Agriculture-led Industrialization for Inclusive Growth in Tanzania

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Abstract

This study analyses the interdependence between industry and agriculture sectors for socio-economic development and poverty reduction in Tanzania during the 1970–2018 period. The study used the Autoregressive Distributed Lag (ARDL) bound test approach and Granger causality test to uncover the relationship. The study found a stable short-run and long-run relationships between agriculture and industrial sectors. Gross fixed capital formation and trade openness have significant short-run and long-run relationship with the growth of the industrial sector. While inflation affect positively industrial growth in the short-run, its impact in the long-run is negative. Moreover, there is a bi-directional causality between agriculture and industrial sectors. Given the importance of agriculture to industrialisation and inclusive growth, the study recommends policies, strategies and further efforts to increase agriculture productivity, output and income. The industrialization policy, as broad as it may be, must build the nexus between the agriculture, manufacturing and other non-farm rural sectors. Equally important is the need to put in place a conducive environment for promoting investment in both industry and agriculture sectors.

Keywords: agriculture, industrialization, inclusive growth, poverty.

JEL Classification: Q18; L16; I31.

1. Introduction

Over the past two decades, Tanzania has experienced relatively high economic growth, whereby the economy grew at an average of 6–7 percent in the period 2001–2018. The consistent high growth is mainly accounted for by various reform measures adopted since the mid-1980s. The reform package has involved stabilization policies and structural adjustment programmes; together with legal, regulatory and institutional reforms in key sectors of the economy. This economic dynamism has resulted in structural change, improved macroeconomic stability and governance, among others. In the period 2009–2018, the services sector emerged as the largest sector, whose contribution averaged 42.6 percent to the GDP; whereas industry and construction activities registered an average of 23.9 percent contribution. Agriculture, which accounts for 95 percent of the food consumed in the country, contributed 30 percent of the total exports, and 65 percent of the raw materials for industries; and provided employment opportunities to about 70 percent of the working population. Nevertheless, its contribution to the GDP declined from over 40 percent recorded in the 1980s to the 1990s, to an average of 25.9 percent in the period 2009–2018; with the growth rate of agriculture, forestry, and fishing being the lowest (4.6 percent) during the period.

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However, the impressive economic growth rate has not translated into substantive reduction in poverty. As well, it has not succeeded at addressing the challenges of inequality and unemployment, for example, through the creation of decent jobs for urban and rural dwellers (URT, 2017). As such, there has been limited diversity of the economy, technological upgrading and structural transformation; with critical issues such as employment creation and improved social services still posing a challenge. Hence, the expected trickle-down effects have not materialized, particularly due to the limited growth of agriculture and industrial sectors; coupled with low employment elasticity in capital intensive sectors, such as telecommunication, mining, financial services and construction, which are the drivers of growth in Tanzania (Mashindano et al., 2013, AfDB, 2014). In addition, as noted by Kanu et al. (2014), strong economic growth in Africa is driven by primary production and exports, particularly the extractive industrial sector, which creates jobs mainly in urban areas.

Poverty in Tanzania is still high, particularly in the rural areas, which has increased among the youth and unemployed rural women.[1] The available data on poverty indicate that growth has not been pro-poor. For example, between 2007 and 2012, the percentage of households in rural Tanzania Mainland living below the poverty line declined from 39.1 percent to 33.4 percent; and further to 31.3 percent in 2017/18. In addition, the overall poverty declined from 34.4 percent in 2007 to 28.2 and 26.4 percent in 2011/12 and 2017/18, respectively (World Bank, 2019). As well, extreme poverty—which is a reflection of the inability to meet minimum food needs—declined from 13 percent in 2007 to 8.0 percent in 2018. Yet, consumption growth became less pro-poor and inequality has increased, with the Gini coefficient rising from 38.5 in 2007 to 39.5 in 2018.[2] Also, in the event of socio-economic shocks, a large number of non-poor people living just above the poverty line are at risk of slipping below it (World Bank, 2019).

According to the 2014 Integrated Labor Force Survey (ILFS), the employed and economically active population in Tanzania was 89.7 percent, while the unemployed figure was 10.3 percent. Most of the unemployed and inactive sub-groups were female, constituting 60.1 percent and 61.7 percent, respectively. Among the working population, paid employees accounted for only 13.9 percent, whereas self-employed workers comprised the largest percentage (86.1 percent), with the private sector employing a majority of paid workers (74.5 percent). Labour market indicators in Tanzania show that employment continues to bring little return to the majority of workers in terms of quality and security (Shamchiyeva et al., 2014). Coupled with this, low quality and insecurity are high proportions of informal and vulnerable employment, especially in rural areas. The apparent high unemployment-to-population ratio implies that an increasing number of people have to work in low quality and/or insecure jobs to make a living.

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[1] The poor were defined as those whose consumption is below the national poverty line, and who therefore were not able to meet their basic consumption needs; the extreme poor were not able to afford enough food to meet the minimum nutritional requirements of 2,200 Kcal per adult per day. The national basic needs poverty line for 2018 was TZS49,320 per adult per month; and the food poverty line was TZS33,748.
[2] Income inequality is measured using Gini coefficient which ranges from zero (perfect equality) to one (perfect inequality)

Sustained poverty reduction requires inclusive growth that allows people to contribute to, and benefit from, economic growth. The inclusive growth approach takes a long-term perspective, with the focus being on productive employment rather than direct income distribution as a means of increasing incomes for the excluded groups.[3] In the short-run, governments could use income redistribution schemes to attenuate negative impacts on the poor of policies intended to jump-start growth, but transfer schemes—such as TASAF in Tanzania—cannot be an answer in the long-run; and can also be problematic in the short-run. In poor countries, such schemes can impose significant burdens on already stretched budgets (Lanchovichina & Lundsrom, 2009).

In societies that are heavily dependent on agriculture, productivity growth is a catalyst for broad shifts in the national employment structure, owing to greater surplus production. With extra incomes, farm-households demand goods and services, thereby deepening the non-farm economy (Johnston & Mellor, 1961). In addition to these forward linkages, farms that are more productive also exhibit backward linkages through agricultural employment and heightened demand for inputs. Owing to its strong backward and forward linkages, it is deemed to exhibit greater multiplier effects than other sectors (Johnston & Mellor, 1961).

In the early stages of economic development, agriculture is tightly related to non-farm economy. A stronger non-farm economy, coupled with rising agricultural labour productivity, spur a labour exit from farming (Jayne et al., 2018). Agricultural surpluses and extensive food markets further enable broad employment shifts by ensuring that non-agricultural households will have reliable access to food, even once they are detached from the land. For these reasons, agriculture has been characterized as an engine for non-farm income opportunities (Larson et al., 2016). In addition, because many poor people are engaged in farming, agricultural growth is considerably more effective at reducing poverty than growth in other sectors (Diao et al., 2010).

Structural transformation entails a large labour exit from agriculture. This transformation calls for investment in—rather than neglect of—the agricultural sector (Davis et al., 2017). Thus, in an effort to fight poverty and make GDP growth inclusive in Tanzania, one alternative has been to make Tanzanian agriculture more competitive, expanding agricultural exports by encouraging broader commitments to the development of agribusiness, and ramping up agricultural production. The World Bank (2008) established that agricultural productivity

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[3] Inclusive growth is defined as output growth that is broad-based across economic sectors, creates productive employment opportunities for a great majority of the country's working age population, and reduces poverty (WEF, 2015). It is active participation of the poor in the growth and benefits from the growth processes, which manifests through both poverty and inequality reduction (Kakwani & Pernia, 2000; Elena & Susana, 2010). In agriculture, inclusive growth is growth accompanied by gains through more employment and income that benefit those sections of society that have been bypassed by the higher rates of economic growth: of particular importance are the most disadvantaged and marginalized rural poor living below the poverty line (Kanu et al., 2014).

growth has a high poverty reduction pay-off than non-agricultural growth or investments. Thus, improvement in agriculture and its productivity is fundamental to achieving food security, poverty reduction and overall sustainable economic development. Consequently, raising agricultural productivity must be an important policy goal for governments and development agencies.

Industrialization is viewed as being very important for economic growth due to the special characteristics, roles and dynamics of the industry, especially the manufacturing sector, in the processes of development. These dynamics include the following: (i) Employment opportunities to unemployed workers in the agricultural sector, especially in developing countries; (ii) Supply of farm inputs so as to increase productivity in the agricultural sector; (iii) Promoting urbanization, which in turn brings about social transformation, induces technical progress, and provides modern production techniques; (iv) Engendering economies of scale; and (v) generating productivity spill-overs and integrating easily into other sectors of the economy and global production networks (Lavopa & Szirmai, 2014; Singh, 2016; Degu, 2019). However, with the exception of East Asian economies, the reforms in developing countries that targeted export-oriented private sector led industrialization and growth in 1990s and 2000s have faced problems of concentrated economic structures, low competitiveness, unemployment and poverty in the post-reform era. As a result, these efforts have failed to contribute significantly to employment generation, value-added exports, total factor productivity growth, and poverty reduction in developing countries (Saddiqui & Saleem, 2010).

