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An Assessment of Tanzania's Agricultural Production, Climate Change, Agricultural Trade and Food Security

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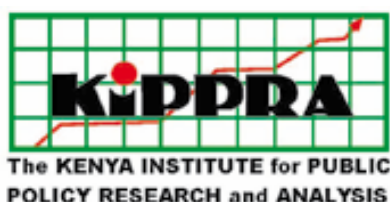
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Tumbo S.D., Mahoo, H.F, Mutabazi, K.D., Kahimba, F.C.,
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Centre for Research and Development (CERDA)
Sokoine University of Agriculture

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KIPPRA in Brief

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Foreword

Climate change and climate change variability is a threat to food production patterns, thus exacerbating food and nutrition insecurity across Africa. Therefore, tackling poverty, hunger and food security is a priority for the Africa Union Agenda 2063 which underscores the right of Africans to live healthy and productive lives. Further, the African Union has set a target to eliminate hunger and food insecurity by 2025 towards achieving the Sustainable Development Goal (SDG) 2 on ending hunger, achieving food security and improving nutrition. Unfortunately, Africa is not on track in meeting these targets mainly because the region is not producing enough food due to climate change and low adoption of technology. However, climate change has variable impacts on food production, with both production losses and gains across the region. As a result, regional trade is critical for facilitating the distribution of agricultural products to enhance food security in the region.

The East Africa Community (EAC) region is particularly vulnerable to climate change. The region is already experiencing increased climate change impacts, including extreme weather conditions, persistent drought, floods, and landslides and rising sea level which threaten food security and efforts to eradicate poverty. Despite the huge potential to produce enough food, the agricultural production system in the region is mainly rainfed, which consequently leads to high food and nutrition insecurity.

Finding solutions to perennial food security challenges in the EAC is crucial and urgent as climate change impacts intensify in frequency and severity. Looking beyond just agricultural production systems is thus critical in tackling this peril. Thus, there is need to apply other approaches such as the nexus approach which allows for evaluating integrative systems where, for instance, trade facilitates food security in a changing climate environment. Although agriculture production is vulnerable to climate change, food security is not necessary a result of low production but a combination of other factors such as poor food distribution caused by perverse subsidies and other trade barriers. The EAC has been able to attain a common market status, which could facilitate trade in the region and thus mitigate food shortages.

Despite the various measures and programmes adopted in EAC, some parts of the region continue to face food deficits due to restrictive trade policies and barriers to trade. Opportunities exist for adopting existing policy frameworks by member countries to address food security needs.

Preface

The project on Regional Assessment of Climate Change, Agricultural Production, Trade in Agricultural Production and Food Security in East African Community (EAC) was carried with support from the ACPC-CLIMDEV Work Programme. The ClimDev-Africa Programme is an initiative of the African Union Commission (AUC), the United Nations Economic Commission for Africa (UNECA) and the African Development Bank (AfDB). It is mandated at the highest level by African leaders (AU Summit of Heads of State and Government). The Programme was established to create a solid foundation for Africa's response to climate change and works closely with other African and non-African institutions and partners specialized in climate and development.

Over the last few years, our understanding and certainty about how climate is changing and the possible impacts this could have has grown immensely. This notwithstanding, agricultural production systems in the EAC region are highly vulnerable to climate change, consequently affecting food and nutrition security. The region is the most developed regional economic community (REC) in Africa, and cross border trade plays a critical role in facilitating food security. In response, the United Nations Economic Commission for Africa–African Climate Policy Centre (ACPC) is increasing its efforts to improve the capacity of EAC member states for mainstreaming climate change impacts in development policies, frameworks and plans.

The three-year project was launched in May 2014 covering Burundi, Kenya, Rwanda, Tanzania and Uganda. The activities carried in this study were linked to the ClimDev-Africa Programme work stream II, which focuses on solid policy analysis for decision support, and was spearheaded by the Kenya Institute for Public Policy Research Analysis (KIPPRA). The overall objective of the project was to assess whether or not agricultural production systems and trade policies in EAC can be adjusted to alleviate the impact of climate change on food security, and promote sustainable development. The project outputs include pre-project report, country scoping studies, indepth EAC studies on climate change, crop production model, economic policy and trade and finally a comprehensive regional report.

