Drivers of Agricultural Growth in Malawi

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Executive Summary

Cognizant of the need to identify strategies that can transform the agricultural sector to attain the targeted 6% annual growth rate, this study identifies the drivers and constraints of agricultural growth in Malawi. Our analysis shows that the key drivers of Malawi's recent growth in agricultural production include input intensification, improvements in irrigation, and land expansion. Despite these gains, production, and yields remain low and below the estimated potentials and desired targets.

The key constraints to current and future agricultural growth include repeated weather shocks; policy implementation challenges relating to the overemphasis of subsidised inputs in the total agriculture budget; limited access to agricultural extension services due to a severe shortage of extension workers; pests and diseases; reliance on rainfed production; and limited access to lucrative markets. While the challenges persist, there also exist several opportunities to support future agricultural growth and productivity gains. The opportunities include the availability of water supplies and land resources, favourable agroecological conditions, and a large labour force. Despite being abundant, the country's water resources face several challenges, including poor catchment management, rising domestic and industrial demand, environmental degradation, sedimentation, declining water tables, pollution, and adverse climate change impacts.

The country is implementing several necessary steps and strategies to ensure that agricultural growth in the country is resilient to climate change. These include policy alignment to create supportive policies and regulations that incentivise investments in

agriculture; the promotion of the adoption of climate-smart agricultural practices, and sustainable land management practices, including soil health improvement and soil conservation practices; development of seed varieties better adapted to changing climatic conditions; training on crop varieties and cropping patterns suited to climatic and favourable agro-ecological conditions across the country; supporting farmers with access to crop insurance and risk mitigation strategies; and diversified production into drought-resistant and improved livestock breeds.

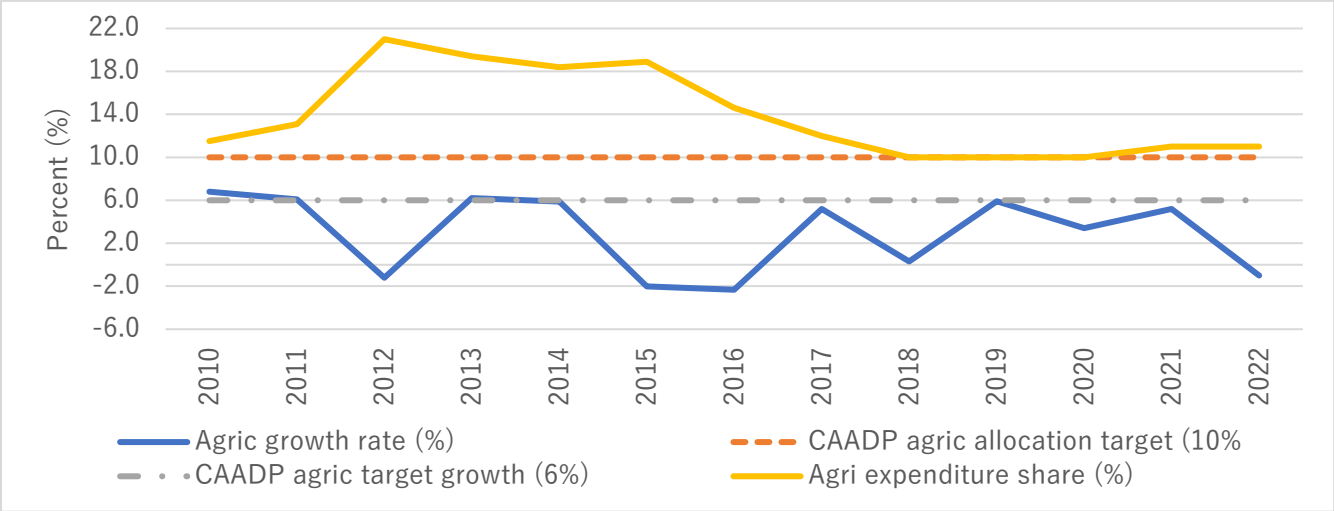
1. Introduction

The challenges of stunted agricultural growth are major concerns for policymakers and development partners in low-income countries. This is the case because agricultural growth can have widespread economic benefits and contribute to development (Cateia et al., 2023). Increased agricultural production can catalyze growth in overall output and economic growth (Rudolf & Zurlinden, 2010), job opportunities (Alani, 2012), improved access to income (Gollin et al., 2014), and reduced poverty (Tiberti & Tiberti, 2015).

To help spur agricultural growth in Africa, the Comprehensive African Agricultural Development Programme (CAADP) in 2003 made a resolution requiring African governments to allocate at least 10% of their national budgets to agriculture to achieve a growth rate of at least 6%. The main aim of this resolution was to reduce food insecurity, malnutrition, and poverty through agricultural-led development agendas and programs. Such an increase is expected to be a catalyst for agricultural growth, which would enable sustainable economic growth in African countries (Somma, 2008; ECA, 2009; Bahta et al., 2014). Malawi has honored the resolution by allocating at least 10% of its national budget to agriculture since 2010. However, the 6% growth target is yet to be seen in Malawi's agricultural growth trajectory. The agriculture growth trend observed in the previous decade remains marginal and volatile (Figure 1). This growth falls short of NEPAD's (2014) definition of 6% as the minimum requirement to support economic development.

Several scholars have attributed the marginal and volatile agriculture growth trend to different factors such as shocks (Xue et al., 2022), uncertainty and risk aversion which are disincentives to agricultural investment (Simtowe et al., 2006); high transfer (transport and transaction) costs (Adamopoulos, 2011); low access to (high cost of acquiring) inputs (Alene et al., 2008); low physical return (yield) from inputs used (Nyondo et al., 2021); low access to extension services (Danso-Abbeam et al., 2018), low access to credits (Houensou et al., 2021), and diminishing land sizes and increased population growth (Mangani et al., 2020).

Figure 1: Share of Agriculture Expenditure in Total Government Budget and Annual Agricultural Growth from 2010-2022



Source: Government of Malawi (2022); Dataset from World Bank (2023)

Despite the marginal performance of the agricultural sector, there is renewed and increasing interest to make the agricultural sector perform through the inclusion of agricultural productivity and commercialization as the key pillar of Malawi's long-term vision (Malawi 2063) and its associated targets (Government of Malawi, 2020b). Through its vision, Malawi plans to increase agricultural value added from MWK406,330 million in 2019 to MWK680,003 million in 2030, and MWK2,200,000 million by 2063 which will require a growth rate of not less than 6% per year. A number of targets are presented for each on the ten-year windows of the implementation of the Malawi 2063. Table A1 in the appendix presents targets for selected indicators of the first 10-year Malawi 2063 Implementation Plan (MIP-1) which covers the period from 2020 to 2030.

Achieving these goals remains a challenge because there is a lack of evidence on how well current policies and program interventions contribute to achieving agricultural growth. This study, hence, builds on this gap to generate the required evidence. In this study, we identify the drivers of agricultural growth and productivity in Malawi by focusing on the following questions: (1) What has driven recent agricultural growth in Malawi? (2) What are

the opportunities and constraints for future agricultural growth in Malawi? (3) What steps are being taken to ensure agricultural growth is resilient to climate change? To address these questions, our analysis focuses on a review of agricultural policies and recent policy changes and assesses the relationship between selected agricultural growth indicators, as detailed in the methodology section.

2. Overview of Malawi's agricultural sector

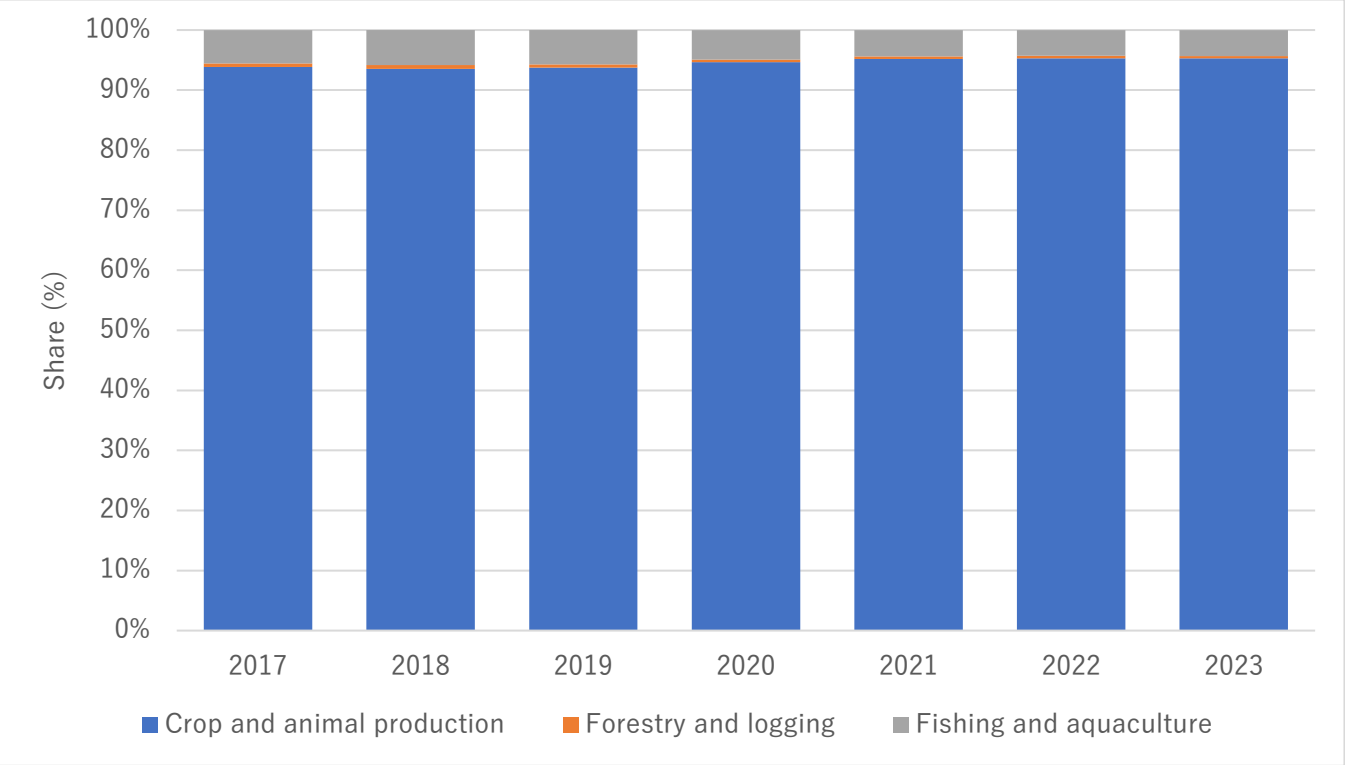
The agricultural sector is comprised of the smallholder sub-sector, contributing more than 70% of the agricultural GDP, and the estate sub-sector, contributing less than 30% of the farm GDP (Zuza et al., 2021; Government of Malawi, 2016). The estate sector is composed of large-scale commercial farms, and they mainly produce cash crops such as tobacco, tea, sugar, coffee, and macadamia for the export market. Smallholder farmers have traditionally grown food crops, such as maize, rice, cassava, sweet potatoes, potatoes, and legumes, to meet the subsistence requirements of their households (Benson & Edelman, 2016; Government of Malawi, 2016). In recent years, smallholder farmers are beginning to produce cash crops that were dominated by the estate sector. More smallholder farmers are now growing tobacco, tea, and coffee, challenging the conventional wisdom that these crops were the exclusive domain of larger farms. Presently, more tobacco is grown by smallholder farmers than by large estates.