Despite the perceived strong interdependence between agriculture and industry, the economic policy framework has failed to link the two sectors in practice. They are seen as substitutes rather than complements in economic decision-making, more often with emphasis on the industry or manufacturing sector alone as the driver for economic growth and development. Considering that agriculture is the main stay of the Tanzanian economy, which contributes nearly one-third of GDP and employs over 60 percent of the population holds the potential to increase incomes and improve livelihoods. A duo focus on agriculture and industry-cum-manufacturing for development may have major positive impacts on welfare, economic growth and inclusiveness. Thus, the paper examines empirically the role of agriculture in promoting industrialization, including inclusive growth and poverty reduction through employment-creation and income-generation. It aimed at analysing how inter-sectoral linkages hinge on poverty reduction in Tanzania, with a view to identifying the long-run growth relationship between the agricultural and industrial sectors of the econom.

This paper is organized into 5 sections. Section 2 covers economic reforms and the sectoral dynamics in Tanzania. Section 3 reviews the theoretical and empirical literature on economic transformation, Agriculture-led Industrialization for Inclusive Growth in Tanzania intersectoral linkages and economic growth. Section 4 presents the methodology of the study, whereas the empirical results and discussion are covered in Section 5. Section 6 provides the study conclusion and implications.

2. Economic Reforms and Structural Shifts in Tanzania
2.1 Agriculture, Industry and Trade Reforms

Following the economic crisis of the late 1970s and early 1980s, Tanzania shifted from its *ujamaa* policy, and re-embraced a private sector and market-led economic system from the mid-1980s. This shift involved the adoption of a series of reform measures, which included trade liberalization (that entailed substantial reduction in the role of the government in production, distribution and marketing), abolition of controlled prices; removal of export taxes; relaxation of foreign exchange and import controls; and bolstering the participation of the private sector in the economy (Potts, 2005).

At the sectoral level, the 25-year *Sustainable Industrial Development Policy* (SIDP 2020), introduced in 1996, aimed at enhancing sustainable development of the industrial sector. Under the SIDP 2020, the private sector is recognized as the main vehicle for making direct investments in the sector, whereas the government is tasked with creating an enabling investment environment. The SIDP 2020 had three phases: Phase I (1996–2000), which focused in rehabilitating and consolidating existing industrial capacities; Phase II (2000–2010), which targeted the generation of new capacities in areas with potential through creating competitive advantage by the use of efficient technologies and learning process. The final Phase III (2010–2020) targeted achieving major investments in basic capital goods industries to ensure a consolidation of the industrial structures developed in the first two phases. In addition, Tanzania adopted the Development Vision 2025 (TDV 2025) in 1999, with an emphasis on the role of the industrial sector for development, and the aim to ultimately make the nation semi-industrialized by 2025; and recognizing the leading role of the industrial sector in transforming Tanzania's economy to the middle-income country class.

Furthermore, the *Integrated Industrial Development Strategy 2025* (IIDS 2025) was adopted in 2010 to provide concrete strategies to implement the SIDP 2020, through building a competitive industry by putting in place a competitive business environment, and developing infrastructure to promote agriculture-led industrialization. The IIDS 2025 reviewed the policies of the SIDP 2020 in the context of the emerging economic environment, and prepared a road map for the implementation of the SIDP strategies so as to achieve the objectives of the industrial sector in line with the TDV 2025 goals. The manufacturing value-added was projected to grow at 15 percent per annum. In 2005, the government created the Tanzania Mini-Tiger Plan 2020 to fast-track the implementation of Vision 2025 by replicating the Asian Tigers' model: i.e., the development of the manufacturing sector. It is the Mini-Tiger Plan that led to the introduction of Special Economic Zones (SEZ) in 2006 to trigger export-led industrialization.

On the other hand, the government of Tanzania embarked on the *Agricultural Sector Development Strategy* (ASDS) in 2001 aimed to address the constraints and challenges in the sector in a holistic manner, focusing on five strategic areas, which included:

(i) Strengthening the institutional framework;
(ii) Creating a favourable environment for commercial activities;
(iii) Enhancing public-private roles in improving supporting services;
(iv) Strengthening marketing efficiency for inputs and outputs; and
(v) Mainstreaming planning for agricultural development in other sectors.

The ASDP was launched in two phases in 2006: ASDP-I, from 2006 to 2013; and ASDP-II, from 2018 to 2025. ASDP I targeted: (i) better access to, and use of, agricultural knowledge, technologies, marketing systems and infrastructure -- all of which contribute to higher productivity, profitability, and farm incomes; and (ii) improved regulatory and policy environment to promote private investment. ASDP II aims at consolidating ASDP I gains and further addressing critical constraints and challenges to the sector performance so as to speed up agriculture GDP, improving growth of smallholder incomes, and ensuring food security and nutrition by 2025. In 2008, the government introduced *Kilimo Kwanza,* with an emphasis on private sector-driven development in support of commercial farming; and the Southern Agricultural Growth Corridor of Tanzania (SAGCOT), which was officially launched in 2010 to attract private investments in agriculture, and public investments in infrastructure to specific geographic clusters.

The *Long-Term Perspective Plan 2011/12–2025/26* is another measure created to implement the Vision 2025. The plan is divided into three five-year plans to facilitate its execution. The first Five-Year Development Plan (2011/12– 2015/16), or FYDP I, was to build the requisite infrastructure, improve energy supply and markets. In addition, it entailed the development of various strategic sectors and areas—cotton textiles industry, high value crops, grains for food self-sufficiency and export, fertiliser, manufacturing, heavy industry, finance and tourism; enhanced skills development; improved business environment; and institutional reforms: all these were to set the stage for more rapid industrialization in the II and III phases. It focused on potential growth drivers, including agriculture, due to their overriding importance in terms of comparative and competitive advantages, significant impact on poverty reduction, and strong synergies with other key sectors in the development process.

The FYDP II (2016/17–2020/21), inter alia, was intended to deepen industrialization as the key pillar of socio-economic and political development; enhance development of sustainable productive and export capacities; promote the availability of requisite industrial skills and skills for other production and services delivery; and to accelerate broad-based and inclusive economic growth that reduces poverty substantially. The main objective of the FYDP III is to contribute to the realisation of the National Development Vision 2025 goals through economic transformation, industrial and knowledge/human development, and ability to participate fully in international trade, and reap more from the country's geographical location and abundance of natural resources.

2.2 Structural Transformation and Economic Growth
2.2.1 Economic Growth

High economic growth in Tanzania has been accompanied by a marked structural shift from agriculture to manufacturing and services sectors (Table 1). The share of the agricultural sector on average was 25.9 percent in 2009–2018, compared to 32 percent in 1999–2008, mainly due to higher growth of other sectors of the economy, namely industry and services. The industry and services sectors contributed an average of 23.9 percent and 42.6 percent, respectively, during 2009–2018; compared to 21.1 percent and 47 percent recorded a decade earlier. However, in the 2000s the services sector grew at about 7 percent. This high growth was propelled by high consumer demand for services such as tourism, communication and transportation in the country and abroad. Industry and construction recorded an average growth rate of 8.8 percent during the 2009–2018 period, whereas agriculture grew at an average of 4.6 percent during the same period, which was below the 6 percent projection considered necessary for reducing poverty. This unbalanced growth explains the stagnation of poverty reduction efforts in Tanzania in spite of relatively high economic growth, spurred by improved macroeconomic policies.

Table 1: Growth Rates and Shares to GDP by Activities (1990–2018)

	1990	1999–2008	2009–2018
	Annual growth Rates (percent)		
1. Real GDP (at factor cost)	6.2	6.4	6.7
2. Agriculture, Forestry & Fishing Forestry	6.5	4.8	4.6
3. Industry and Construction	19.0	8.4	8.8
Manufacturing	4.1	8.9	8.4
Construction	30.0	9.5	11.1
4. Services	1.1	6.8	7.0
	Shares in GDP (percent)		
1. Agriculture, Forestry & Fishing	53.6	32.0	25.9
2. Industry and Construction	12.3	21.1	23.9
Manufacturing	8.5	9.2	8.5
Construction	5.5	6.5	10.1
3. Services	34.1	47.0	42.6

Source: Computed from Tanzania Economic Survey various issues

Agriculture in Tanzania is still dominated by small-scale farmers, with poor yields and scanty economic returns, while facing high production price volatility and limited incentives to invest (Acre & Caballero, 2015). The major risks causing losses to the agricultural sector are: droughts, which affect mainly the output of maize, rice, and cotton; widespread outbreaks of pest and diseases, especially for cotton, maize, and coffee; price volatility for cotton and coffee; and regulatory risks, mostly within the trade policy framework, for various cash crops, and especially for maize. Although these risks do not necessarily manifest themselves in the form of catastrophic shocks to agriculture, they are identified as the main drivers of volatility, resulting in income instability and recurrent food security problems (ibid.).