Acknowledgements

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The study was conducted as a part of the activities of the Climate Change and Development in Africa (ClimDev-Africa) Programme supported by the UK Department for International Development (DfID), European Union Commission, Norway, Sweden, France, Nordic Development Fund, and the United States Agency for International Development (USAID).

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The regional Partner Institutions included Economic Policy Research Centre (EPRC)–Uganda team lead by Dr Isaac Shinyekwa, Sokoine University–Tanzania team led by Prof. Siza Tumbo, University of Burundi team led by Dr Alex Ndayiragije, and Kigali Independent University team led by Mr Paul Muzungu. The participation of the stakeholders in various stages of the preparation of the report was highly valuable in enriching the report.

The Economic Commission for Africa and KIPPRA would like to express their appreciation to all the government Ministries, State Departments and Agencies in Burundi, Kenya, Rwanda, Tanzania and Uganda for their active participation and providing the data and information used in preparing the report.

Executive Summary

Agriculture is the mainstay of Tanzania's economy. The sector contributes significantly to national GDP and export earnings, supplies raw materials for agro-industries, supports rural livelihoods and feeds the urban population. Agriculture is important in managing inflation because it constitutes over half of the inflation basket as reflected in consumer price indices. However, the sector is dominated by smallholder farmers characterised by small family farms of around one hectare with limited industrial inputs and access to modern farm technologies.

The agriculture sector is accorded the highest priority in the national development policies as an engine of growth and poverty reduction. The main policy goal is to achieve food security and eradicate poverty and hunger through agriculture development and transformation. However, the sector's growth rate has stagnated at around 4 per cent in the last decade. The sector need to grow much faster (6%) than it has been over the past decade.

Productivity in crop agriculture is still low at around 1-2 tonnes per hectare for cereals and grain legumes, which are central to the national food security. The sector is predominantly rain-fed and therefore prone to the vagaries of weather, which is expected to intensify with climate change. Tanzania has a huge potential of advancing its agriculture sector. Less than a quarter of its arable land (44 million) is currently cultivated. Smallholder farmers manage around 14 million hectare and large-scale commercial farming accounts for 1.5 million hectares. The country is using less than 2 per cent of its irrigation potential. The use of productivity-enhancing inputs, particularly both organic and inorganic fertilizer, is overly limited. Productivity can also be improved through better agronomic and soil-water management.

Tanzania has a huge potential in livestock production, ranking second in Africa after Ethiopia in terms of number of livestock heads (20 million cattle and 17 million goats and sheep). However, the contribution of the livestock sector to national GDP is still around 18 per cent, and to agriculture 15 per cent. The livestock sector is dominated by indigenous cattle (80%) kept mainly under agropastoral system for dual purpose of supplying meat and milk. Only around 6 per cent of cattle are under commercial and smallholder dairy production systems. Productivity in the livestock sector, especially in the traditional system, is low.

Tanzania is a fairly food secure country. When food security is envisioned beyond the pillar of availability – to access, stability and utilization – the country has miles to stride before achieving sustainable food security. Over the vast country and across seasons, there is normally localized food insecurity due to locational crop failures of varying magnitudes. The food security risks are made worse by a poorly integrated food system that does not enable movement of foods from surplus to deficit regions efficiently and affordably.

The Government of Tanzania has implemented a number substantial programmes of trade liberalization that started in the 1980s. By 1990, virtually all restrictions on private trade in grains had been removed. Since then, food trade has been liberalized, thus encouraging private sector participation. However, trade of food

crops is occasionally interrupted by export bans by the government in cases of anticipated food shortage mainly due to drought.