The agricultural sector is a very important sector to Malawi's economy, contributing at least 22% to the country's Gross Domestic Product (Malawi Government, 2022), over 80% of forex earnings, and national food self-sufficiency and household food and nutrition security (Ministry of Agriculture and Food Security, 2010). The contribution of agriculture to GDP in Malawi has been above 28% before 2018 but this since has dropped to around 22%. The decline in the contribution of the agricultural sector was associated with the increase in the contribution of the manufacturing sector to GDP which would imply the attainment of the structural transformation of the Malawian economy. However, the transformation stagnated

because the agricultural sector has been contributing around 22% for the past five years suggesting that no further economic transformation has taken place.

Within the agricultural GDP, crops and livestock production provide the largest share (Figure 2). In terms of crops, maize has dominated public policies and expenditures for the past decades – e.g., the inclusion of these crops in the Input Subsidy Programme. Maize is important due to its contribution to the national/household's food and nutrition security. It is the main staple food for most households and covers about 50% of the total cultivated land each season.

Figure 2: Share of Contribution to Agricultural GDP by Agricultural Sub-Sectors



Source: Government of Malawi (2023)

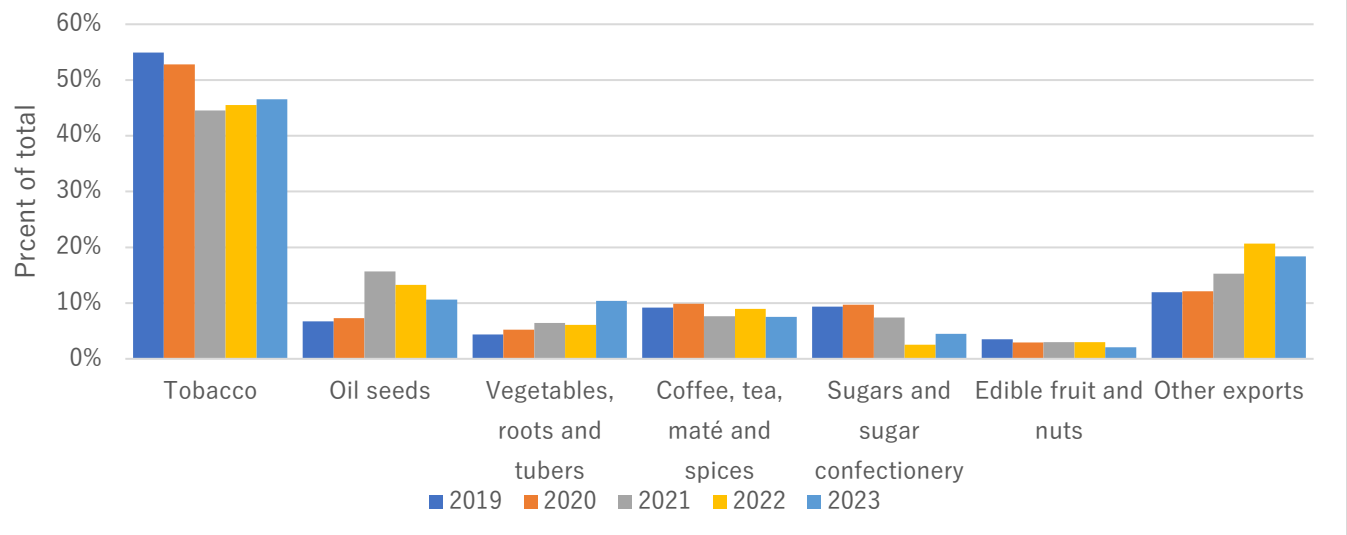
Livestock contributes about 8% of the total GDP and 36% of the total value of agricultural products. It is estimated that about 1.2 million families own at least one or more livestock types. A small proportion of farmers practice intensive husbandry techniques while the majority operate low capital or input, low return management systems. Small ruminants and

scavenging poultry form a big part of the livestock industry in Malawi. Just as crops, livestock also contributes much to household food and nutrition security and incomes. The growth of the livestock sector has been hampered by a lack of better policies and infrastructures, poor husbandry practices, and animal diseases (National Livestock Development Project, 2004; Ministry of Agriculture, 2004).

2.1 Agriculture's contribution to exports

Figure 3 shows the contributions of the various agricultural sub-sectors to the country's exports. While Tobacco remains the main contributor to the nation's export earnings, its contribution to total exports has declined from 55% in 2019 to 47% in 2023. Meanwhile, the contribution of oil seeds comprising soya beans and groundnuts has increased significantly from 7% in 2019 to 11% in 2023. Specifically, data shows that the contribution of oilseeds has surpassed that of coffee, tea, mate', and spices; and sugars and sugar confectionaries which contributed 8% and 4% in 2023, respectively, from 9% each in 2019. Furthermore, the contribution of vegetables, roots, and tubers has also significantly increased from 4% in 2019 to 10% in 2023.

Figure 3: Contribution of Tobacco to Malawi's Exports

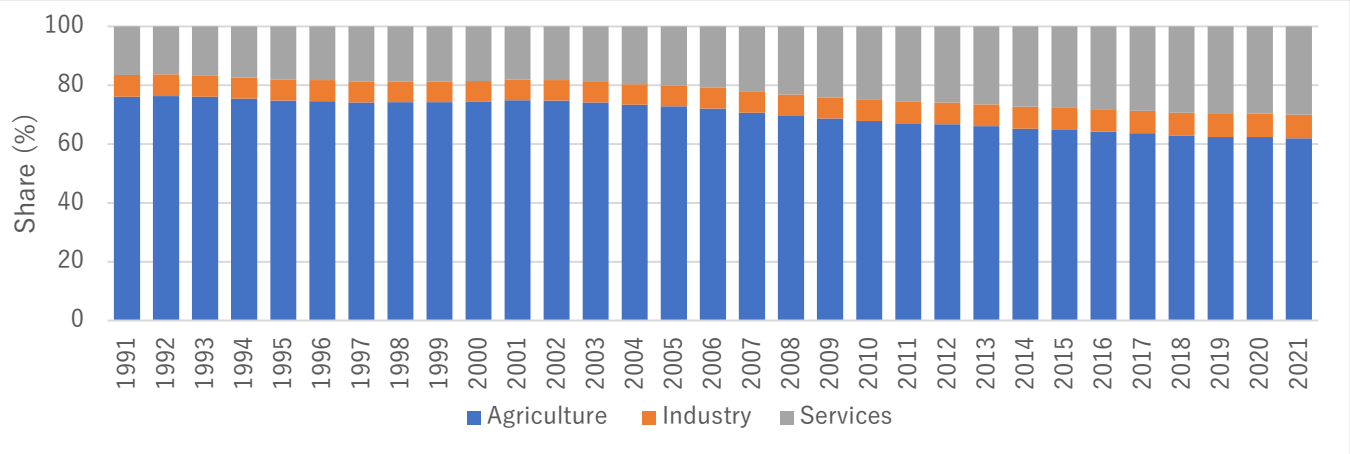


Source: Trade Map- International Trade Statistics

2.2 Agriculture's contribution to employment

Agriculture is a significant employer in the Malawian economy, followed by the services sector and industries. It contributes to the nation's employment by providing direct and indirect employment. Over 84% of households in Malawi engage in farming activities (Government of Malawi, 2020a). Evidence shows that the agriculture sector is also responsible for employing over 60% of the nation's employed population, a decrease from 76% in 1991 (Figure 4). Hence, agriculture's role as a source of livelihood is significant. Agriculture is also responsible for raw materials used in the industrial sector.