The steady decline in the relative contribution of agriculture to GDP did not emanate from the sectoral loss in value because agricultural output kept growing throughout

the period (Table 2). However, other sectors of the economy grew faster, which caused the relative weight of agriculture to decline. For example, during the period 2013–17, industry grew at a 9.4 percent annual compounded rate, and services at 6.2 percent.

**Table 2: Sectoral Contributions (supply side) to Economic Growth (pp)**

	1998–2002	2003–2007	2008–2012	2013–2017
Real GDP growth	*5.6*	*7.0*	*5.9*	*6.7*
Agriculture	**1.8**	**1.4**	**1.3**	**1.4**
Industry	**1.5**	**2.5**	**1.7**	**2.6**
Manufacturing	0.4	0.7	0.6	0.7
Construction	0.6	1.1	0.8	1.6
Services	**2.4**	**3.2**	**2.8**	**2.7**
Trade, transport & accommodation	1.1	1.4	1.2	1.1
Financial institutions & real estate	0.5	0.8	0.9	0.7
Public administration	0.7	0.8	0.4	0.6

Source: World Bank (2019)

As seen in Table 2, higher growths for industry and services sectors facilitated the high GDP growth in 2016 and 2017. Until 2016, services were the primary driver of growth, contributing about 2.8 percentage points annually in the 2008–2016 period. However, in 2016 industry took the lead; primarily due to the construction subsector, whose contribution averaged 1.8 percentage points to overall economic growth in 2016 and 2017. Tanzania registered per capita income of US$1,090 in 2018, up from US$1,044 and US$947.9 in 2017 and 2015, respectively. When adjusted for population growth, Tanzania's GDP per capita grew by 3.2 percent annually from 1999 to 2017, and by 3.4 percent for the 2013–17 period (World Bank, 2020).

2.2.2 Contribution to GDP by Activities
The contribution to GDP by activities during the 2009–2018 period indicates that crops and livestock, which accounted for 13.7 percent and 8.1 percent, respectively, dominated the sector of agriculture, forestry and fishing (Figure 1).
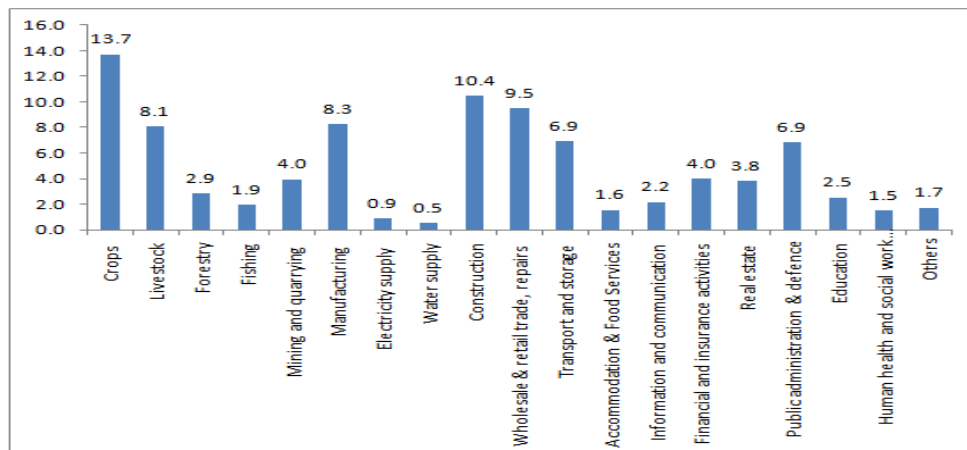
Figure 1: Contribution to GDP by activities (2009–2018)
Source: Author's from the basic data set

Figure 1 further shows that the sub-sectors of construction (10.4 percent) and manufacturing (8.3 percent) dominated the industry and construction sectors, respectively, while mining and quarrying had a 4.0 percent share during the same period. For the services sector, wholesale and retail trade and repairs led by 9.5 percent, followed by transport and storage (6.9 percent), and public administration (6.9 percent) during the same period.

During the period 2009–2018, the manufacturing sector grew at an annual average of 8.4 percent, and its share to GDP averaged 8.3 percent: the highest growth rate of 10.8 percent recorded in 2016. However, the 8.3 percent recorded share of the manufacturing sector in Tanzania during the period was lower than Africa's average of 10 percent. Notably also, the growth rate in 2016 was below the FYDP I target of 12.1 percent for 2015/16; while the actual annual average growth rate of 2010–2015 fell short of the 11 percent FYDP I target as well. As highlighted in the *Tanzanian Industrial Competitiveness Report 2015/16,* the contribution of manufacturing to Tanzania's GDP was 8.1 percent in 2013, lower than that of Kenya (9.4 percent), South Africa (14.9 percent), and Mozambique (11.4 percent) (URT, 2015).

However, manufacturing exports have grown strongly, targeting Asian markets such as China, Singapore, Thailand and Pakistan; as well as regional markets including the East African Community (EAC) and the SADC. However, there has been little penetration to European and North American export markets due to requirements of high standards (AfDB, 2014). Moreover, the manufacturing sector in Tanzania has a narrow range of products, mainly low value-added basic goods, consisting of limited processed agricultural goods or resource raw materials (Mwang'onda et al., 2018). Food and beverages account for more than half of Tanzania's manufacturing output, and constitute about 50 percent of the total manufacturing value-added (MVA); followed by non-metallic mineral products (11 percent), tobacco (7 percent), and textiles (5 percent). The private sector dominates the manufacturing sector (91 percent).

2.3 Sources of Growth

The contribution to growth could be gauged on partial productivity measures, such as productivity due to physical capital, human capital, and labour. Alternatively, growth may be accounted to total factor productivity (TFP) growth. Empirical studies often adopt growth accounting approach using the Cobb-Douglas production function to analyse and compare the contribution to growth of TFP, capital accumulation, labour and human capital (Bunini, 2017). In decomposing potential output growth, total factor productivity (TFP) growth is an unobservable component that is analysed alongside the growth of the factors of production: labour, capital, and human capital. TFP measures how the factors of production in their totality become more productive, such as through technological progress, since there is a natural limit to input growth for a given technology; hence, sustaining higher potential output growth can be supported by higher productivity growth (Anand et al*.,* 2014).

In Tanzania, Masenya et al. (2018) found that the country's economy was largely driven by capital accumulation during the period 1990–2016, which accounted for 71 percent of the real GDP growth; followed by labour (19.2 percent) (Table 3). The increase in capital stock resulted from both public and private investments in the economy; including infrastructure (particularly roads and bridges), mining and quarrying, real estate, telecommunication, and manufacturing.

Table 3: Growth Accounting for Tanzania (1990–2016)

Sources of Growth	Input Share (average)	Input Growth (average)	Output Growth (average)	Contribution to Output (percent)	TFP Contribution to GDP (percent)
1990–2016					
Capital stock	0.654	0.054	0.053	71.0	9.8
Total labour force	0.346	0.029		19.2	
1991–2000					
Capital stock	0.931	-0.011	0.038	-26.6	121.1
Total labour force	0.069	0.030		5.5	
2001–2005					
Capital stock	0.578	0.237	0.068	201.3	-185.63
Total labour force	0.422	0.136		84.4	
2006–2016					
Capital stock	0.450	0.083	0.061	61.4	10.7
Total labour force	0.550	0.031		27.9	

Source: Masenya et al. (2018)

However, during the 1991–2000 period, GDP growth was largely explained by TFP, which contributed 121.1 percent. These findings share commonality with Bunini (2017) and Treichel (2005). The contribution of growth through TFP may be accounted to the civil service and institutional reforms, which raised total productivity in the delivery of public services.

In 2001–2005 and 2006–2016 periods, capital stock contributed significantly to economic growth, accounting for 201.3 and 61.4 percent, respectively. These periods were marked by large investments in infrastructure by the government, including tarmac roads and the national electricity grid system, as well as the national fibre optic. There was also an increase in economic activities by local and foreign investors. TFP explains about 10.7 percent of the GDP in 2006–2016: the performance emanating from improved technological advancements resulting from investments in public goods and services, and reforms in public services. The fifth-regime government picked up from its predecessors and implemented a number of strategic investments in infrastructure, transportation and power generation, which are crucial for economic growth, and are likely to lead to further growth.

According to Masenya et al. (2018), growth sustainability entails the building of right institutions, policy consistency, timely implementation and completion of the identified

projects/initiatives, coordination among stakeholders, deliberate skills development initiatives, and establishing connectivity between production platforms and market gateways. Inputs should be available at competitive prices, particularly power and other utilities. Favourable external environment is equally important as some projects rely—partly or wholly—on international markets for funding and technical skills.