Agricultural food trade has not grown to the anticipated pace to contribute to growth, livelihood improvements and food security. Due to fluctuations in domestic supply from local production and demand, Tanzania exports and imports food products. The major food products envisaged in the export and import trading portfolio are maize and rice. Others include wheat, sunflower, sorghum, beans and pulses. Over almost a decade, the annual growth in quantity and value of major food exports has been fluctuating, with net export balances in most of the years (6 out of 9 years). However, the global export share of Tanzania is infinitesimally low; for example, 0.1 per cent for maize. In contrast with food exports, food imports increase during droughts. The terms of trade in food crops is sensitive to the quality of the growing seasons.

The impact of climate change on the performance of the agriculture sector is real. Projections indicate that different agro-ecological zones will be warmer with a temperature rise of 0.5°-2°C across the country. The impact of climate change on rainfall over the country are mixed with respect to the amount of precipitation—with a decrease of up to 200 mm in some parts and an increase of up to 300 mm in other areas. Crop yields will increase in some parts and decrease in others. Food trade will be affected as well. With reduced yields, prices will rise and vice versa. In this regard, climate change will be associated with challenges and opportunities at the same time. With increasing precipitation in the currently drier areas, productivity might improve, *ceteris paribus*. A slight increase of temperature in cooler places of southern highlands could shorten the maturity period of maize.

Tanzania has a landscape of policies, strategies and programmes to improve agricultural productivity and enhance agricultural trade to deliver food security and poverty reduction. In the policy planning processes, efforts are normally made to mainstream important cross-cutting issues such as climate change, HIV-AIDS, gender and ICT. The importance of mainstreaming climate change in the agricultural policies and plans has been increasingly acknowledged. The agriculture sector was the first to initiate the development of the agriculture climate change resilience plan, which has been recently endorsed by the sector management. The policy challenge around agricultural production, trade, climate change and food security is not lack of policies but how to coordinate policy plans and actions in different agriculture line sectors.

Abbreviations and Acronyms

ACRP	Agriculture Climate Resilience Plan
AFSP	Accelerated Food Security Project
AMP	Agriculture Marketing Policy
ASDP	Agricultural Sector Development Plan
CAADP	Comprehensive African Agriculture Development Plan
DDB	duty draw back
DRC	Democratic Republic of Congo
EAC	East African Community
ESRF	Economic and Social Research Foundation
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
MAFC	Ministry of Agriculture, Food Security and Cooperatives
MMA	Match Maker Associates
MT	Metric Tonnes
NAIVS	National Agricultural Input Voucher Scheme
NAPA	National Adaptation Programme of Action
NBS	National Bureau of Statistics
NSGRP	National Growth and Reduction of Poverty
PPP	Public Private Partnerships
SADC	Southern Africa Development Community
SAGCOT	Southern Agricultural Growth Corridor of Tanzania
SMEs	Small and Medium Enterprises
SPS	sanitary and phytosanitary
UAE	United Arab Emirates
URT	United Republic of Tanzania
WFP	World Food Programme
WRS	Warehouse Receipt System

Table of Contents

Foreword.....	iii
Preface	iv
Acknowledgements.....	v
Executive Summary	vi
Abbreviations and Acronyms.....	viii
1. Introduction	1
1.1 Linking the Key Concepts.....	1
1.2 Objectives of the Study.....	3
1.3 Organization of the Study	4
2. Agricultural Production, Food Security and Trade	5
2.1 Agricultural Production	5
2.2 Food Security	6
2.2.1 Tanzania’s food security from a seasonal perspective	7
2.2.2 Crop production.....	7
2.2.3 Livestock production	8
2.3 Trade in Agricultural Production	9
2.3.1 Overview	
2.3.2 Maize sub-sector.....	9
2.3.3 Rice sub-sector.....	13
2.3.4 Other crops sub-sector	16
2.3.5 Livestock.....	18
3. Policies in Agricultural Production, Food Security and Trade.....	20
3.1 Policies Governing Agricultural Production and Food Security.....	20
3.1.1 Agricultural-related policies	20
3.1.2 Policy frameworks and plans	25
3.2 Policies in Agricultural Trade.....	32
4. Climate Change and Its Implications on Agricultural Production, Food Security and Trade	38
4.1 Climate Change and Its Implications on Agricultural Production.....	38
4.2 Climate Change, Food Security and Trade	43
5. Conclusion and Recommendations	47
5.1 Conclusion	47
5.2 Recommendations.....	49
References	51