Figure 4: Employment by Sector



Source: World Bank (2023), based on modeled ILO estimates

3. Data Sources and Methodology

The study primarily uses multiple sources of data, including the Agricultural Production Estimates Survey (APES), the national agricultural expenditure data, fertiliser use, precipitation, national accounts, and fertiliser use, largely covering the period from 2005 to 2022. Collected annually by the Ministry of Agriculture, the APES data includes information on the volume of production, size of area planted, yield, and regions under irrigation by the estate and smallholder sub-sectors.

We conduct a descriptive trend and correlation analysis of selected indicators such as public agricultural expenditure data, production and productivity levels, irrigation, fertiliser use, and seed uptake. Furthermore, to estimate the drivers of agricultural growth, we apply linear regression analysis on the growth rate of total cereal production[1] as the dependent variable and differenced natural logs of agricultural land, precipitation, and fertiliser use as explanatory variables[2]. The model is specified as follows: -

$$G_t = \alpha + \beta_1 \Delta \ln(L_t) + \beta_2 \Delta \ln(R_t) + \beta_3 \Delta \ln(F_t) + \epsilon_t$$

Where:

- $G_t = \ln(P_t) - \ln(P_{t-1})$ is the growth rate of total cereal production (P) and (t) is the time in years;
- $\Delta \ln(L_t) = \ln(L_t) - \ln(L_{t-1})$ is the differenced natural log of total agricultural land(L);
- $\Delta \ln(R_t) = \ln(R_t) - \ln(R_{t-1})$ is the differenced natural log of precipitation(R) defined as the total annual moisture received in Malawi;
- $\Delta \ln(F_t) = \ln(F_t) - \ln(F_{t-1})$ is the differenced natural log of the amount of fertiliser use$d(F)$ in kilograms per hectare of agricultural land;
- $\beta_1, \beta_2, \beta_3$ are the coefficients of interest indicating how the growth rate in total cereal production responds to changes in agricultural land, precipitation, and fertiliser consumption, respectively.
- ϵ_t is the error term

[1] Cereals include maize, rice, sorghum, millet, and wheat. We use cereals because it is more representative as a proxy for overall agricultural production and also more suited to capture the effects of factors that affect multiple crops not just maize.

[2] We take the first differences to eliminate the problem of unit root because the variables were integrated of order 1 or in levels.

4. Agricultural Policies in Malawi

This section considers various policies that are existing or under development as they relate to the national development agenda, including the proposed reforms aimed at eliminating trade barriers, streamlining regulations that inhibit private investment and competition in agricultural value chains, reducing the level of unpredictability in agricultural markets to promote new entry and investment in agricultural value chains.

4.1 National Development Agenda

Being an agrarian economy, national development goals in Malawi have always recognised agriculture as a very important sector. Malawi's national development goals have always placed the responsibility of developing the Malawian economy through agricultural transformation. That is why the first pillar of the current long-term vision targets to derive an optimally productive and commercialised agriculture sector In support of the vision, Malawi developed MIP-1 that focuses on promoting agricultural diversification; increasing investments in irrigation systems; promoting the establishment of big aggregate farms or cooperatives; establishing of a sustainable high-quality input supply and access system; increasing mechanization and use of modern technologies; ensuring of well-functioning structured markets; and investments in genetic improvement programs for generation of high yielding crop varieties, fast-growing animal and fish breeds and scaling up seed and animal multiplication(Government of Malawi, 2020b). The focus areas of MIP-1 are an indication of the areas that are believed to unlock agricultural growth in Malawi. The other two pillars, industrialization, and urbanization also possess a lot of forward and backward linkages with the agricultural sector and could facilitate agricultural growth. For example, two of the four focus areas of the industrialization pillar in MIP-1 include increasing the transformation of raw materials in the agriculture and mining sectors into high-value products largely for export and the creation of employment, including employment for skilled and unskilled youth; and creation of special economic zones and export processing zones

that promote trade and exports. These focus areas will promote the attainment of increased agricultural productivity and commercialization, which will lead to agricultural growth. Similarly, one of the four focus areas for the urbanization pillar aims to develop secondary cities that are anchored by economic activities. A number of economic activities that will anchor the secondary cities will be agro-related, thereby developing the agricultural sector further. The analysis of the national development vision and goals therefore shows the importance that Malawi places on agriculture.

4.2 Sectoral Policies

Apart from the national development agenda, several sectoral policies are developed and implemented to guide agricultural development goals. The overarching sectoral policy is the National Agricultural Policy (NAP) which was implemented between 2016 and 2021 and a new policy (NAP 2023-2030) has been developed and approved, but is yet to be released. The policy priority areas for the 2016-2021 NAP were coherent with the medium-term national development agenda of that time, the third Malawi Growth and Development Strategy (MGDS III) emphasizing the point that Malawi has always sook agro-based growth. A review of the 2016-2021 NAP found that the NAP was very well formulated with clear, valid, and relevant, but the policy was not effectively implemented, largely because most of the budgetary allocations of the Ministry of Agriculture (MoA) went towards the Farm Input Subsidy Programme (FISP), thereby crowding out other key priority areas such as irrigation, extension, mechanization, market development and the promotion of agro-processing (Mangani et al., 2022). The overarching sectoral policy is supported by sub-sector policies such as the National Irrigation Policy (2016-2022), which focuses on addressing several challenges, including sustainable irrigation development, irrigation management, and capacity development. Malawi also developed the National Irrigation Master Plan and Investment Framework (2015-2035), which aims to boost agricultural development through irrigation development, sustainable irrigation management, capacity building, and coordination and management of irrigation programs. For nearly two decades, Malawi has

been implementing an input subsidy program with the main aim of raising maize productivity and attaining food self-sufficiency. Other important sub-sector policies are presented in Table 1.

The national development agenda and the sectoral policies in the agriculture sector create opportunities for implementing interventions that drive the growth of the agriculture sector. The challenge for Malawi has been the implementation of the policies. Many times, there has been selective and insufficient implementation of the policies, and the outcomes of policy implementation have been marginal.

Table 1: Summary of Agricultural Policies in Malawi

Policy	Aim/Objective
National Agriculture Extension and Advisory Policy (2020)	To harmonise extension methods and improve coordination among stakeholders who provide extension services
National Livestock Development Policy (2021)	To regulate and standardise the provision of livestock extension and veterinary services with the aim of improving livestock production and exports
National Fertiliser Policy (2021)	To improve the industry's performance by sustainably increasing farmers' profitable access to and use of soil—and crop-appropriate fertilisers
National Seed Policy (2018)	To enhance proper and effective seed regulatory framework; enhance seed quality assurance for improved performance of agriculture; develop consistent and internationally acceptable seed certification system; improve growth of the domestic seed industry.

Source: Information summarised from various policy documents

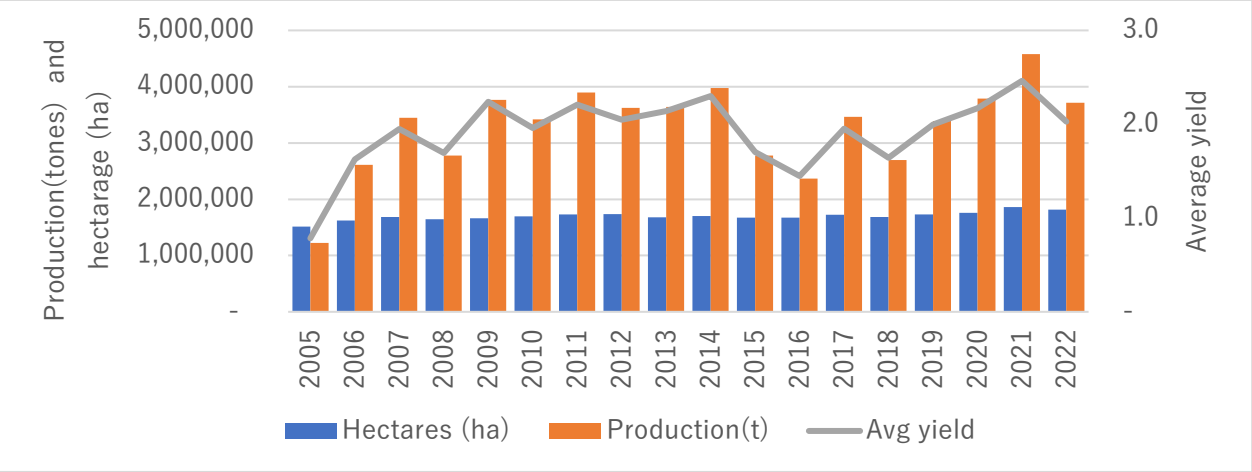
5. What is Driving Agricultural Growth?

Different scholars have identified factors that contribute to agricultural growth. However, these pathways are sometimes unique to a country while others are common. In most cases considering that crop production takes a major share in the sector, soil health has been strongly and commonly highlighted across the literature as the major contributor to agriculture growth (Burke et al., 2022; Khonje et al., 2022; Liu & Basso, 2017). In an attempt to address the soil health issue as a pathway to agricultural growth, agriculture needs timely,

adequate, and good-quality inputs, crop insurance, price incentives, markets, and storage infrastructure to propel its growth (Hoda et al., 2021). Furthermore, agriculture needs intensification of improved technologies such as fertiliser, integrated soil fertility management innovations, and water use (Khonje et al., 2022; Pandey & Kumari, 2021). However, most African countries lack implementation and adoption of these initiatives. Hence, institutional factors such as credit, markets, and extension facilities have to be built to support implementation and access to innovations that would address agriculture growth challenges. Furthermore, developing household social, and economic factors such as resource (wealth, land, inputs, and harvest) control and ownership across gender, land ownership, and education attainment (Julien et al., 2023) is key in enhancing agricultural growth.