2.4 Employment and Productivity

The movements in sectoral shares (output and labour force) point at broad processes of how people work and secure livelihoods in the context of development and change. In a developing economy, the standards of living of the large majority of people mostly depend on their productive employment and the incomes they derive from it. Shares in GDP represent flows of incomes to sectors, while shares in the labour force represent how employment is distributed across sectors—i.e., how the national cake is shared (Wuyts & Kilama, 2014). A growing divergence over time between these shares signals differences in nominal productivity across sectors and, hence, differences in average incomes derived from these activities. In Tanzania, the share of agriculture in GDP is falling over time, but its share in the labour force remains stubbornly high, thus making nominal productivity (as measured by value-added per person in the labour force) between agriculture and industry/services to widen. The growing gap between these shares over time imposes serious limitation on effective poverty reduction and human development, and can cause social tensions (ibid.).

In Tanzania, the net increase in the number of employees in each sector between 2002 and 2012 indicates that almost 90 percent of the jobs created over this ten-year period were in the non-agricultural sectors, namely services and industry (Table 4). According to Ellis et al. (2017), the key facts in the Tanzanian new employment between 2002 and 2012 were: (i) Majority of new jobs were created in the private sector—about 94 percent of increased non-agricultural employment during the period is in the private sector; (ii) Of the private-sector jobs, 83 percent were created in the so-called informal economy by micro and small firms. Micro, small and medium enterprises (MSMEs) stand out to be the main employers in the country, especially in manufacturing and trade services.

There were two sources of labour productivity growth in Tanzania in the period 2002–2012, namely, productivity growth within sectors, or the movement of labour from less productive sectors to those that were more productive. During the period, GDP growth averaged 6.5 percent, whereas labour productivity grew at an annual average of 4.1 percent (Diao et al., 2016). More than three-quarters of this growth in labour productivity resulted from structural change; the remainder of the growth was largely attributable to within sector productivity growth in agriculture. The average labour productivity in Tanzania's manufacturing sector is more than seven times that of the agricultural sector, while trade registered labour productivity of 3.5 times that of agriculture between 2002 and 2012. Structural change accounted for almost 80 percent of economy-wide labour productivity growth in Tanzania; through growth in employment in small firms in the informal economy, hence linking Tanzania's growth in labour productivity to the growth in employment in informal small firms (ibid.).

Table 4: Contribution to New Employment by Sector, 2002–2012

	Total increase Formal and Informal (percent)	Formal Sector Share (percent)	Informal Sector Share (percent)
1. Agriculture	11.2	-0.1	11.3
2. Mining	10.1	0.2	11.1
3. Manufacturing	7.8	2.6	5.9
4. Utilities	4.9	4.9	0.0
5. Construction	7.0	0.5	7.9
6. Trade services	24.2	0.0	27.2
7. Transport services	4.6	0.5	4.6
8. Business services	2.6	1.4	1.4
9. Personal services	22.0	0.0	22.0
10. Public Sector	5.6	5.6	0.0
Total private non-agriculture	83.2	10.1	73.1
Total private economy	84.4	21.1	63.2
Total non-agriculture	88.8	15.1	73.1

Source: Diao et al. (2016)

The main instrument for a sustainable and inclusive growth is productive employment. Employment growth generates new jobs and income for individuals—from wages or self-employment—while productivity growth has the potential to lift the wages of those employed, and returns to the self-employed. In Tanzania, the number of persons in employment increased from 17m in 2006 to 20.0m in 2014; and further to 22.0m in 2018 (Table 5), which is an indication that the economy has continuously been absorbing more employees into the production of goods and services.

Table 5: Distribution of Employment by Major Sector (percent)

	2006	2014	2015	2016	2017	2018*
1 Agriculture	76.4	66.9	65.9	65.0	64.0	63.0
2 Industry	4.3	6.5	6.7	6.8	7.1	7.3
3 Services	19.3	26.7	27.4	28.2	28.9	29.7
Employed (million)	17	20	21	21	21	22

Notes: *NBS projections
Source: ILFS (2006) and (2014), and NBS (2018)

The change in sectoral employment shares gives a better picture of structural change than changes in value-added. The trend shows an ongoing shift of labour from agriculture to other sectors, mainly (traditional) services and manufacturing. Those who stay in agriculture are also diversifying towards non-farm wage and self-employment activities (NBS, 2018). Despite the sectoral shift from agriculture to manufacturing and services, employment transitions across sectors have been limited. Overall, over 60 percent of the labour force still works in agriculture, and high-growth sectors have not experienced complementary employment shifts (World Bank, 2019). For example, the share of agriculture in total employment (primary jobs) remained high at 58 percent in 2018 (from 75 percent in 2012), and

reached 79 percent among the poor; while services and industry had shares of 34.8 percent and 6.9 percent, respectively. For household heads, an estimated 54.3 percent were employed in agriculture, 9.1 percent in industry, and 36.5 percent in services, which indicate that employment in the sectors that drive economic growth were still low (HBS, 2018).

3. Literature Review

Development theorists such as Lewis (1954), Fei and Ranis (1961), Kaldor (1966), among others, assert that a development process is propelled by structural transformation from the traditional subsistence agriculture to a modern manufacturing sector. Lewis (1954) emphasizes the role of the dual economy; with traditional agricultural, rural and subsistence economy on the one hand; and an industrial, urban and capitalist sector on the other. The subsistence or agriculture sector is characterised by low—or close to zero—marginal productivity of labour and underemployment; and it serves as a supplier of labour and savings for the modern urban sector to enhance industrialisation and economic growth. Literature also acknowledges that increases in incomes move together with increases of the proportion of services among economic activities (Khanna et al.*,* 2016). As noted elsewhere, economic growth and development in general are associated with structural transformations, the most notable manifestations being the rising share of services in national economies (Liping & Evenett, 2010)

The unbalanced growth theory by Hirschman (1958) called for investment in selected and strategic sectors of the economy at a time; such that other sectors would spontaneously develop by themselves via backward and forward linkage effects. Since resources are scarce, the strategic sectors in the economy should get priority over others. The expansion of strategic sectors encourages the growth of other set of industries through backward and forward linkages. The balanced growth theory, on the other hand, advocated for large investments in different sectors of the economy, especially in developing countries. Accordingly, the expansion and inter-sectoral balance between agriculture, industry and service is necessary so that each of these sectors create a market for the products of the other; which will in turn supply the required raw materials for growth and the success of the other sectors (Sylvester et al.*,* 2016).

Agricultural and industrial sectors have their respective roles to play in the process of economic development. However, their significance differ depending on the level of the structure of economies at a certain time. One major feature of economic development is the considerable increase in demand for agricultural products as the economy evolves. The expansion of exports of agricultural products is one way of increasing income and foreign exchange earnings, mostly in the early stages of economic development. The sector provides labour force for the modern sectors of the economy; it can be a source of capital required for investment in non-agricultural sectors; and also a destination for industrial products (Kassahun, 2006). In most developing countries, however, although large amounts of resources such as land and labour are engaged in agriculture, they are being exploited at the

lower stages of productivity (Kym, 1987). As the economy expands, the share of agricultural output to GDP declines, and the share of industrial sector grows. In this case, industrialization has various roles to play in the process of development. Industrialization is necessary to provide employment opportunities to the unemployed in the agricultural sector, especially in developing countries. It also provides supplies of farm inputs to increase productivity in the agricultural sector. Equally, it is argued that industrialization comes with higher returns and economies of scale than agriculture. It also solves the problem of worsening terms of trade of primary products, in addition to bringing urbanization, which in turn brings social transformation (Kassahun, 2006).

Development economics and economic history literature have underscored the contribution of agriculture to economic development in Europe during the seventeenth and eighteenth centuries. O'Brien (1977) summarizes the role of agriculture on the pace and pattern of British industrialization from I650 to I8I5 by pointing out that it served as the source of the supply of commodities (food and raw materials); factors of production (labour, investible funds, and land); and acted as a market for industrial goods: both intermediate goods used as inputs on farms, and manufactured goods consumed by families who derived their livelihoods from agricultural production.

In low-income agrarian economies, the process of structural transformation may lead to higher incomes with a smaller but more productive agricultural sector. Such transformation is generally characterized by agricultural intensification with the adoption of improved seeds and other modern inputs, greater participation in the agricultural factor markets, a shift toward higher-income crops and animal products, a greater commercial orientation of farms, and increased integration of farm and off-farm stages of the agri-food system. Also, here, labour productivity rises both within and beyond agriculture as labour shifts away from farming toward higher-return sectors (Wineman et al., 2020).