1. Introduction

1.1 Linking the Key Concepts

In Tanzania, agriculture is predominantly characterized as a smallholder business, with farm sizes ranging from 1 to 3 hectares (ha), dedicated to subsistence with limited marketable surpluses. Smallholders have been responsible for more than 80 per cent of Tanzania's agricultural exports dominated by traditional exports, including coffee, tea, cashew nuts, tobacco and sisal. Agriculture accounts for 30 per cent of total exports. The contribution of agriculture to GDP has declined over the decade from about a half in the 1990s to around a quarter most recently. The declining GDP share of agriculture is due to the increasing importance of the mineral sector. Further, the agricultural sector is characterized by traditional farming methods with low levels of technology adoption, low utilization of modern inputs and inefficient resource allocation (Mashindano and Kaino, 2009). It has poor linkages to other domestic sectors, with a poorly developed marketing system, and under-developed infrastructure that affects access to both domestic and international markets.

The agricultural sector is the main contributor to food security and is the primary source of livelihood for more than 80 per cent of the population (United Republic of Tanzania-URT, 2012). However, agriculture is characterized by high production risks due to its dependence on unpredictable and highly variable weather, and low returns on investment. Due to the country's dependence on agriculture, all strategies for sustainable development have identified agriculture and food security as critical pillars for poverty alleviation. The food crops sub-sector accounts for about 65 per cent of agricultural GDP, while cash crops account for about 10 per cent; about a quarter of the remaining percentage is accounted for by the livestock sub-sector (URT, 2006). Within food crops, maize is the most important accounting for over 20 per cent of total agricultural GDP followed by rice, beans, cassava, sorghum, and wheat (URT, 2006c).

Usually, food security also addresses the issue of availability, accessibility, utilization and stability and therefore policies guiding it are very important. However, in the country, the link between food security and food availability through production is very strong because most of Tanzania's population is involved in that sector. Essentially, food availability is more defined by what a household is capable of producing rather than what it is capable of purchasing or accessing in the market. Essentially, the estimated traded maize is around 3 per cent and the remaining 96 per cent ends up being consumed at household level (Barreiro-Hurle et al. 2014).

The agricultural sector's weakness resonates with an unsatisfactory level of food security and consequent widespread poverty and poor quality of life. Food production has remained low, failing to meet household and national food requirements. The dependency on agriculture as the mainstay of the economy has made the Tanzanian economy more vulnerable to both external and internal shocks. As a result, the food security situation in Tanzania varies from one region to another, and from one season to another. There are some perennial pockets of food shortages, particularly in the coastal regions of Pwani, Lindi, Mtwara and Tanga, together with the semi-arid central regions of Dodoma and Singida, and some parts of Shinyanga, Morogoro, Kigoma and Mara (Ashimogo, 1995).

According to the marketing policy document, the development of an efficient agricultural marketing system is critical for fostering an agriculture sector that generates income, creates jobs, earns foreign exchange, supplies food, and links with industry (URT, 2008a). The overall objective of the marketing policy is to facilitate strategic marketing of agricultural products that ensure fair returns to all stakeholders based on a competitive, efficient and equitable marketing system. Furthermore, it recognizes the necessity of improving the agricultural marketing capacities by facilitating financing, promoting cooperatives, associations and groups; improving marketing infrastructure; providing timely and adequate agricultural marketing information services and intelligence; management of risks; investing in agro-processing; and marketing research and development (URT, 2008a).

Another important issue is that trade volumes and prices in Tanzania are highly influenced by the weather. For example, maize prices in the markets tend to reflect the amount of the locally produced crop and not on the short-term changes in the international markets (World Bank, 2013). It was noted that higher peaks in the domestic prices are reached after a drop in the domestic production. Crop production oscillations are normally caused by high temporal and spatial variability of rainfall. Trade and climate change inter-linkages with food security are not always straightforward and, therefore, making the right policy choices is a challenging task.