The pathways to agricultural growth can be attained through the expansion of cultivated land and the growth in factor productivity. Figure 5 presents a graphical assessment of the trend in the production of maize (the main staple food), productivity, and agricultural land.

Figure 5: Trends in Maize Production and Productivity in Malawi



Source: Annual Production Estimates data

Data reveals the presence of an association between maize output and maize yield between 2005 and 2022, but there seems to be no relationship between land allocated to maize production and volume of production.

To test this relationship, as earlier explained, we estimated a simple agricultural growth model that used the change in the natural log of total cereal production (growth rate in total cereal production) as a dependent variable, while the differenced natural log of agricultural land, precipitation, and fertiliser consumption were used as dependent variables. The findings are presented in Table 2 below.

Table 2: Determinants of Growth in Cereal Production in Malawi

Variable	Coefficients
First difference of natural log of fertiliser	0.228**
	(0.110)
First difference of natural log of precipitation	0.869***
	(0.210)
First difference of natural log of land	9.073**
	(4.095)
Constant	-0.0936
	(0.068)
R-squared	0.40
Number of observations	25

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The findings in Table 2 show that the growth in total cereal production in Malawi is positively influenced by the growth in fertiliser use, precipitation, and land expansion. This shows the role of both land expansion and input intensification in agricultural growth. The influence of the growth in cereal production due to the increase in precipitation points to the importance of climate change in driving agricultural growth in Malawi. More importantly, the adoption of climate-resilient agriculture is expected to lead to agricultural growth in Malawi.

Figure 5 also shows limited changes in the amount of land allocated to maize which has moved from 1.5 million hectares in 2005 to 1.8 million hectares in 2022, adding 300 thousand hectares in 18 years. This is largely due to land pressure in Malawi experiences because of

high population density and growth. Population density in Malawi is estimated at 221 people per square kilometer compared to 23.5 people per square kilometer in the SADC region. In this case, land expansion is not a viable option for increasing agriculture output in Malawi. During the same period, maize productivity has averaged 1.9 tons per hectare against the potential yield of up to 10 tons per hectare for hybrid maize varieties and between 3 to 5 tons per hectare for open-pollinated unimproved maize varieties under good production and management practices. It should further be noted that the drop in yields in years 2005, 2008, 2016, and 2018 has been attributed to drought, floods, dry spells, and late-onset of rains (World Bank, 2021). This shows that the incidence of weather-related shocks also influences agricultural productivity in Malawi. Despite the observed fluctuations in production, there has been a general increase in production between 2005 and 2022 where the initial growth between 2005 and 2006 can be attributed to the introduction of the farm-input subsidy programme comprising the distribution of subsidised chemical fertilisers and improved maize seeds to smallholder farmers.

The existence of the wide yield gap points to the potential of deriving agricultural growth in Malawi through productivity growth, rather than expansion of cultivated land. We, therefore, attempt to identify identifying drivers of productivity growth as drivers of agricultural growth in Malawi.

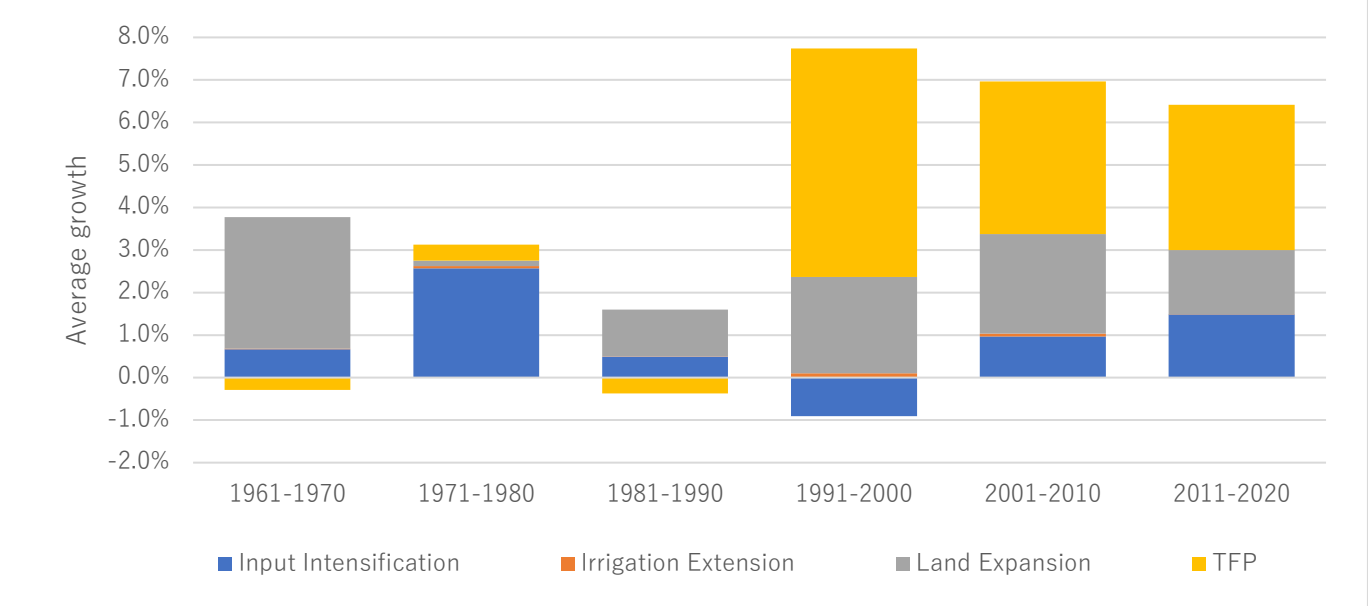
5.1 Sources of agricultural productivity growth

In Figure 6, we assess the sources of growth in Agriculture in Malawi between 1961 and 2020. The Global Agricultural Productivity data shows that on average the Agricultural Total Factor Productivity (TFP) in Malawi has grown by 2% per year between 1961 and 2020. During this period, land expansion and input intensification have grown by 1.7% and 0.7% per year, respectively[3]. Most of the growth in TFP has been observed between 1991 and 2020

[3] TFP refers to the gross amount of crop, livestock, and aquaculture products produced per inputs of labour, materials, and capital; input Intensification is the gross amount of labour, materials, and capital used per

where the TFP has grown by an average of 5.4% per year. Over this period, land expansion and irrigation extension experienced positive growth rates while input intensification growth was negative. Overall, the contribution of irrigation extension to TFP growth has been marginal over the period under consideration. This may be due to the size of irrigation investments that have been made in Malawi and not the inability of irrigation to contribute to TFP growth, as we will show below.

Figure 6: Sources of Agricultural Total Productivity Growth



Source: Global Agricultural Productivity Initiative, 2024

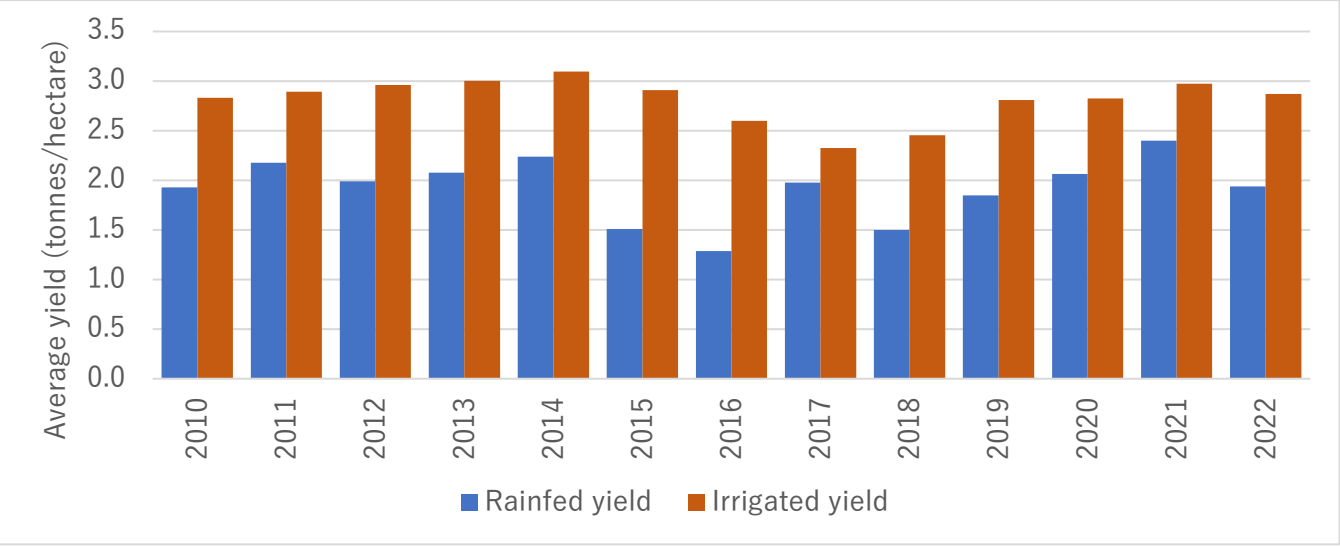
5.1.1 Irrigation extension and agricultural productivity

Irrigation improves farmer's preparedness and ability to use improved farm inputs (Zewdie et al., 2019, 2020). This allows farmers to have increased household income through crop revenue which then enhances farmers' ability to invest more in agriculture. Evidence has shown that farmers engaged in irrigation not only have high crop revenues but also livestock (Zewdie et al., 2020). In Figure 7, we show that maize yields are higher under irrigated

hectare of land; Irrigation Extension refers to the expansion of irrigation to agricultural land; land expansion refers to the extension of agriculture to previously forested areas or grasslands; and output growth is the change in the gross amount of crops, livestock and aquaculture products produced.

production compared to rainfed production. For the period under study, the average maize yield was 2.81 tons per hectare under irrigation compared to the average of 1.92 tons per hectare. This illustrates the potential that irrigation has in driving productivity growth in the country. The drawback is that the country has not invested adequately in irrigation, and most of the irrigation investments are externally financed. Nevertheless, there have been efforts to increase the area under irrigation as shown by the increase in the area under irrigation has increased from 90,563 hectares to 148,851 hectares, representing a growth rate of 64% between 2010 and 2022. This was still low as it only represented about 36% of the total potential area suitable for irrigation.