The experience of growth and poverty reduction globally shows that GDP growth originating in agriculture is at least twice as effective at reducing poverty as GDP growth originating outside agriculture. Hence, agriculture is—and will continue to be—the engine of national growth and development (Larson et al., 2016). According to Kaur (2013), agriculture is central to economic growth owing to the fact that it still has a significant share in the GDP, and it stimulates structural transformation.[4] Structural transformation can be driven by productivity improvements within the agricultural sector, or outside the agriculture sector. This is very crucial given the important roles of agriculture sector: a source of inputs for industrial processing such as food and textiles; and a potential source of demand for manufactured products such

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[4] Structural transformation is a process whereby resources (inputs) move from low productivity sectors to higher productivity sectors. Structural transformation is the reallocation of economic activity across three broad sectors: agriculture, manufacturing, and services; which accompanies the process of modern economic growth (Herrendorf et al., 2014)

as machinery, fertiliser and processed foods. In open economies, agricultural exports may provide scarce foreign exchange used to import key industrial intermediate or investment goods. Thus, agriculture is seen as providing both demand and supply side links to industry. Hwa (1989) hypothesises that faster agricultural GDP growth 'causes' faster growth in industrial sector GDP, *ceteris paribus*.

For these reasons, agriculture is often characterized as an 'engine' that generates non-farm income opportunities (Larson et al*., 2016). It exhibits greater multiplier effects than other sectors owing to its strong backward and forward linkages (Johnston & Mellor, 1961). As already pointed out, many poor people are in farming; implying that agricultural growth is considerably more effective at reducing poverty than growth in other sectors (Diao et al*., 2010).

Chaudhuri and Rao (2004) find a bidirectional causality between agriculture and industrial sectors in India. Another study by Paul (2010) estimates causality among services, industrial and agricultural sectors for Indian data, and find the existence of a unidirectional relationship from the industrial sector or the services sector, to agricultural output. The result supported earlier findings by Koo and Lau (1997): that the Chinese agriculture growth output depends on the industrial sector. Kaur (2013), in analysing the dynamics of structural transformation in the Indian economy and the major drivers of transformation, observed three key roles that agriculture can play in promoting inclusive growth. The links are through stimulating economic growth, reducing poverty, and creating employment. Granted, even where inclusive growth is guaranteed, the extent of the contribution to achieving more inclusive growth through any of the above ways vary depending on the context of a country, and within a country over time.

There is evidence to suggest that broad-based agricultural revolution is possible in the economic transformation process of African countries (Diao et al*., 2010). However, agriculture alone cannot steer countries on the path of strong growth because, according to classical economic theories, the value-added of output per capita generated by the agricultural sector is less than the one generated by the industrial sectors, although the former is vital for industrial development (Lewis 1954). Nevertheless, Henneberry et al. (2000) assert that the industrial sector in Pakistan benefits more from growth in agriculture than the other way round. Agricultural development is very important for industrial sector development; though it is common to find a weak link between the two in developing countries (Abdelmalki & Mundler, 1995; Kafondo, 2018).

Some literature suggests that in Africa, industrialization is necessary to narrow the economic gap with other regions (Cornwall, 1977; Tregenna, 2007; Szirmai & Verspagen, 2011). Seka (2009) points out that for West African states, there is a unidirectional Granger causality from agriculture to industrial growth. A study by Amone et al. (2017) on agriculture and inclusive growth in Uganda cites low agricultural productivity as the main challenge in closing the gap. The inhibiting factors include limited capital and farming skills, pests and diseases, bad weather,

scarcity of land, as well as limited use of modern inputs. Productivity is also constrained by poor rural physical and social infrastructure: including water, electricity and access to health facilities; price fluctuation; and post-harvest losses. The study suggests to augment agricultural productivity through increasing resource support for farmers, increasing access to various assets, and investing in research, development and extension systems. The government should also foster rigorous use of modern inputs, including hybrid seeds, fertilizers, pesticides, and feeds; and it should equally develop rural infrastructure.

Kafando's (2018) study adopted an industrial development model based on agricultural production to uncover the link between agriculture and manufacturing sectors, as well as mechanism through which agricultural sector promotes the development of manufacturing activities. The study period was 1980–2009, and used a sample of 37 African countries with five subsamples, each representing a region. The study findings reveal that the size of the agricultural sector is a prerequisite for industrial take-off. The analysis shows that some regions of Africa have a great potential for achieving industrial development through primary products processing, or the use of another form of agricultural surplus. It demonstrates that there is a positive statistical correlation between agricultural and manufacturing sector value-added.

However, Kafando (2018) finds that the levels of manufacturing in Central, West and East Africa are low, unlike in Southern Africa and North Africa. West and Central Africa have the highest agricultural sector contribution to the manufacturing sector, with a low total agricultural value-added, and the lowest manufacturing value-added on the continent. The contribution of the agriculture sector to the manufacturing sector in East Africa is positive, but low. This weakness may highlight the lack of an industrial policy, or its inadequate application thereof to develop the agri-food industry. The very small share of manufacturing value-added in total value-added suggests that these regions should make more investments in agricultural production; and adopt measures to ease the transfer of agricultural surplus to the manufacturing sector. Countries with the highest level of manufacturing activities in Africa—such as South Africa, Swaziland, Namibia, Morocco, Libya, Tunisia, Central African Republic, Cameroon, Gabon, Botswana and Ghana—also enjoy good agricultural performance.

In Tanzania, Shombe (2008) used time series data for the period 1970–2005 to uncover the causal relationships between agricultural GDP, manufacturing GDP, and total exports. The study employs co-integration analysis and the Granger causality test, as well as the vector error correction model (VECM). The findings indicate an evidence of Granger causality where agriculture Granger causes both exports and manufacturing.

Treichel (2005) posits that reforms implemented since 1995 in Tanzania paid dividends in terms of strong growth and low inflation, i.e., macroeconomic stability. Also, he says that growth has increasingly been driven by higher factor productivity, and that a continuation of reform policies should allow the country to grow at above 5 percent a year over the medium term. He further posits that Tanzania is on the right track to meet the MDG targets for reducing income poverty, provided reform-

oriented policies are continued and, in the case of the rural economy, are intensified. The study called for further reforms of the business environment with a view to attracting investments, and putting in additional efforts to reform the agricultural economy as an essential ingredient for poverty reduction.

The study by Levin and Mhamba (2007) shed some light on intersectoral linkages and the prospects of growth and poverty reduction in the longer term. They noted that a poverty reduction strategy should entail promoting accelerated and equitable growth. The study used a static 2001 SAM for Tanzania to assess whether economic growth was pro-poor. Employment multipliers were derived to identify sectors with potential high capacity to absorb labour. In the static multiplier analysis, the study found that the agricultural sector—followed by public administration, building and construction, and manufacturing—had the largest impact on employment. With regard to poverty reduction, the agricultural sector had the highest multiplier effect. In addition, employment generation in the agricultural sector showed to benefit women more than men. The best outcome in terms of poverty reduction seems to be a strategy focusing on where productivity gains can be achieved in staple-food sectors. Urban poverty was found to be reduced by an agricultural-led strategy. Projections of growth and poverty at regional level showed that a strategy supporting staple-food crops would reduce poverty in most cases across the different regions.

Lyatuu et al. (2015) observe that agricultural development in Tanzania is necessary to stimulate growth not only within agriculture but also in non-agricultural sectors. The study argues that given its roles—such as being a source of food and supporting other sectors (e.g., manufacturing)—the agricultural sector needs the following: (i) social protection to minimize risk of investment in the sector and ensure benefits to agricultural growth more directly; (ii) prioritization of agricultural innovation and investment; (iii) availability of inputs to farmers; (iv) availability of markets for farmer's produce with minimum cost associated with transportation and reasonable tax; and (v) supportive policy to small farmers, and encouragement of more people to invest in agriculture. Furthermore, the study observed that whereas agriculture employs over 63 percent of the population, a majority of these are smallholder farmers producing food for their families, and a small surplus for sale. Since poverty is dominant in the rural areas and agriculture is a major economic activity for the rural population, success in poverty reduction requires enhancing agricultural productivity. Thus, to promote agricultural growth, the focus should not only be to increase farmers' incomes, but also to support the development of non-agricultural activities in the rural and urban areas to narrow inequality and improve the lives of the rural poor.

A study by Lyatuu et al. (2016) in Tanzania and Togo for the period 1961–2013 shows a marginal increase in productivity of both countries for cereal crops. However, high population growth was found to increase the demand for food, thereby exacerbating poverty. The study notices that farmers will continue to face low productivity and marketing risks, which in turn increase the variability in production and income growth of the sector. The study recommended that the countries needed to improve the productivity of maize and paddy, which are not internationally traded, but are consumed by the poor, and are traded locally.

However, scarcity of resources entail cost-sharing, which is the ultimate solution for poverty reduction in weak economies.

Wineman et al. (2020) assess whether, in Tanzania, trends in the 2008–2014 period in farm behaviour, structure of farming, and agricultural commercialization and productivity conformed to stylized facts about agricultural transformation. The findings show that during that period, agricultural output grew by 58 percent in real terms. The expansion of crop area—the evidence of pattern that shows better conditions for farmers, and more so for medium-scale farmers—seemed to drive the entire growth. Although there was limited movement in partial land productivity, labour productivity rose as the labour intensity of agriculture declined. Among other changes documented in this study, farmers were increasingly found to utilize mechanization and sow improved seed varieties; hire agricultural labour and rent in land; specialize in one type of farm product; and to sell an increasing share of their crop production on the market (and more often by selling right at the farm gate). Along with these changes, Tanzanians were shifting their work time from farming to off-farm activities; the urban population share was growing; and poverty rates were falling. These various changes are consistent with the notion that agricultural growth plays a pivotal role in structural changes (Johnston & Mellor, 1961; Barrett et al., 2017; Jayne et al., 2018), strengthening the (rural) non-farm economy through backward and forward linkages, and in enabling people to securely exit agriculture.