There are some policy measures that distort the food trade – including food export ban and food import permits. These aim at ensuring that food security is guaranteed and prices are controlled (World Bank, 2013). When the government foresees that there will be food shortage, it allows food importation. Sometimes the local markets are flooded with low-priced imported food, particularly rice from Asia. This causes a decline of prices for locally produced rice and maize, which are close substitutes for starch.

In the context of food security, trade and climate change interactions, Tanzania is holding a very important strategic position in the East and Central African region. First, it still holds a huge amount of potential for land production of food crops such as maize and rice, which are critical for food security, in comparison to East African countries such as Rwanda, Burundi, Uganda and Kenya. Therefore, the future of agriculture in Tanzania has significant implications on food security to other countries in the region. Second, it is one of the major gateways for imports and exports of agricultural and non-agricultural goods and services for landlocked countries such as Malawi, Zambia, Burundi, Rwanda, Uganda and Congo-DRC. Therefore, Tanzania's policy guiding agricultural trade has an implication on the other landlocked countries, which consider it as their gateway for imports and exports.

Some of the literature linking agricultural production, food security and trade in Tanzania has highlighted some of the key problems that exist in these three key areas. Sectoral policies are not adequately harmonized, and are sometimes conflicting. Whereas good policies exist and policy commitments are declared, the implementation on the ground is curtailed by budgetary constraints. For example, Bamwenda et al. (2013) pointed out that there is some mismatch between what is stated in government official documents such as policies, strategies, legislations on one hand, and what is actually implemented on the ground. Recently, the government of Tanzania launched several initiatives such as *Kilimo Kwanza*. This is plausible but there were no funds for sustainability. Other initiatives by the government include *ig Results Now (BRN)*, whose funding is also not very clear.

1.2 Objectives of the Study

The main objective of this study was to undertake a desk review of agricultural production, climate change, agricultural trade and food security in Tanzania, with the aim of understanding the interactions between climate change and agricultural production. The specific objectives were to:

- (i) Appraise agricultural production and food security in the country, and trade on food and livestock products in the face of a changing climate;
- (ii) Examine country policies related to agricultural production, food security and trade;
- (iii) Evaluate the impact of climate change on food production and agricultural trade; and

- (iv) Recommend policies that will address resilience and risk management in relation to climate change and agriculture, linking food production, food security and trade.

1.3 Organization of the Study

This work was carried out as a scoping study on agricultural production, climate change, agricultural trade and food security in Tanzania. It was carried out as a desk study which involved review of both published and grey literature.

Section two provides a brief description of the state of Tanzania's agricultural production sector and how it relates to food security and trade. Section 3 presents the policies in agricultural production, food security and trade in Tanzania while Section 4 deals with climate change and its implications on food production and trade. The conclusion and recommendations are discussed in Section 5.

2. Agricultural Production, Food Security and Trade

2.1 Agricultural Production

Tanzania is endowed with enough fertile arable land, diverse climatic zones and plenty of water sources across the country. However, only 24 per cent of about 44 million ha of the total land area suitable for agriculture is utilized, mainly by smallholder farmers with average farm sizes of between 1 and 3 ha using traditional cultivation methods. Only 10 per cent of the arable land is ploughed by tractor, and production is determined by rainfall. Around 85 per cent of farmers own fewer than four hectares of land, the average size of a cultivated farm plot being 2.6 hectares (NBS, 2012).

Both crops and livestock are adversely affected by periodical droughts. Small-scale farmers lack capital, skills and can only manage to cultivate for subsistence. One third of Tanzanian farmers sell some of their produced crops (34%). Most farmers cultivate four or more crops (53%); with maize being the main crop as it is cultivated by 83 per cent of all farming household (NBS, 2012).

Use of agricultural inputs is quite low. Tanzania uses only nine kgs per hectare of fertilizer, and only 10 per cent of farmers use improved seed.. Though irrigation holds the key to stabilizing agricultural production to improve food security, increasing farmers' productivity and incomes and producing higher valued crops, only 326,492 ha out of 2.3 million has of high potential land for irrigation is developed by farmers, making them vulnerable to changes in rainfall amount and distribution (NBS, 2012).

