5% level.

4.3 Lag Length Selection Criteria

The findings showed that all lag selection criteria in **Table3** were optimal at lag length 4. Therefore, the study employed lag 4 and used in the ARDL model

Table3: Lag selection-order criteria

Lag	LL	LR	Df	P	FPE	AIC	HQIC	SBIC
0	-2173.66				9.4^52	136.167	136.242	136.396
1	-1987.29	372.4	25	0.0000	4.0^48	126.081	126.536	127.455
2	-1903.45	167.69	25	0.0000	1.1^47	122.403	123.238	124.922
3	-1774.91	257.08	25	0.0000	2.5^44	115.932	117.146	119.596
4	-1704.38	141.05*	25	0.0000	3.3^43*	113.086*	114.681*	117.896*

Source: Author's compilation from STATA 15 output

*Indicates lag order selected by the criterion

4.4 ARDL Approach to Bound Test for Co-integration

The results in **Table 4** show that long-run relationship existed between agricultural sub-sectors and economic growth since the calculated F-statistic (5.0225) value was higher than the upper critical bound value (4.088) at the 5% level of significance. This result implies that the nature of the relationships could be investigated via the analyses of estimated parameters from the ARDL-ECM model regression.

Table 4: ARDL Bound Test for Co-integration

Estimated Model	F-Statistic	Critical Value		Conclusion
		Lower Bound I(0)	Upper Bound I(1)	
F (GDP/CoP LiveS FiSh FoR)	5.0225**	2.947	4.088	Co-integrated

Source: Author's computation from E-views 10 output

4.5 Auto Regressive Distributive Lag (ARDL) Model Outputs

The Adjusted R-squared value in Table 5 shows that the independent variables were able to explain the dependent variable by 98.9% since the F-statistics was 142.2899 and was statistically significant (p-value < 0.05). In addition to that, the Durbin-Watson statistic (2.146794) implies absence of autocorrelation in the model since R^2 was less than DW.

Table 5: ARDL Model Output

Dependent Variable:			Gdp_1	
Dynamic Regressors (4 Lags, Automatic): Crop; Livestock01; Forestry01 and Fishery01				
Fixed regressors: C				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
Gdp_1(-1)	-0.102299	0.236381	-0.432774	0.6754
Crop	2.081058	0.431635	4.821341	0.0009
Livestock01	14.76373	67.40658	0.219025	0.8315
Forestry01	14.57257	6.999777	2.081862	0.0671
Fishery01	3.990601	2.959682	1.348321	0.2105
C	-139814.8	884588.1	-0.158056	0.8779
R-squared	0.996997			
Adjusted R-squared	0.989990			
S.E. of regression	193550.5			
F-statistic	142.2899			
Prob(F-statistic)	0.000000			
Durbin-Watson stat	2.146794			

Source: Author's compilation from Eviews 10 output

*Note: p – values and any subsequent tests do not account for model selection

4.5.1 ARDL Long Run Model

According to Table6, the equation for the long run relationship in two decimal places was defined as follows:

Gdp = -80911.98 + 0.05*Crop + 12.44*Livestock - 11.89* Forestry + 1.98* Fishery ..... (3)

According to Table **6,** the crops subsector, with the p-value of 0.9306, was not significant at the 5% level which indicated that an increase in the crops gross value added by 1 million TZS led to an increase in economic growth by 0.05 million TZS in the long run. For the livestock sub-sector, an insignificant p-value (0.9100) at the 5% level of significance was observed, meaning that an increase in the livestock gross value added by 1 million TZS led to an increase in economic growth by 12.44 million TZS in the long run. For forestry, a negative insignificant p-value (0.6538) at 5% level of significance indicated that an increase in forestry gross value added by 1 million TZS led to a decrease in economic growth by 11.89 million TZS in the long run. For fishery, a positive insignificant p-value (0.8781) at 5% level of significance proved that an increase in fishery gross value added by 1 million TZS and led to an increase in economic growth by 1.98 million TZS in the long run.