4. Methodology
4.1 Model Specification
This study adopts the auto-regressive distribution lag (ARDL) cointegration approach in examining the long-run relationship between industrial output *(io)* and agriculture *(ao);* as well as other control variables such as capital formation *(gfcf),* trade openness *(top),* inflation *(infl),* nominal exchange rate *(nexr),* and population growth *(popugr).* The rationale for the use of the ARDL approach for cointegration is built on the premise that time series variables trend in difference in order of stationarity, hence the traditional approach to cointegration becomes inefficient. The implicit form of the model is specified as:

$$io = f(ao, gfcf, top, infl, nexr, popugr) \qquad (1)$$

Dummy variables are included to capture economic recovery programs such as trade liberalisation and the policy changes of 1986 (D1), and the fiscal reforms of 1996 (D2). The model (equation (1) can explicitly be specified in the log form:

$$io = \beta_0 + \beta_1 ao + \beta_2 gfcf + \beta_3 top + \beta_4 infl + \beta_5 nexr + \beta_6 popugr + \beta_7 D1$$
$$+ \beta_8 D2 + \varepsilon_t \qquad (2)$$

where ε_t is the error term.

Since some variables are I(0), while others are integrated of order one I(1), this entails the use of the autoregressive distributed lag (ARDL) model for better estimates:

$$\Delta Y_t = \alpha_0 + \sum_{i=1}^{k} \gamma_i \Delta Y_{t-i} + \sum_{i=1}^{k} \delta_i \Delta X_{t-1} + \lambda_1 Y_{t-1} + \lambda_2 X_{t-1} + \varepsilon_t \quad (3)$$

where X and Y are independent and dependent variables, respectively; ε_t is random error with no serial correlation; λ_1 and λ_2 are long-run multipliers; γ_i γ_i and δ_i are short-run dynamics, α_0 is a constant (drift term); and k is the maximum lag order of the ARDL model.

Extending to include lagged variables for the dependent and independent variables used in the study, the equation for short-run and long-run relationship in ARDL takes the form:

$$\Delta io_t = \alpha_0 + \sum_{i=1}^{k} \gamma_{1i} \Delta io_{t-i} + \sum_{i=0}^{k} \gamma_{2i} \Delta ao_{t-i} + \sum_{i=0}^{k} \gamma_{3i} \Delta lngfcf_{t-i} + \sum_{i=0}^{k} \gamma_{4i} \Delta lntop_{t-i}$$
$$+ \sum_{i=1}^{k} \gamma_{5i} \Delta lninfl_{t-i} + \sum_{i=1}^{k} \gamma_{6i} \Delta lnnexr_{t-i} + \sum_{i=1}^{k} \gamma_{7i} \Delta popugr_{t-i}$$
$$+ \lambda_{10} io_{t-1} + \lambda_{11} ao_{t-1} + \lambda_{12} lngfcf_{t-1} + \lambda_{13} lntop_{t-1} + \lambda_{1} lninfl_{t-1}$$
$$+ \lambda_{15} lnnexr_{t-1} + \lambda_{16} popugr_{t-1} + \theta_1 D1 + \theta_2 D2 + \varepsilon_t \qquad (4)$$

Where, Δ represents the first difference $\gamma_{1i}, \gamma_{2i} \dots \gamma_{7i}$ show the short-run dynamics of the model; $\lambda_{10}, \lambda_{12} \dots \lambda_{16}$ indicate the long-run association; while k is the optimal lag lengths.

Bound test was used to test for the presence of long-run relationship among the variables. The F-statistic was used to test whether the variables are cointegrated or not. The null hypothesis that there is no long-run relationship between the variables is tested. This test implies that the coefficients of lagged variables in equation (4) are all equal to zero [*Ho: λ1= λ2= λ3= λ4=0*], against the alternative hypothesis that the variables have long-run relationship; to mean that the coefficients of lagged variables are not the same, and that they are different from zero [*Ha: λ1≠ λ2≠ λ3≠ λ4≠0*]. The guideline was to reject the null hypothesis if the calculated F-Statistic is greater than the upper bound critical value at 5 percent level of significance. From the statistical standpoint, if variables exhibit long-run relationship, it implies that there exists causality running in at least one direction. In this regard, the Granger causality test was employed to establish the direction of the causal relationship between the variables.

The main variable of interest in this study is agricultural output; and it is expected that its coefficient should be statistically significant, greater than zero, and positive ($\varphi_i > 0$). This will mean that the growth of agriculture output contributes positively to the growth of industrial output.

4.2 Data
The analysis in this paper is based on annual time series data from the Bank of Tanzania and the National Bureau of Statistics, for the period 1970–2018. This period capture economic recovery program of 1986 and the fiscal reforms of 1996 which are treated as dummy variables in the model specification.

5. Results and Discussion
5.1 Time Series Properties of the Data
5.1.1 Descriptive Statistics
The summary statistics indicates that all the variables have a skewness close to zero, with small standard deviations (Table 6). The skewness and Jarque-Bera statistics suggest that the variables are about normally distributed.

Table 6: Descriptive Statistics of the Variables

	lnio	*lnao*	*lngfcf*	*lntop*	*lninfl*	*lnnexr*	*popgr*
Mean	12.267	13.129	3.173	3.489	2.526	5.107	3.048
Maximum	17.366	17.397	3.568	3.937	3.592	7.725	3.5
Minimum	7.224	8.120	2.424	2.845	0.875	1.931	2.5
Std. Dev	3.354	3.049	0.274	0.316	0.767	2.260	0.233
Skewness	-0.036	-0.245	-0.435	-0.431	-0.157	-0.399	-0.549
Kurtosis	1.537	1.646	2.546	1.978	1.748	1.401	2.666
Observations	49	49	49	49	49	49	49

5.1.2 Unit Root Tests
The results of the ADF test reported in Table 7 show that agriculture output *(ao)*, trade openness *(top),* and population growth *(popugr)* were integrated at order I(0), i.e., stationary at level; while other variables were integrated at order I(1).

Table 7: ADF Unit Root Test Result

Variables	ADF Test (with Intercept)		ADF Test (with Intercept & Trend)	
	Level	*Fist Difference*	*Level*	*Fist Difference*
lnio	-1.678	-3.671***	-3.202*	-3.645***
lnao	-3.646***		-4.144***	
lngfcf	-1.057	-4.273***	-1.760	-4.264 **
lntop	-4.366***		-4.325***	
lninfl	-1.342	-4.139***	-2.270	-4.313***
lnnexr	-1.745	-4.131***	-0.901	-6.011***
popugr	-2.818*	-3.958***	-3.227**	-3.954***

Note: ***<0.01, **<0.05 and * p<0.1
Source: Estimated by authors

5.2 ARDL Cointegration Test
The presence of cointegration among the series was tested by employing the bound test approach. Accordingly, the results presented in Table 8 show that computed F-statistic was greater than the F-critical value at 1 percent. Consequently, the results supported the rejection of the null hypothesis; thus indicating the existence of a long-run relationship (cointegration) between the variables in the model.

Table 8: Estimated F-Statistics by ARDL Long-run Bound Test for Cointegration

	I(0)	I(1)
F = 21.397	2.62	3.79
t = -0.323	-2.86	-4.19

Note: Ho: no levels relationships; accept if F < critical value for I(0) regressors; reject if F > critical value for I(1) regressors
Source: Estimated by authors

In this regard, the existence of cointegration among the series aids in analysing the short-run and long-run relationships among the sectors.

5.3 Long-run and Short-run Multipliers
5.3.1 Long-run Impact Multipliers
The estimated long-run coefficients, standard errors, along with their corresponding probabilities, are depicted in Table 9. The post estimation tests such as Breusch–Godfrey shows there is no serial correlation, whereas the White test indicates that the residuals are homoscedastic. The results show that the contribution of agriculture, fishery and forestry to economic growth is positive and significant at 1 percent levels. The agriculture sector recorded a 0.739 coefficient, implying that the long-run real industrial output increases by approximately 0.739 from every unit growth in agriculture, fishery, and forestry; *ceteris paribus*.