Agriculture production being one of the leading sectors contributing to Tanzania's economy and performance by contributing substantially to the GDP accounts for about one fifth of the foreign earnings and supports the livelihoods of more than two thirds of the population. The sector is faced by different constrains which impedes the rapid growth of the sector; for example insufficient agricultural extension services, low labour productivity, deficient transportation and marketing infrastructure, and facilities. Important as it is, the agriculture sector is linked with other sectors. It has forward linkages with the non-farm sector through agro-processing, consumption and export; provides raw materials to industries; and is a market for manufactured goods (URT, 2010b).

The aggregate national food availability in Tanzania is a critical balance between food production and needs. The average yields for maize and rice in Tanzania are far below the African average. Low productivity of cereals is attributed to dependency on rain-fed agriculture and low usage of fertilizer, lack of improved seeds and pesticides (URT, 2010b). Tanzania reintroduced agricultural

inputs subsidies in 2003/2004 to support technology adoption by smallholder farmers in the country. This move was necessitated by the utilization level of improved agricultural inputs which was very low by regional and international standards. As a result, the country experienced low and declining production and productivity. Maize production and productivity in the big four regions of the Southern Highlands, namely Ruvuma, Mbeya, Iringa and Rukwa began to decline because the soils required greater use of fertilizers.

The Government of Tanzania recognizes the importance and potential of agriculture as a contributor to wealth creation and, therefore, in the 2009/2010 fiscal year agriculture received 7 per cent of the national budget allocation which is an increase of 30 per cent over the Tsh 513.0 billion allocated in 2008/2009 (URT, 2010b).

2.2 Food Security

Food security is ranked as one of the top issues in Tanzania as explained in various policy documents such as Vision 2025, MKUKUTA, Five Year Development Plan (FYDP) and the National Adaptation Programme of Action (NAPA). For example, MKUKUTA states that the Government of Tanzania is committed to ensure food and nutritional security, environmental sustainability and climate change adaptation and mitigation. It has also noted that at the moment, Tanzania is somehow food secure, although this varies widely geographically. Food availability forecast for 2012/13 nationally is overall satisfactory, with food self-sufficiency ratio of 113 per cent slightly higher than 2011/12 (112%). However, major inter and intra-regional and council variations exist due to localized food crop failures of varying magnitudes. Food security has been fluctuating between years of surplus in good seasons and years of deficit in poor rainfall seasons. Some regions and districts have had food surpluses of varying magnitude on an annual basis. However, there are still regions and districts with pockets of persistent food shortage.

The Ministry of Agriculture, Food Security and Cooperatives (MAFC) identified 63 councils in 17 regions that may experience food shortage and will require close monitoring. The report emphasizes the importance of looking down farther at household levels, as national food surplus/security can mask high vulnerability (FNSA, 2012). FEWSNET (2008) did an informal rating of food insecure areas based on stakeholders' perceptions through various workshops. The results showed that 70 per cent of livelihood zones are reasonably food secure, and just fewer than 30 per cent of livelihood zones were considered borderline (MAFC, 2010).

The Government of Tanzania has made recent commitments to agricultural reform and improvement such as the Agriculture First Programme. A growing share of the country's budget is being allocated to agriculture while agribusiness development is being encouraged under programmes such as the Southern Agricultural Growth Corridor of Tanzania (SAGCOT). The Government of Tanzania is implementing the National Agricultural Input Voucher Scheme (NAIVS) as part of its efforts to achieve greater food security by increasing food production and productivity. The World Bank supports the scaling up and implementation of the NAIVS through the Accelerated Food Security Project (AFSP). Among African countries, Tanzania has some of the highest levels of malnutrition. Approximately 42 per cent of children under five years suffer from malnutrition and stunting (World Food Programme-WFP, 2012). Overall, Tanzania's food security situation appears to be improving but food security gains are not matching national economic gains (Barham and Chitemi, 2008). The country's poor farming households need better livelihood support such as access to credit and training so that they can improve their agricultural inputs and techniques, increase yields and alleviate poverty.