Table 6: ARDL Long run Model output

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Crop	0.048988	0.546880	0.089578	0.9306
Livestock01	12.44242	107.0032	0.116281	0.9100
Forestry01	-11.88626	25.62853	-0.463790	0.6538
Fishery01	1.983928	3.539847	0.560456	0.5888
C	-80911.98	512603.8	-0.157845	0.8781

Source: Author's computation from E-views 10 output

4.5.2 ARDL Short Run (Error Correction Model)

The findings in Table7 show that the co-integration equation [CointEq (-1)] had a negative coefficient and a very significant p-value (0.0001) which was less than 0.05. The coefficient of the ECT_{-1} (-1.73) suggests that 1.73% of disequilibria from the previous quarter's shock converge back to the long run equilibrium in the current quarter. In this case, the findings indicate that the speed of adjustment was slow and hence it would take quite some time for the system to get back to the long run equilibrium after a short run shock.

The findings in Table7 also indicate that the coefficients of all short run dynamics multipliers of the model had different signs like what was revealed in the long

run. The results in Table 7 also reveal that the 1st and 3rd lagged periods of GDP would be able to predict themselves by 0.63 and 0.47 respectively in the short run. On the contrary, the 2nd lagged period of GDP indicates inability to predict itself.

The estimated co-integration ECM equation of the ARDL Model is given below as:

$$\Delta Gdp = -80911.98 + 0.625687\Delta gdp(-1) + 0.473713\Delta gdp(-3) + 2.08\Delta crop + 86.06005\Delta livestock(-3) + 14.57\Delta forestry + 52.01518\Delta forestry(-1) + 41.54317\Delta forestry(-2) + 19.17680\,\Delta forestry(-3) + 3.99\Delta fishery - 4.815919\,\Delta fishery(-1) - 1.727986\,ect_{-1} \quad \ldots\ldots (3)$$

From equation 3, results for the crops sub-sector relate positively and significantly to their contribution to economic growth of Tanzania Mainland in the short run. The coefficient (2.08) implies that a 1million TZS rise in the GDP of the crops sub-sector led to an increase of 2.08 million TZS in economic growth per quarter in the short run, ceteris paribus. Equation 3 shows a positive and significant relationship between 3rd lagged period of livestock and economic growth of Tanzania Mainland. The sub-sector, at the 5% level of significance, demonstrated high effect with a coefficient (86.06) value indicating that 1 million TZS rise in the 1st lag of livestock would lead to an increase of about 86 million TZS in economic growth in the short run, ceteris paribus.

Table 7: ARDL Short run (Error Correction Model) output

Original Dependent Variable: GDP

ECM Regression ARDL (4, 3, 4, 4, 2) Selected based on AIC

Variable	Coefficient	Standard Error	t-statistics	P-value
D(Gdp_1(-1))	0.625687**	0.237170	2.638137	0.0270
D(Gdp_1(-2))	0.229707	0.166832	1.376872	0.2018
D(Gdp_1(-3))	0.473713**	0.119990	3.947932	0.0034
D(Crop)	2.081058**	0.242432	8.584102	0.0000
D(Crop(-1))	0.144940	0.349940	0.414185	0.6884
D(Crop(-2))	0.656560	0.348369	1.884667	0.0921
D(Livestock01)	14.76373	41.44018	0.356266	0.7299
D(Livestock01(-1))	74.11438	35.20539	2.105200	0.0646
D(Livestock01(-2))	3.771251	42.32542	0.089101	0.9310
D(Livestock01(-3))	86.06005**	36.25932	2.373460	0.0417
D(Forestry01)	14.57257**	4.098246	3.555807	0.0062
D(Forestry01(-1))	52.01518**	7.802696	6.666309	0.0001
D(Forestry01(-2))	41.54317**	8.316861	4.995053	0.0007
D(Forestry01(-3))	19.17680**	4.677327	4.099949	0.0027