Table 9: long-run Regression Results
(Dependent variable: industrial output -lnio)

Variable	Coefficient	Std. Error	Pro.
Agriculture output (lnao)	0.739***	0.153	0.000
Nominal exchange rate (lnrexr)	0.0489	0.071	0.491
Gross fixed capital formation (lngfcf)	0.497***	0.135	0.000
Openness (lntrade)	0.265**	0.114	0.020
Inflation (lninfl)	-0.155***	0.060	0.010
Population growth (popgr)	0.385	0.254	0.130
Economic reforms dummy (d86)	0.196	0.133	0.139
Fiscal reforms dummy (d96)	0.443**	0.209	0.045
Constant (C)	-2.998***	0.717	0.000
$F_{(6, 37)} = 95.02$ R-squared = 0.651			
Observations = 47 AdjR-squared = 0.588			
Breusch-Godfrey LM test: Prob > chi2 = 0.0149; H0: no serial correlation			
Breusch-Pagan / Cook-Weisberg test: Prob > chi2 = 0.832; Ho: Constant variance			

Note: *** $p<0.01$, ** $p<0.05$, * $p<0.1$
Source: Estimated by authors

It is worth noting that gross fixed capital formation and trade openness have the correct signs, and were statistically significant. Inflation had adverse effects on industrial output growth in the long-run, with a coefficient of (-0.155). The dummy variables (d86) is statistically insignificant, while the dummy variable (d96) is positive and statistically significant. This suggests that fiscal and economic reforms, together with the policies adopted in 1996 had positive impact in scaling up industrial growth during the study period.

5.3.2 Short-run Impact Multipliers
When there is an existence of co-integration, then the construction of an error correction model becomes imperative to model the dynamic relationships. The short-run results in Table 10 show that the coefficient on agriculture output (lag-1), gross fixed capital formation (lag-1 & lag-2), and population growth, are statistically significant at 1 percent level and have positive relationship with the dependent variable. Unlike in the long-run, inflation impacts positively on industrial output in the short-run with a coefficient of 0.137.

Table 10: Estimated Error Correction Model
(Dependent variable: industrial output -lnio)

Variable	Coefficient	Std. Error	Pro.
Δlnao (t-1)	0.493**	0.230	0.000
Δlnrexr (t-1)	-0.334***	0.099	0.003
Δlngfcf (t-1)	0.475***	0.131	0.001
Δlngfcf (t-2)	0.812***	0.140	0.000
Δlntrade (t-1)	0.027	0.100	0.790
Δlninfl(t-2)	0.137**	0.060	0.025
Δpopugr) (t-1)	0.976**	0.350	0.010
Economic reforms dummy (d86)	-0.00026	0.161	0.999
Fiscal reforms dummy (d96)	0.560***	0.164	0.002
ECT (t-1)	-0.785***	0.134	0.000
Constant (C)	-3.870***	0.789	0.000

**Note:** *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
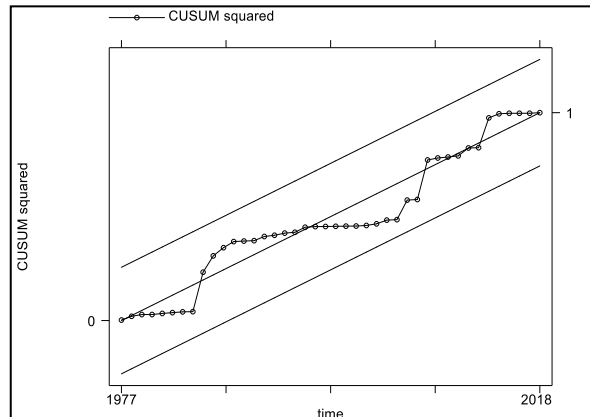**Source:** Estimated by authors

The error correction term (ECT) indicates the speed of adjustment from the short-run equilibrium to the long-run equilibrium state. As a rule of thumb for an ECM, a variable converges to equilibrium if its coefficient is negative and significant. The adjustment term (-0.785) is statistically significant at 1 percent level, which suggests that the system corrects errors of previous years within the current year at a convergence speed of 78 percent.

5.4 Stability Test
The study used CUSUM and CUSUM of squares to testing for the stability of the model at 5 percent level of significance. Figures 2(a) and 2(b) are clear evidences that the model was stable, since the graph for CUSUM and CUSUM of squares tests, which are the plots of recursive residuals and cumulative sum of squared recursive residuals, respectively, are within the boundary of the critical regions.
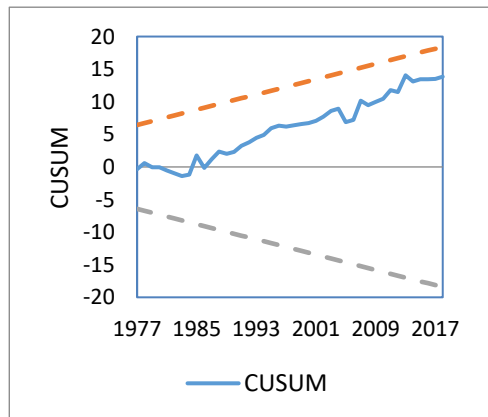
Figure 2(a): CUSUM Test   **Figure 2(b): CUSUM of Squares for ARDL**

5.5 Causality Analysis

The causality test can be determined using the Wald test on the joint significance of the lagged independent variables. The results in Table 11 suggest that a bidirectional causality exists between the growth of industrial and agriculture outputs.

Table 11: Granger Causality Tests (Wald tests)

Equation	Excluded	Chi2	df	Prob.	Decision
Lnio	lnao	9.619	2	0.008***	Agriculture granger-cause industrial output (lnio)
Lnio	ALL	87.338	12	0.000***	ALL jointly granger cause industrial output
Lnao	Lnio	5.166	2	0.076*	Industrial output granger-cause agriculture output
lnao	ALL	60.409	12	0.000***	ALL jointly granger causes agriculture output

Note: *** p<0.01, ** p<0.05, * p<0.1
Source: Estimated by authors

6. Conclusion

The study analysed intersectoral linkages between agriculture and industry, and their impact on economic growth and poverty reduction in Tanzania during the 1970–2018 period. The study used bound test for cointegration, the ARDL model, and Granger causality test to uncover the relationship. The study found a stable short-run and long-run relationship between agriculture and industry. The findings also revealed that the contribution of agriculture, fishery, and forestry to industry and construction sectors in Tanzania is positive and statistically significant. Further, there is a bidirectional causality from agriculture to industrial sector growth.

Accordingly, given that the majority of the poor and vulnerable populations are concentrated in the agriculture and rural non-farm sectors in the country, achieving inclusive growth entails the need for new approaches to developing the agriculture and rural non-farm sectors. Therefore, it is of utmost importance to address the key challenges that have inhibited agricultural transformation and agro-industrialisation. In this regard, some of the possible policy and strategic interventions should include: expanding extension services to farmers; ensuring access to quality seed and fertilisers; vertical integration of smallholder farmers into markets and supply chains; strengthening existing monitoring mechanisms to target quality control interventions; improving agricultural finance initiatives; while also creating conducive environment for investment in the sectors of agriculture and industry in the country. Furthermore, scaling up rural infrastructure to increase productivity in agriculture is equally important.

It needs no emphasis that agriculture has the potential to contribute to industrialization through the provision of raw materials; and being a source of household income and government revenue. It is also a market for agricultural and industrial outputs; and a source of foreign exchange, food security, and job creation. Thus, industrialization policy, as broad as it may be, must build the nexus between agriculture, other non-farm rural sectors, urban areas, and manufacturing. Policies that enhance this linkage will see the agricultural sector being a constructive player in the industrialization process and poverty reduction in Tanzania.

References

Abdelmalki, L. & Mundler, P. (1995). Economie du développement, les théories, les expériences et les perspectives (311 pages). Paris: Hachette Supérieur.

Acre, C & Caballero, J. (2015). Tanzania: Agricultural sector risk assessment. World Bank Group, Washington, DC. https: //openknowledge.worldbank.org/handle/10 986/22277.

AfDB. (2014). Eastern Africa's manufacturing sector promoting technology, innovation, productivity and linkages. *Tanzania Country Report,* November.

Amone, W., Kamuganga, D. & Makombe. G. (2017). Promoting agricultural productivity and inclusive growth in Uganda. In: Wayne G. Ganpat et al. (eds.). *Agricultural Development and Food Security in Developing Nations.* IGI Global, pp. 249–262. https: //doi.org/ 10.4018/978–1–5225–0942–4.ch011.

Anand, R., Cheng, M. K., Rehman, S. & Zhang, M. L. (2014). Potential growth in emerging Asia. *Working paper*. International Monetary Fund.

Arce, C.E. & Caballero, J. (2015). Tanzania: Agricultural sector risk assessment. World Bank, Washington, DC. https: //openknowledge. worldbank.org.

Barrett, C., Christiaensen, L., Sheahan, M. & Shimeles, A. (2017). On the structural transformation of rural Africa, *Journal of African Economies*, 26(1): 11–35.

Bunini, M. D. 2017. Comparative analysis of sources of growth in Tanzania, Uganda and Kenya: A growth accounting approach. Turin School of Development Working Paper No. 5. International Training Centre of the ILO, Turin, Italy.

Chaudhuri, K. & Rao, R.K. (2004). Output fluctuations in Indian agriculture and industry: A re-examination. *Journal of Policy Modeling*, 26(2): 223–37.