2.2.1 Tanzania's food security from a seasonal perspective

In most developing countries, hunger is seasonal and Tanzania is no exception. Food shortages reportedly peaked outside the main harvest periods (Thurlow and Pauw, 2010). According to the report, it was common for households to report the number of times there was not enough food to eat. In (2010/11), 20 per cent of households faced at least one situation when there was not enough food to feed members. The zones most likely to report a food shortage were the Lake zone (26%), Western (25%) and Central (24%). The Southern Highlands and Zanzibar were least likely (11.5% and 7.1%). Of the households facing food shortage, on average, they were short of food for around 3.5 months. The reasons for food shortages were largely linked to the weather. In 2010-11, 25 per cent reported being severely affected by drought some time during the previous five years (USAID, 2013).

2.2.2 Crop production

More than half of the country's total harvested land area is allocated to cereals, of which maize is the country's dominant staple food crop. Despite its favourable agro-ecological conditions, Tanzania is a net importer of wheat and rice. Maize yields are typically low (0.75 tonnes per ha) and smallholder farmers rely on traditional technologies and produce mainly for subsistence (Government of Tanzania, 2006). Wheat, on the other hand, is produced almost exclusively by large-scale commercial farmers in the Northern zone using modern inputs. Roots,

such as cassava and potatoes are also important food sources in Tanzania and account for almost 15 per cent of harvested land.

Root crop production grew annually by more than 4 per cent between 2000-2007. However, vegetable production stagnated and that of pulses declined by more than 4 per cent per year over the same period. In the Northern and Eastern zones, fruit production has significantly increased, making up for the lack of growth in the vegetable sector, and oilseed has become a more important crop across the country (Thurlow and Pauw, 2010).

Principal export crops include coffee, tea, cotton, cashews, sisal, oil seeds, horticultural crops, pyrethrum, fresh cut flowers, cloves and spices. In terms of agricultural exports, coffee constitutes the most important cash crop. Recent reports have indicated that coffee accounted for 17.7 per cent of Tanzania's total agricultural exports in 2009/2010 (WFP, 2010). Cotton was the second most important cash crop followed by cashew nuts, tobacco, tea and sisal. In Zanzibar, the major cash crop is cloves, 90 per cent of which is produced on the Island of Pemba. The major importers of Tanzania's agricultural exports are the EU countries, especially the United Kingdom, Germany, and the Netherlands.

2.2.3 Livestock production

Tanzania is endowed with abundant natural resources which include land, water, forage and a large livestock resource base. Out of 94 million ha of land resource, 24 million ha are used for grazing. The country ranks third in terms of cattle population in Africa after Sudan and Ethiopia. The 2010/2011 statistics indicate that there are about 21.3 million cattle, 15.2 million goats and 6.4 million sheep (URT, 2011). Other livestock include 1.9 million pigs, 35 million local chicken and 23 million improved chicken. About 90 per cent of the livestock population is indigenous (URT, 2011).

Livestock production is one of the major agricultural activities in Tanzania contributing towards achieving development goals of the National Growth and Reduction of Poverty (NSGRP). The livestock sector provides livelihood support to a total of 1,745,776 (37%) households out of 4,901,837 agricultural households (URT, 2005) and is one of the major economic activities in rural areas.

Livestock and fisheries account for almost a third of agricultural GDP. In recent years, growth in fisheries has kept pace with overall agricultural production, growing at 5.1 per cent a year from 1998–2007. However, livestock has not performed as well as crop agriculture, growing at only 3.3 per cent per year. Income from livestock and poultry are particularly important for the livelihoods of smallholder farmers and low income families in many parts of the country. Indeed, almost all households in rural areas participate in either crop or livestock

activities and earn, on average, two thirds of total income from the sector (Zezza, 2012).