Figure 7: Comparison of Yield of Rainfed and Irrigated Maize



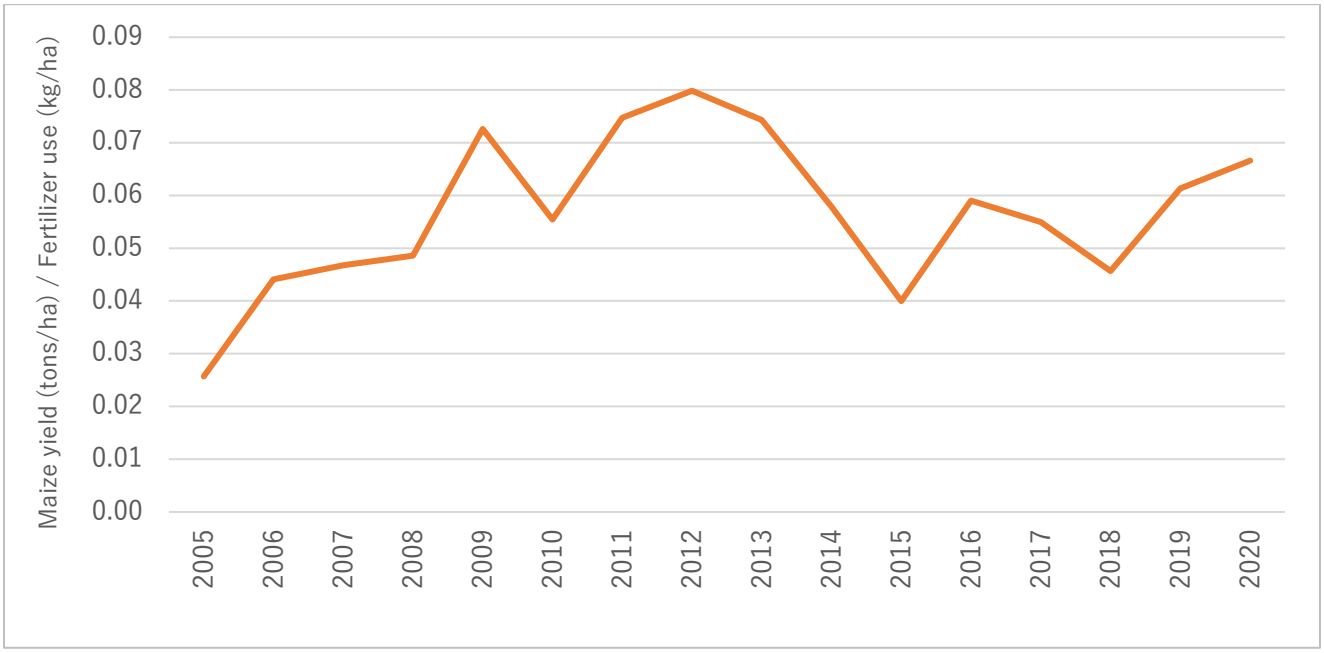
Source: Annual Production Estimates Survey data

5.1.2 Fertiliser use and agricultural productivity

We used fertiliser use as an indicator of input intensification. Fertiliser use is widely known for improving agricultural productivity (Hemming et al., 2018; McArthur & McCord, 2017).

Data in Figure 8 shows an initial improvement in fertiliser yield between 2005 and 2013 followed by a decline between 2014 and 2020[4].

Figure 8: Trends in maize yield per hectare per unit of fertiliser use in Malawi



Source: Computed using APES and World Bank data

The amount of fertiliser applied per hectare of arable land has been increasing in Malawi, with the largest increase taking place around 2004/05—coinciding with the launch of the FISP, suggesting the potential role played by the programme in the increased use of fertilisers in Malawi. The increase in maize production between 2005 and 2014 has been attributed to FISP (Abman & Carney, 2020; Burke et al., 2022; Chirwa & Dorward, 2013). However, the intense use of fertiliser has been widely criticised for having long-term negative effects on soil fertility, reducing agriculture growth (Burke et al., 2022). Despite the rise in productivity in Malawi following the implementation of fertiliser subsidies, recent trends show a decline in yield response to fertilisers as a result of poor crop nitrogen uptake (Burke et al., (2022). Holden and Lunduka (2018) further reveal that beneficiaries of government-sponsored input subsidies had a lower yield than non-beneficiaries due to

[4] Fertiliser yield has been computed as a share of maize yield per hectare to the amount of fertiliser used per hectare. We use maize because it is the dominant crop grown in Malawi and fertiliser subsidies are primarily designed to support maize production as opposed to other crops.

inefficacies by input subsidy beneficiaries. Thus, even though fertiliser use has increased in Malawi, its effects on agricultural growth are curtailed by inefficient fertiliser users and poor crop nitrogen uptake. To address the challenge of low yield response to fertilisers, evidence by Khonje et al. (2022) suggests the integration of soil and health-enhancing innovations into the subsidy programs improves crop productivity.

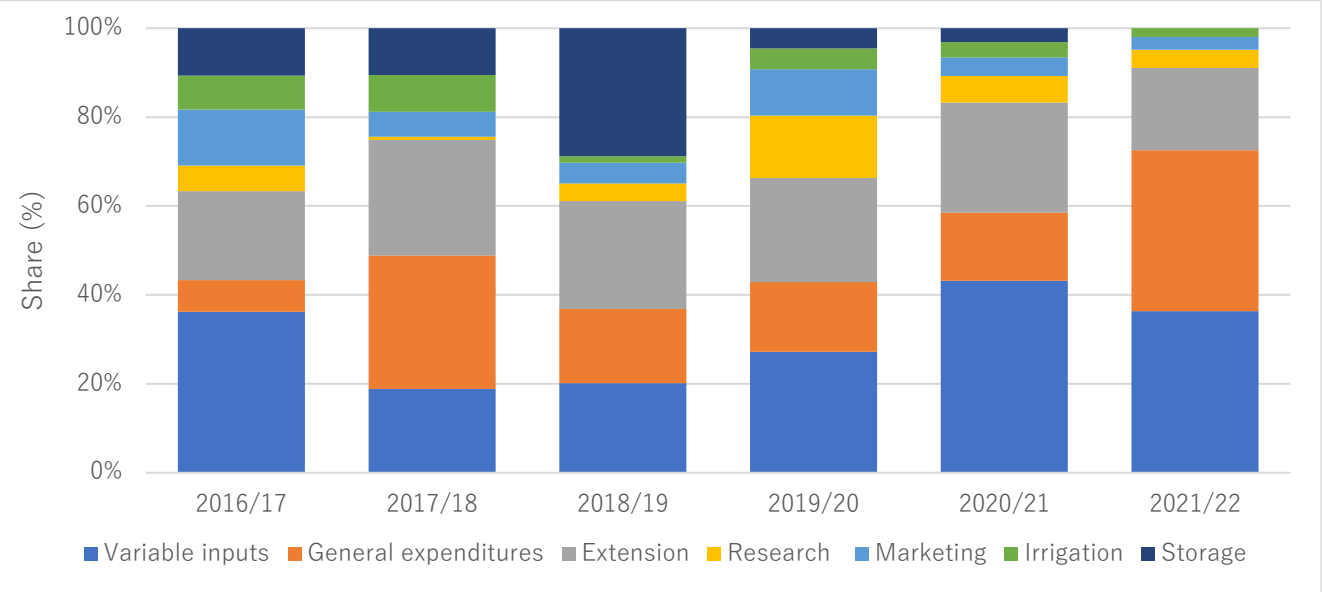
5.2 Agricultural policy implementation

As has been stated above, Malawi has a robust policy framework that could ably support agricultural growth. However, Malawi's challenge is in policy implementation. One of the ways to assess policy implementation is to look at investments that a government makes in the sector. Evidence compiled from various scholars spanning two decades underscores the significance of public investments in agriculture especially in research and development (R&D), irrigation, and extension to achieve agriculture growth (Alston et al., 2015; Benfica et al., 2019; Kamenya et al., 2022; Mogues et al., 2012; Sánchez et al., 2022; Thirtle et al., 2003). Despite the variances in the extent of sectoral contribution to agriculture growth, there is evidence of strong and stable positive correlations between R&D and extension investments on agricultural growth (Cai et al., 2017; Chandio et al., 2023; Sánchez et al., 2022).