D(Fishery01)	3.990601**	1.296541	3.077883	0.0132
D(Fishery01(-1))	-4.815919**	1.101715	-4.371294	0.0018
CointEq(-1)*	-1.727986**	0.252384	-6.846656	0.0001

Source: Author's compilation from E-views 10 output
Note: The asterisks (**) denote significant level at 5%

The forestry sub-sector showed completely dissimilar results as compared to its long run results. The coefficients (14.57), (52.02), (41.54) and (19.18) of the sub-sector in the current period, 1st, 2nd and 3rd lags respectively were positive and statistically significant. These findings postulate that when all other things remain constant, the 1st, 2nd and 3rd lags of the forestry sub-sector would contribute highly to economic growth of Tanzania Mainland in the short run. The fisheries sub-sector showed a completely dissimilar result as compared to its long run result. The coefficient (-4.82) of the sub-sector in the 1st lag was negative and statistically significant. This finding postulates that the 1st lag of fisheries contributed negatively to the economic growth in the short run. This is due to the fact that domestic fisheries activities remain low as a result of under-development in the sub sector.

4.5.3 Serial Correlation

The study employed the Breusch-Godfrey test for serial correlation in order to ensure that residuals were not correlated. The findings in Table 8 show that the F-statistic (4.3752) with a p-value of 0.0685 was above the 5% significance level for all lags in the model. Hence, the absence of serial correlation was justified.

Table 8: Breusch-Godfrey Serial Correlation LM test for Autoregressive Model

F – Statistic	Probability
4.3752	0.0685

Source: Author's compilation from Eviews 10 output

4.5.4 Test for Heteroscedasticity

The findings in Table 9 show that the calculated probabilities (0.2844) for Breusch-Pagan-Godfrey test did not give enough evidence to reject the null hypothesis. Hence, it was concluded that the residuals were homoscedastic (the residuals were not heteroscedastic).

Table 9: Breusch-Pagan-Godfrey test for Heteroscedasticity

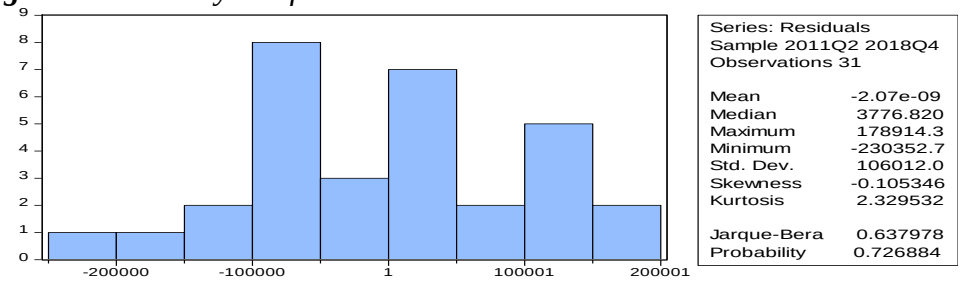
F-statistic	1.519406	Prob. F(21,9)	0.2638
Obs*R-squared	24.17974	Prob. Chi-Square(21)	0.2844
Scaled explained SS	1.354822	Prob. Chi-Square(21)	1.0000

Source: Author's compilation from Eviews 10 Output

4.5.5 Normality

The Jarque-Bera statistic was used to test for normality of residuals. The decision rule was to reject the null hypothesis "residuals are normally distributed" if the probability of the calculated Jarque-Bera statistic was less than 0.05. We therefore failed to reject the null hypothesis since the calculated probability for the Jarque-Bera statistic (0.727) was greater than the critical value probability (0.05). Hence the assumption of the normality test was met

Figure2: *Normality test for ARDL*



Source: Author's computation from E-views 10 output

4.6 Discussion of the Findings

According to the findings in Table 6 and Table 7 it was revealed that the crops sub-sector had a significant positive effect on economic growth only in the short run but not in the long run; the livestock sub-sector had an insignificant positive effect on economic growth in the long run and a positive significant effect in the short run; the forestry sub-sector had an insignificant negative effect on economic growth in the long run and a positive significant effect in the short run; and the fishery sub-=sector had an insignificant positive effect on economic growth in the long run and a positive significant effect in the short run.