Cornwall, J. (1977). *Modern capitalism: Its growth and transformation*. London: Martin Robertson.

Davis, B., Di Giuseppe, S. & Zezza, A. (2017). Are African households (not) leaving agriculture? Patterns of households' income sources in rural sub-Saharan Africa. *Food Policy,* 67: 153–174.

Diao, X., Kweka, J. & McMillan M. (2016). Economic transformation in Africa from the bottom up: Macro and micro evidence from Tanzania. NBER Working Paper 22889. National Bureau of Economic Research.

Diao, X., Hazell, P. & Thurlow, J. (2010). The role of agriculture in African development. World Development, 38(10), 1375–1383.

Degu, A.A. (2019). The causal linkage between agriculture, industry and service sectors in Ethiopian economy. *American Journal of Theoretical and Applied Business*, 5(3): 59–76.

Elena, I. & Sushana, L. (2010). Inclusive growth analytics: Framework policy research working paper. World Bank, Economic Policy and Debt Department, Economic Policy Division, WP: No.4851.

Ellis, M., McMillan, M. & Silver, J. (2017). Employment and productivity growth in Tanzania's service sector. WIDER Working Paper 2017/16. Helsinki: UNU-WIDER.

Henneberry, S.R., Khan, M.E. & Piewthongngam, K. (2000). An analysis of industrial-agriculture interactions: A case study in Pakistan. *Agric. Econ.*, 22: 17–27.

Herrendorf. B., Rogerson, R. & Valentinyi, A. (2014). Growth and structural transformation. *Handbook of Economic Growth*, 2: 855–941.

Hirschman, A.O. (1958). *The strategy of economic development*. Yale University Press, New Haven.

Hwa, E-C. (1989): The contribution of agriculture to economic growth: Some empirical evidence. In: J. Williamson and V.R. Panchamurchi. *The Balance between Industry and Agriculture in Economic Development*, *Volume 2, Sector Proportion*. New York: The World Bank.

Jayne, T. S., Chamberlin, J. & Benfica, R. (2018). Africa's unfolding economic transformation. *Journal of Development Studies*, 54(5): 777–787.

Johnston, B. F. & J. W. Mellor. (1961). The role of agriculture in economic development. *American Economic Review,* 51: 566–93.

Kafando, N.C. (2018). does the development of the agricultural sector affect the manufacturing sector? *Monographs: Applied Economics, AgEcon Search*, Number 302444, July

Khanna, A., Papadavid, P., Tyson, J. & te Velde, D.W. (2016). The role of services in economic transformation – With an application to Kenya. SET Programme Report, February 2016. London: SET.

Kaldor, N. (1966), *Causes of the slow rate of economic growth of the United Kingdom: An Inaugural Lecture*. Cambridge: Cambridge University Press.

Kakwani, N. & Pernia, E. (2000). What is pro-poor growth? *Asian Development Review: Studies of Asian and Pacific Economic Issues*, 18(1). Mandaluyong City, Philippines, Asian Development Bank.

Kanu, B., Salami, O.A. & Numasawa, K. (2014). Inclusive growth: An imperative for African agriculture. African Development Bank's (AfDB).

Kassahun, T. (2006). *Dynamic sectoral linkages in the Ethiopian economy: A preliminary assessment*. Addis Ababa: Ethiopian Economic Association /Ethiopian Economic Policy Research Institute.

Kaur, G. (2013). Sustainable development in agriculture and green farming in India. *OIDA International Journal of Sustainable Development*, 06(2): 61–64.

Koo, W. & Lou, J. (1997). The relationship between the agricultural and industrial sectors in Chinese economic development. Agricultural Economic Report, No. 368.

Anderson, K. 1987. On why agriculture declines with economic growth. *Agricultural Economics,* 1(3): 195–207.

Lanchovichina E. & S. Lundsrom, (2009): Inclusive growth analytics: Framework and application. Policy Research Working Paper, World Bank, Washington DC.

Larson, D., Muraoka, R. & Otsuka, K. (2016). Why African rural development strategies must depend on small farms. *Global Food Security*, 10: 39–51.

Lavopa, A. & A. Szirmai. 2014. Structural modernization and development traps: An empirical approach. UNU-MERIT Working Paper 2014–076.

Lewis, W.A. (1954). Economic development with unlimited supplies of labour. *The Manchester School of Economic and Social Studies*, 22(2): 139–191.

Levin, J. & Mhamba, R. (2007). *Economic growth, sectoral linkages and poverty reduction in Tanzania*. Washington, D.C: World Bank Group..

Liping, Z. & Evenett, S. (2010). *The growth of China's services sector and associated trade : Complementarities between structural change and sustainability*. Development Research Center: State Council, China.

Lyatuu, E.T., Nie, F. & Fang, C. (2015). The role of agriculture in the economic growth and poverty reduction in Tanzania. *Journal of Economics and Sustainable Development*, 07(31): 1–16.

Lyatuu, E.T., Gbete, G.E.W. & Nie, F. (2016) Does the improvement of productivity of maize and rice reduce poverty? Comparison case study for Tanzania and Togo. *Journal of Economics and Sustainable Development*, 07(2): 25–35.

Masenya. C, Reweta. W, Magere. D, Temba, L. & Macha. D, (2018) Drivers of Economic Growth in Tanzania. Bank of Tanzania Working Paper Series No 14: May.

Mashindano, O., K. Kayunze, L. Da Corta & Maro, F. (2013). *Translate growth into poverty reduction: Beyond the numbers*. Dar as Salaam: Mkuki na Nyota Publishers.

O'Brien, P.K. (1977). Agriculture and the industrial revolution. *The Economic History Review, New Series*, 30(1): 166–181.

Paul, M. (2010) A re-look at sectoral linkages in more recent Indian data. *Indian Journal of Economics and Business*, 9(4): 665–673.

Potts, D. (2005). Policy reform and the economic development of Tanzania. BCID Research Paper No.14 Bradford Centre for International Development University of Bradford Bradford, BD7 1 DP United Kingdom.

Ranis, G. & Fei, J. (1961). A theory of economic development. *Am. Econ. Rev*. 51: 533–565.

Seka, P.R. (2009). Integrating agrarian economies: The case of ECOWAS. *African Integration Review,* 3(2): 1–42.

Shamchiyeva, L., Kizu, T. & Kahyarara, G. (2014). Labour market transitions of young women and men in the United Republic of Tanzania. International Labour Office, Youth Employment Programme, Employment Policy Department. ILO, Geneva. Switzerland. (Work4Youth Publication Series, No. 26).

Shombe, N.H. (2008). Causality relationships between total exports with agricultural and manufacturing GDP in Tanzania. IDE Discussion Paper. No. 136. 2008.2 http: //hdl. handle.net/2344/726.

Siddiqui, S.H. & Saleem, H.M.N. (2010). Service-led industrial policy for inclusive growth and competitiveness. *Competitiveness Review*, 20(2), Emerald.

Singh, T. (2016). On the sectoral linkages and pattern of economic growth in India. *Journal of the Asia Pacific Economy*, 21(2): 257–275.

Szirmai, A. & Verspagen, B. (2011). *Manufacturing and economic growth in developing countries, 1950–2005*. Wp2011–069, Maastricht Economic and Social Research and training Centre on Innovation and Technology, United Nations University (UNU-MERIT).

Tregenna, F. (2007). Which sectors can be engines of growth and employment in South Africa? An analysis of manufacturing and services. UNU-WIDER Conference on 'Southern Engines of Global Growth: China, India, Brazil and South Africa', Helsinki, Finland.

Treichel, V. (2005). Tanzania's growth process and success in reducing poverty. Working Paper 05/35. Washington, DC: International Monetary Fund.

United Republic of Tanzania (URT). (2009). Accelerating pro-poor growth in the context of Kilimo Kwanza. Dar es Salaam: Government Printer, pp.13–23.

URT. (2015). Tanzania at a crossroad: Shifting gears towards inclusive and sustainable industrialisation. Dar es Salaam: Government Printer.

Wineman, A., Jayne, T.S., Isinika, M.E. & Kray, H. (2020). The changing face of agriculture in Tanzania: Indicators of transformation. *Development Policy Review,* 38: 685–709. https: //doi.org/10.1111/dpr.12491.

World Bank (2019). *Tanzania Mainland poverty assessment: Part 1 - Path to poverty reduction and pro-poor growth*. World Bank, Washington, DC. World Bank. https: //openknowledge.worldbank.org/handle/10986/33542.

World Bank. (2020). *Tanzania mainland poverty assessment: Part 2 - Structural transformation and firms performance*. Washington, DC.

World Economic Forum (WEF). (2015). *The inclusive growth and development report 2015*. Geneva: World Economic Forum.

Wuyts, M. & Kilama, B. (2014). Economic transformation in Tanzania: Vicious or virtuous circle? Working Paper 14/4, Dar es Salaam, REPOA.