Despite the wide range of evidence on the positive effects of public expenditure on R&D and extension on agriculture growth, Malawi's public agriculture expenditure has been dominated by fertiliser and seed input subsidies. Figure 9 shows the shares of expenditure on variable inputs (seeds and fertiliser), extension, irrigation, and other agricultural expenditures between 2016 and 2022 to the total Ministry of Agriculture budget. The data shows that expenditures on variable inputs have been above 40% of the Ministry of Agriculture budget reaching the highest in 2020/21 when this represented 86% of the budget. The increases and decreases in the share of variable costs are due to some policy changes (fertiliser input subsidy targeting) which have been implemented in the country from time to time. Budget shares for extension, irrigation, and other programs such as research and development have been very low. The skewed distribution of expenditures by

the Ministry of Agriculture has significantly undermined growth in the sector. Slow growth in Agriculture GDP can, therefore, be attributed to poor policy implementation.

Figure 9: Trends in Central Ministry of Agriculture Public Agriculture Expenditure (FY2016/17 - FY 2021/22)



Source: Authors. Data: public expenditure data

6. Challenges Facing Malawi's Agriculture Sector

Despite the Government's efforts to enhance agriculture growth, current agricultural growth remains below the 6% CAADP target as earlier shown. This can be attributed to several factors constraining the agricultural sector, including climatic shocks, market challenges, low access to inputs, and low access to extension services.

6.1 Dominance of subsidised input programmes in the agricultural budget

As shown in Figure 9, for the past ten years, the budgetary allocations in the Ministry of Agriculture have been dominated by FISP which was later transformed into a broader Affordable Inputs Programme (AIP) in 2020. The dominance of subsidised fertiliser and seed has led to the crowding out of other key priority areas such as irrigation, extension,

mechanization, market development, and the promotion of agro-processing. Hence, excluding the allocation for input subsidy programs, it is evident that the sector received significantly inadequate resources in comparison to the total Ministry of Agriculture budget.

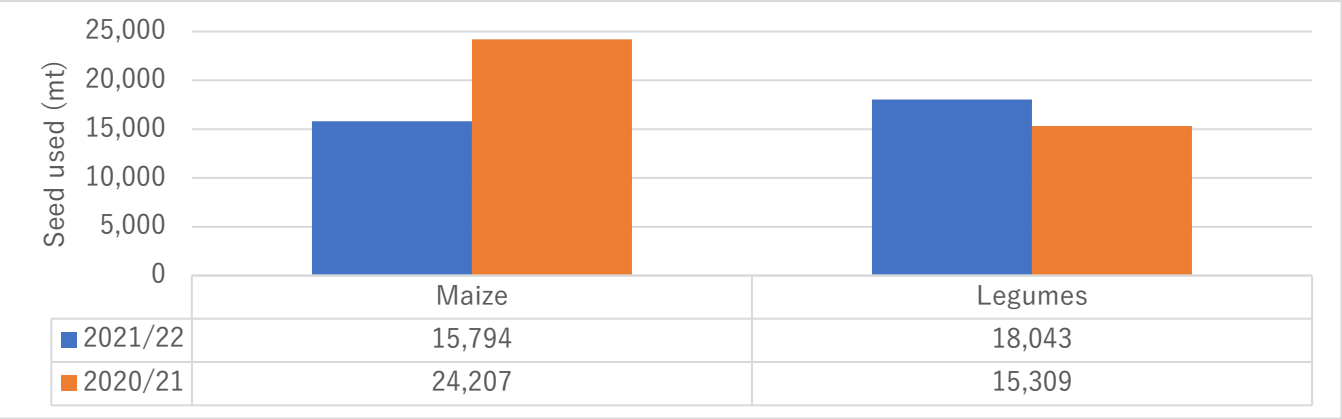
6.2 Limited access to extension

Agricultural extension plays a crucial role in enhancing agriculture productivity by promoting the acceleration of technology adoption, supporting rural adult learning, enhancing farmer problem-solving capacity, and improving farmers' participation in agricultural knowledge and information systems (Swanson, 2008; Danso-Abbeam et al., 2018). The National Agricultural Policy (2016) sought to reduce the farmer-to-extension-worker ratio from 3,000:1 in the 2017/18 fiscal year to 1,000:1 by the 2022/23 fiscal year. In 2020/21 the farmer-extension ratio was 1,929:1 and the ratio worsened to 2,017 to 1 in 2021/22 due to high vacancy rates which continue to impede the delivery of extension services (Government of Malawi, 2022). The few government extension officers are hardly funded to provide extension services to the smallholder farmers. The Government continues to solicit financial assistance from development partners to assist in acquiring motorcycles, hire more extension workers, and utilise alternative agriculture extension channels such as electronic gadgets tablets, and mobile phones. This means that many smallholder farmers do not have access to extension services.

6.3 Limited access to improved inputs

Although the country has been implementing the farm input subsidy program, access to and availability of improved inputs (fertilisers and seeds) has been a challenge for many smallholder farmers. During the 2021/22 season, the uptake of improved maize seed used was estimated at 15,794 mt, which is lower than 24,207 mt accessed by farmers in the 2020/21 season, partly due to the high cost of improved inputs and availability. The limited supply of certified and inadequate seed multiplication efforts has led to an increase in the supply of counterfeit seeds and low-yielding local seeds.

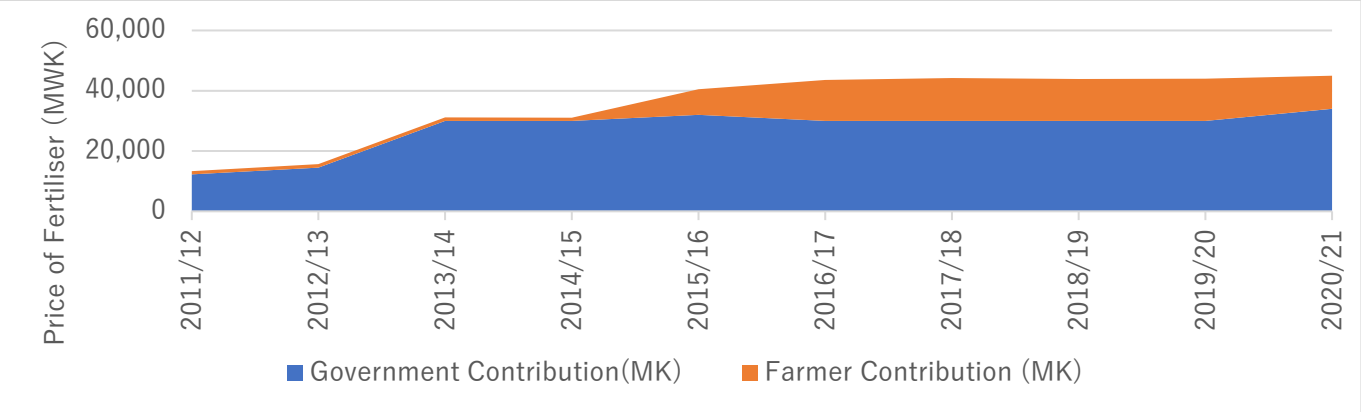
Figure 10: Improved Seed Uptake during 2020/21 and 2021/22 Seasons



Source: Ministry of Agriculture

Increasing prices of inputs is one of the major reasons for the low uptake of inputs. For example, as shown in Figure 11, the share of the cost of fertiliser and seeds contributed by farmers has increased from 8% during the 2011/12 season to 24% in the 2020/21 season. Another reason for the low uptake of inputs is the unavailability of improved inputs of preferred choice, exacerbated by the late delivery of affordable inputs (Booth et al., 2006).

Figure 11: Share of Farmer and Government Contribution in Subsidised Fertiliser Programme Based On 50kg of Basal and Top-Dressing Fertiliser



Source: Computed from Ministry of Agriculture data

Furthermore, there has been a low-crop response rate to fertiliser as a result of soil characteristics such as low pH (acidity) and low soil carbon (Marenya & Barrett, 2009; Snapp et al., 2014; Burke et al., 2017). Recent studies recommend the usage of other inputs such

as organic fertilisers and lime to improve soil health in addition to inorganic fertilisers which most farmers fail to access (Islam et al., 2021).

6.4 Climatic shocks, pests and diseases

Research has shown that climatic shocks continue to have agronomic impacts specifically on crop yields (Magaga & Malakini, 2015). These agronomic and economic impacts depend on the extent of climatic change, and the environment's ability to absorb the impacts of climate change (Xiang et al., 2010). Recent evidence suggests that Malawi is likely to face more climate shock with high magnitudes. The estimated rising temperatures and dwindling rainfalls will lead to a reduction in yield as a result of heat and a reduction in water supply (Simelton et al., 2013). This is likely to affect agriculture growth considering that there is low adoption of adaptation strategies (Maguza-Tembo et al., 2017).

In Malawi, climate-related shocks in the form of repeated weather shocks (e.g., droughts, dry spells, floods, and cyclones), pests and diseases (e.g., fall armyworms, banana bunchy top, locusts) have increased the vulnerability of affected communities to food insecurity and undernutrition especially in the southern region of Malawi (Nyirenda et al., 2022). While the Government of Malawi has been promoting integrated management and control of pests and diseases, most of the performance indicators are below target (Table 3).