A study done by **Raza, Ali, & Mehboob (2012)** about the role of agriculture in economic growth in Pakistan using time series 1980-2010 found that agricultural sub-sectors contributed positively and significantly to economic growth of Pakistan and that the crops and livestock sub-sectors together had the largest contribution (91%), while the fisheries and forestry sub-sectors registered minimal contributions. This conforms with this study that in the long run, agricultural sub-sectors contributed positively to economic growth in Tanzania Mainland with the exception of the forestry sub-sector which had a negative contribution, although it was insignificant in the long run and significant in the short run. The livestock and crops sub-sectors had the largest contribution, while the fisheries and forestry sub-sectors had minimal contributions.

Also, a study conducted by **Mtaturu (2020)** assessed the role of agricultural sub-sectors in contributing to economic growth of Tanzania. Specifically, the study analysed times series data from 1971 to 2013. The study employed OLS and Newey-West methods to empirically analyse the contributive effect of the crop, livestock and fishery sub-sectors to economic growth. The study revealed that, all agricultural sub-sectors included in the study had positive influence on economic growth in Tanzania, compared to our study which concluded that, all agricultural sub-sectors (crops, livestock and fisheries) with the exception of forestry have positive contribution in both long run and short run.

5. Summary, Conclusions and Recommendations

5.1 Summary of the study

The study intended to investigate the contribution of agricultural sub-sectors to economic growth in Tanzania Mainland. The study used secondary time series data on crops, livestock, forestry and fisheries gross value added for the period 2010 to 2018, collected from the National Bureau of Statistics (NBS). The study employed descriptive and inferential analyses. ADF approach was employed to ascertain the stationarity of variables whose outcome revealed a mixture of I (0) and I (1) (in Table2). Therefore, ARDL was confirmed as an appropriate modelling approach to be employed in the study. The VAR lag selection procedure determined the lag length specified by the Akaike information criterion (AIC). The findings in Table3 indicate that a model with an unrestricted constant was statistically preferred and fitted for the study. According to the findings in Table 7, the optimal lag length appropriate for building the models of the study were in the order of lags (4, 3, 4, 4, 2). Results from the bound test of co-integration indicated a long run relationship between variables of the model. Subsequently, the study proceeded with the estimation of both long-run and short-run coefficients of the models. The model diagnostic tests such as correlation, heteroscedasticity, and normality were conducted to ensure that the resulting models were suitable and well fitted.

5.2 Conclusions

The main objective of the study was to investigate the contribution of agricultural sub-sectors to economic growth in Tanzania Mainland. The results were significant at the 5% level of significance hence giving strong evidence on rejecting the null hypothesis of the study that **there is no impact of agricultural sub-sectors on economic growth** hence concluding that agricultural sub-sectors (crops, livestock and fisheries) have positive relationship with economic growth, but forestry revealed a negative relationship with economic growth.

5.3 Recommendations

1. Forestry has negative insignificant effect in the long run but a positive significant effect in the short run on economic growth in Tanzania Mainland. Thus, policy makers should encourage investment in advanced technology such as use of quality seeds in forestry activities. Also, the Ministry of Natural Resources and Tourism should encourage research and create markets for forestry products.

2. The Government Tanzania should apply vertically integrated approach as an adopted policy package in the agricultural sector. This approach is supposed to balance out the parity between the crops and livestock sub-sectors and the other agricultural sub-sectors since the crops and livestock sub- sectors are found to dominate the entire agricultural sector. The study also recommends for policy of fair distribution of resources towards the growth of individual subsectors. This will balance out the lopsidedness of the agricultural sector on the crops and livestock sub-sectors. The government should consider the forestry and fishery sub-sectors shares as they have potential to play an important role in the growth of the country's economy as well as helping reduction of poverty.

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