Table 3: Status of Selected Livestock Diseases

No	Baseline indicator, and year	Baseline	2021/22	NAP Target
1	Newcastle disease mortality in chickens per year (2016)	80%	60%	< 5%
2	African Swine Fever mortalities of pigs per year (2014)	90%	>80%	< 20%
3	East Coast Fever mortalities per year (2016)	70%-90%	>70%	< 10%

Source: Mangani et al. (2022)

6.5 Low production and productivity levels

Malawi's agriculture suffers from low production and productivity levels due to several challenges highlighted in the foregoing subsections. Tables A2 to A4 in the appendix show

the agricultural production and productivity indicators of cereals, legumes, livestock, and fisheries against NAP 2026 and the National Agricultural Investment Plan (NAIP) targets.

According to the NAP review report, agricultural production and productivity have not sufficiently been able to match the growing domestic demand and exploit the available export opportunities due to climate variability and change, dependence on rain-fed production, low adoption of improved inputs, low mechanization, low technical labour skills, declining soil health, and weak linkages to lucrative markets, particularly among smallholder farmers (Mangani et al., 2022; Burke et al., 2020).

6.6 Market challenges

Malawi's agriculture sector is predominantly supported by unstructured markets as most farmers produce for their own consumption. Following this, farmers face uncertainties in terms of market prices and buyers (Ochieng et al., 2020). Production volatility leads to price shocks (Dorward & Kydd, 2004). This is worsened by unpredictable government policies which restrict the trade of maize and other crops. These restrictions prevent surplus maize producers from accessing better regional markets. Such initiative has made the maize market more volatile to prices which increases market risks for potential commercial maize producers and traders(Fuje & Pullabhotla, 2020). Thus, preventing commercial growers from engaging in some value chains which negatively affects agriculture growth.

7. Opportunities for future agricultural growth

There exist several opportunities to support agriculture growth in Malawi despite the challenges facing the agricultural sector such as the impacts of climate change, low input supplies, unstructured markets, and unpredictable policies. These include vast water supplies to support additional investments in irrigation, favourable agroecological conditions, and a large labour force. Furthermore, most agricultural sub-sectors such as

livestock, fisheries, and horticulture are still in their infancy stages which gives room for improvement.

7.1 Potential to improve yields

There exists a potential to improve yields in Malawi by making investments in the supply of improved inputs (seeds, fertilisers) and good production practices which can be transferred through access to extension services. Increases in production and productivity levels can be achieved with investments in irrigation and improved inputs to reach the estimated yield potentials without the need to develop new farms. As shown in Table A2, the current yield levels for both cereals and legumes fall below their potential levels and targets set in NAIP.

7.2 Endowment of water resources for irrigation

Malawi is endowed with abundant water resources comprising surface and groundwater resources to support additional investments in irrigation development. Surface water bodies cover 21% of Malawi's total land area and 20% of the surface water resource is Lake Malawi. Groundwater on an annual average represents only about 3.6 % of the total sustainable water resource available in the country (Government of Malawi, 2014). Furthermore, according to the Irrigation Master Plan and Investment Framework 2015-2035, the country is said to have 408,000 ha that are suitable for irrigation of which only 146,966 ha is being irrigated (Government of Malawi, 2022). Although abundant, the existing water resources face challenges which include poor management of catchment areas; rising demand for water for domestic, industrial production, and irrigation uses; environmental degradation and disruption of the ecosystem; sedimentation and siltation; declining water tables; pollution, and adverse impacts of climate change (Government of Malawi, 2014).

7.3 The potential of the mega-farms programme to transform Malawian agriculture

About 59% of Malawi's total land area is suitable for agriculture, and 38% of it is arable land. This amounts to 3.6 million hectares, of which 2.1 million hectares are currently being

utilised. However, as already noted in Section 5, Malawi is a densely populated country with a high population growth rate and this puts a strain on land availability and contributes to the challenges of deforestation and soil erosion. However, the Malawi Government has established a mega-farm initiative that aims to make available idle estates for use by the private sector. The mega-farms will also serve as pivots for large-scale production and anchor smallholder farmers in surrounding communities by providing private markets for inputs, outputs, and extension services (Gondwe et al., 2022). This initiative seeks to enhance agricultural growth in several ways. Firstly, it seeks to address the challenge of input access among smallholder farmers as discussed in section 6.3 above (Joseph et al., 2023). Secondly, it seeks to link farmers to lucrative local and export markets which are crucial for stimulating agriculture growth as highlighted in Section 6.6. Finally, it enhances access to extension services which is key in enhancing the adoption of new technologies and promoting agriculture productivity (Danso-Abbeam et al., 2018). Mega-farms can integrate vertically beyond the production stage, tackle market imperfections in input markets, and may even have the ability to exert market power (Ao et al., 2021). Thus, produce from smallholder farmers is likely to be sold to the mega-farms that anchor smallholder farmers. These mega-farms are also more likely to be linked to commercial or export markets that demand large volumes of produce. In some instances, mega-farms have processing units that process raw produce for final consumption. Either way, the mega-farms will demand quality produce from the smallholder farmers, and hence likely to invest in extension services to ensure that good quality produce is met.

7.4 Favourable agro-ecological conditions

Agroecological zones are developed from different characteristics, including soil texture and rainfall patterns. This makes them unique in influencing agricultural planning, technology dissemination, and use of resources. Malawi's agroecological zones are classified into four – highlands, escarpment, plateau, upper shire valley, and lower shire valley. These zones have different soil textures and rainfall patterns and support a mix of crops, including

cereals, legumes, and an assortment of cash crops (Benson et al., 2016). The ability of these agroecological zones to accommodate various crops and livestock provides an opportunity for agricultural expansion across the country. Recent evidence suggests that farmers across these agroecological zones are already cultivating a variety of crops beyond traditional crops like maize (Kamkwamba et al., 2018; Fatch et al., 2021).

7.5 Abundant labour force

As discussed in Section 2.2, more than 84% of Malawi's population is reported to be engaged in agriculture or farming activities. A majority of the farmers are smallholders residing in rural areas where poverty levels are high. While some farmers are increasingly diversifying their sources of livelihoods outside agriculture, crop production remains the dominant source although incomes from agriculture remain lower compared to non-agricultural livelihoods (Benson & De Weerdt, 2023). Consequently, there is an abundant labour force that could support agriculture investments including seasonal and temporary employment. Moreover, most of the farmers possess agricultural skills and some knowledge of improved production methods, leading to increased productivity and higher farm incomes.

7.6 Growth in global trade and market opportunities

Global population growth, commodity price improvement, and economic growth of developing countries are expanding domestic and export markets which is creating opportunities for smallholder farmers who can consistently increase production for the market (Ferris et al., 2014; Fukase & Martin, 2020). The increased demand for high-value fruits and vegetables across the globe is also providing opportunities. Following this high food demand, smallholder farmers are now considered key suppliers in both domestic and regional markets. Similarly, Malawi's growing population provides an opportunity for increased production.

Furthermore, government initiatives to expand the export base also provide an opportunity for agricultural growth. This is guided by the Malawi National Trade Policy (2016) and Malawi National Export Strategy II (2021-2026) which focuses on increasing the value and diversifying the country's export base (Government of Malawi, 2016; Government of Malawi, 2021). Lessons from Mamba & Ali (2022) and Xu et al. (2023) suggest that enhanced exports increase agriculture growth. Therefore, considering that Malawi is a signatory of various trade arrangements such as the World Trade Organization, the European Union's Everything But Arms (EBA) agreement, COMESA and SADC, the Africa Growth and Opportunity Act (AGOA), Africa Continental Free Trade Area (AFCTA) and bilateral agreement with countries like China, Zimbabwe, Japan, South Africa, and Malaysia provide an opportunity for growth.

8. Government strategies to ensure agricultural growth is resilient to climate change

Addressing these constraints is vital for the sector's sustainability and economic well-being. To ensure that agricultural growth in Malawi is resilient to climate change, several key steps and strategies are being implemented by the Government of Malawi.

8.1 Policy alignment

The existing National Agriculture Policy, which covers the period from 2016 to 2021, was aligned with the CAADP and the United Nations' Sustainable Development Goals for 2015-2030. The policy is currently under review and one of the recommendations being considered is the need for the new National Agricultural Policy to be aligned with the Malawi 2063 and MIP-1 which identify agriculture as one of the key priority areas to anchor the national development agenda (Government of Malawi, 2020b, 2021a).

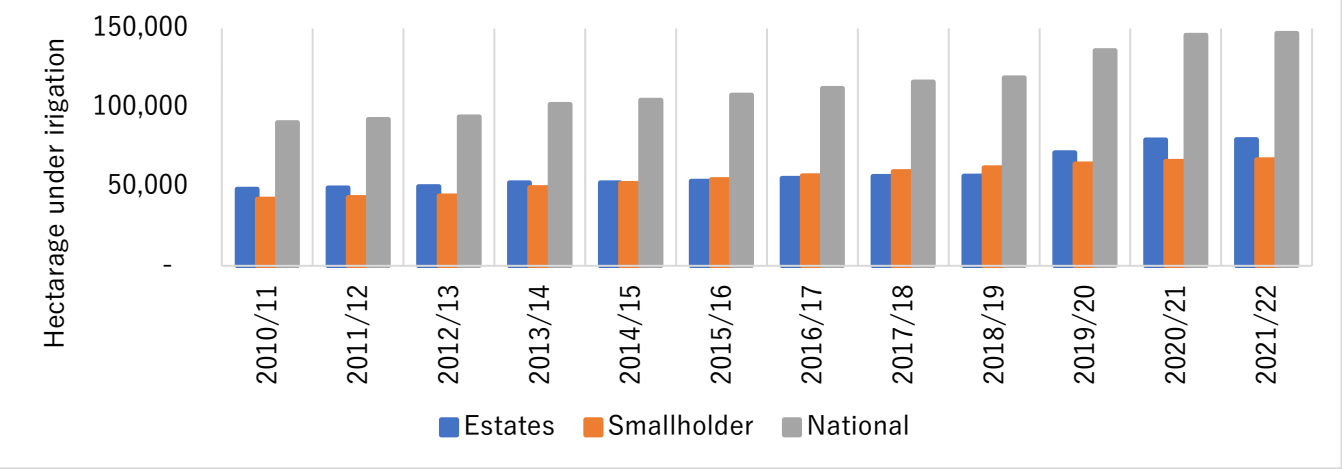
8.2 Climate-smart agricultural practices and resilient livelihoods and production systems

The Government of Malawi is promoting the adoption of climate-smart agricultural practices, such as conservation agriculture, crop rotation, and agroforestry, which enhance soil health, conserve water, and reduce vulnerability to extreme weather events. Furthermore, the Government is promoting sustainable natural resource management, afforestation, and reforestation initiatives. These help stabilise local climates and provide additional income opportunities (Government of Malawi, 2022).

8.3 Sustainable irrigation and water management practices

The Government is currently investing in sustainable irrigation systems and water management practices to ensure a consistent water supply for crops and expand the area under irrigation. As at the end of 2022, about 148,851 ha out of the potential irrigable area of 407,862 ha was reported to have been developed for irrigation in Malawi as shown below in Figure 12 (Government of Malawi, 2022).

Figure 12: Share of Irrigation by Farm Type



Source: Government of Malawi (2022)

The Government aims to irrigate an additional 220,000 ha by 2035 (Malawi Government, 2016). To this effect, several initiatives are currently in place, including the Shire Valley Transformation initiative which aims to develop 43,370 hectares with irrigation; the Program for Rural Irrigation Development (PRIDE) which seeks to develop about 6,000 ha of irrigation area; and the Malawi Food Systems Irrigation Project which seeks to develop 4,243 ha (Government of Malawi, 2022). These initiatives will significantly increase the area under irrigation and contribute to agricultural growth.

8.4 Seed development

The Government is promoting research and development efforts aimed at breeding and improving farmer access to crop varieties that are better adapted to changing climate conditions. The initiatives focus on developing and disseminating varieties with shorter growing seasons and increased heat tolerance. However, research highlights the importance of soil health improvement in sustaining agricultural productivity, highlighting the need to promote soil conservation practices, organic farming techniques, and the use of organic fertilisers and soil conditioners to enhance soil health, fertility, and carbon content (Kihara et al., 2020; Ogieriakhi & Woodward, 2022). Furthermore, providing training and capacity-building programs for farmers helps to equip them with the knowledge and skills required to adapt to changing climate conditions and adopt sustainable farming practices (Ahsan et al., 2021).

8.5 Crop Insurance

The Government is improving farmers' resilience to losses from climate-related events by supporting their access to insurance and risk mitigation schemes. Risk-reduction strategies include crop diversification and disaster preparedness plans. Notably, with the financial assistance of its partners, including KfW, FCDO, and Swedish Development Cooperation, the Government obtained a Drought Insurance Policy for four ADD clusters from the African Risk Capacity Insurance (ARC) (Government of Malawi, 2022). Furthermore, the World Food

Programme (WFP) under the Adaptation Fund Programme provided crop insurance coverage for 64,709 households in 8 districts in the southern region of Malawi during the 2021/22 season (Government of Malawi, 2022). Additionally, WFP and ARC, the One Acre Fund (OAF) provide insurance to farmers against extreme maize harvest losses. Specifically, during the 2021/22 season, 62,000 farmers were covered by the area yield weather index product with a total of K37,379,095 paid out to about 10,382 farmers affected by Cyclone Ana (Government of Malawi, 2022). Moreover, the ARC policy triggered payouts totaling USD14.2 million in four ADD clusters (Government of Malawi, 2022).

8.6 Agricultural diversification

The Government's diversification agenda is focused on promoting the cultivation of high-value crops for both export and local consumption. Strategies are focused on enhancing agricultural production and productivity; agro-processing; value-addition; diversified crop portfolios; and promoting the production of drought-resistant crop varieties, and improved livestock breeds. The National Export Strategy II, covering the period from 2021 to 2026, specifically promotes the export of priority non-traditional crops such as soya, groundnuts, and macadamia (Government of Malawi, 2021b). This should be supported by training on climate-resilient crop varieties and optimised cropping patterns tailoured to the diverse agroecological zones and favourable climatic conditions across the country.

9. Summary and proposed recommendations

The study relies on publicly available data from the annual agricultural production estimates and agricultural expenditure data to conduct a descriptive and trend analysis of the key drivers of agricultural growth and productivity. It highlights the challenges facing the agriculture sector, opportunities for future agricultural growth, and the measures taken by the Government of Malawi to ensure that agriculture is resilient to climate change.

The study indicates that recent growth in Malawi's production and productivity has been driven by factors such as expansion in irrigation, increased uptake of improved fertilisers, and land expansion. However, our study shows that despite these gains, the levels of production and productivity are low and remain below the potential. The limiting factors include the dominance of fertiliser and seed input subsidies in the country's public agricultural expenditure; limited access to extension services; limited access and supply of improved inputs such as fertilisers; repeated weather shocks exacerbated by the country's overreliance on rain-fed production; pests and diseases; and limited access to lucrative markets.

Despite the limiting factors, the study highlights numerous prospects that exist for strengthening Malawi's agriculture and supporting future growth. The opportunities include the availability of abundant water resources to support additional investments in irrigation despite growing demand and the challenges posed by climate change; unutilised land reserves; favourable agroecological conditions; a substantial labour pool; and the availability of regional and global market opportunities. Moreover, most of the sub-sectors are at the early stages of development, offering substantial room for improvement.

The Government of Malawi is taking significant steps and strategies to ensure that agricultural growth in the country remains resilient to the impacts of climate change. These include policy reforms aimed at aligning with the current development agenda; promotion of climate-smart agricultural practices and resilient livelihood; promotion of sustainable irrigation and water management practices; development of seed systems; supporting farmer access to insurance and risk mitigation schemes and promoting agricultural diversification.

The study recommends the urgent need to address the challenges limiting agricultural production and productivity in Malawi. Strategies include investments in irrigation; improved access to seed; strengthening access to extension services which is critical for the transfer

of knowledge and modern farming practices; implementation of integrated pest and disease management strategies and capacity development for farmers in pest and disease control to minimise crop losses and ensure food security; develop infrastructure and policies to enhance access to markets including improving transportation, storage, and market information systems; and promotion of climate-smart agricultural practices and resilient livelihoods, with a focus on sustainable water management and irrigation; promotion of sustainable land management practices, including soil health improvement and soil conservation. There is also a need to increase access to insurance and risk mitigation schemes to protect farmers against weather-related losses and other agricultural risks; review and update policies as needed to address emerging challenges and opportunities, and ensure that policies and regulations are aligned to support agricultural growth and create a conducive policy environment that encourages private sector investment in agriculture.

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Appendix A – Agricultural Production and Productivity Indicators

Table A 1: Selected MIP-1 Agricultural-Related Targets (2020-2030)

Description		Baseline (2020)	Target (2030)
Area under irrigation (ha)			
	Large scale	56,856	63,656
	Smallholder	61,987	77,987
	Total	118,843	141,643
Crop production ('000 mt)			
	Industrial hemp	0	250
	Pulses	233	1,000
	Cereals (rice and wheat)	318	367
	Tobacco	114	501
	Maize	2,786	3,120
Livestock population ('000)			
	Cattle	1,890	2,220
	Goat	10,030	13,100
	Chicken	197,000	268,000

Source: Government of Malawi (2021a)

Table A 2: Productivity Levels for Cereals and Legumes

	2020/21	2021/22	Annual % Change	NAIP Target Yield (MT/ha)
Maize	2.5	2.0	-20.0%	4.0
Rice	2.1	1.8	-14.3%	2.0
Wheat	1.2	0.9	-25.0%	-
Millet	0.7	0.7	0.0%	1.0
Groundnuts	1.0	1.0	0.0%	2.0
Pulses	1.0	1.0	0.0%	2.0
Beans	0.6	0.6	0.0%	1.0
Pigeon peas	1.6	1.6	0.0%	2.0
Soya beans	1.2	1.2	0.0%	2.0

Source: Ministry of Agriculture

Table A 3: Production Levels for Livestock

Description	2020/21	2021/22	Proportion of Targets- %	NAIP Targets
Cattle	1,959,101	2,054,208	103	2,000,000
Goats	11,104,382	12,238,382	122	10,000,000
Sheep	373,715	404,956	8.4	-
Pigs	9,312,073	10,698,418	268	4,000,000
Chickens	227,140,227	230,056,331	208	110,000,000

Source: Ministry of Agriculture

Table A 4: Production Levels for Fish

Category	2020/2021(Mt)	2021/2022(Mt)	Percentage Change
Large Scale Capture Fisheries (Lake Malawi)	2,344	1,844	-21%
Small scale Capture Fisheries (All Water Bodies)	171,087	168,481	-2%
Large Scale Aquaculture (Cage Culture)	5,703	5,302	-7%
Small Scale Aquaculture (Pond Culture)	2,957	4,611	56%
Total Production	182,091	180,238	-1%

Source: Ministry of Agriculture