The livestock industry has maintained a steady annual growth rate of over 2.7 per cent during the last decade. However, human population growth is increasing at a higher rate than the livestock sub-sector, which indicates that Tanzania is increasingly unable to meet the internal demand for livestock products (URT, 2010b). This is further compounded by the culture of retention of large cattle herds as a status symbol in some parts of the country. The current challenges facing the sector include: animal diseases, poor infrastructure and lack of reliable markets, investments and processing industries.

2.3 Trade in Agricultural Production

2.3.1 Overview

Trade in agricultural products, especially the staple foods, is significant throughout Tanzania as majority of small holder farmers depend on it for their livelihood and food security (USAID, 2010). The crops sub-sector is the main source of staple foods in Tanzania which include maize, wheat, rice, sorghum, millet, beans and pulses (pigeon pea, cow pea, and chick pea), cassava and groundnuts. The livestock sub-sector complements the crop sub-sector for income and food security. It comprises of cattle, goats and sheep, pigs and chicken.

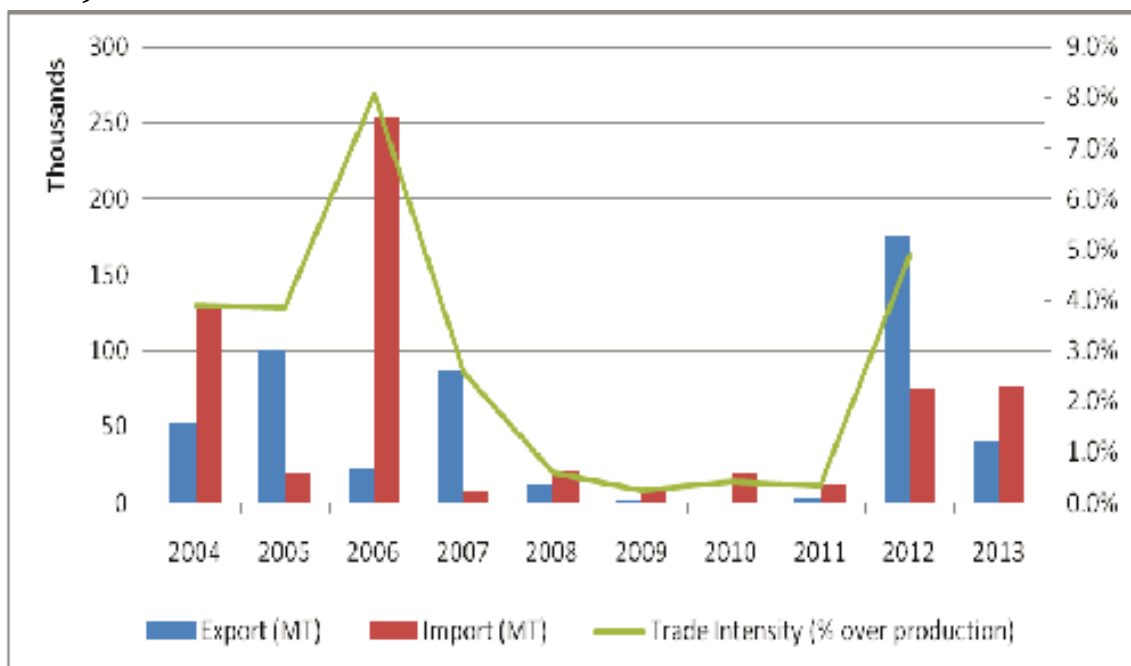
2.3.2 Maize sub-sector

Maize is the most important staple food in Tanzania and in the eastern Africa. During the period 2004-2008, maize was one of the major agricultural imports. From 2004 to 2013, trade intensity (total trade over production) averaged 3 per cent although there has been a decreasing trend since 2006 (Figure 2.1).

However, the annual growth in value during the period 2008-2012 was 68 per cent and the share in the world export was 0.1 per cent (Barreiro-Hurle et al., 2014). While it is widely considered that the Government of Tanzania could be one of the breadbaskets of East Africa with a production potential to feed deficit neighbouring areas for 6 out of the last 10 years, the URT is a net importer of maize (Figure 2.2).

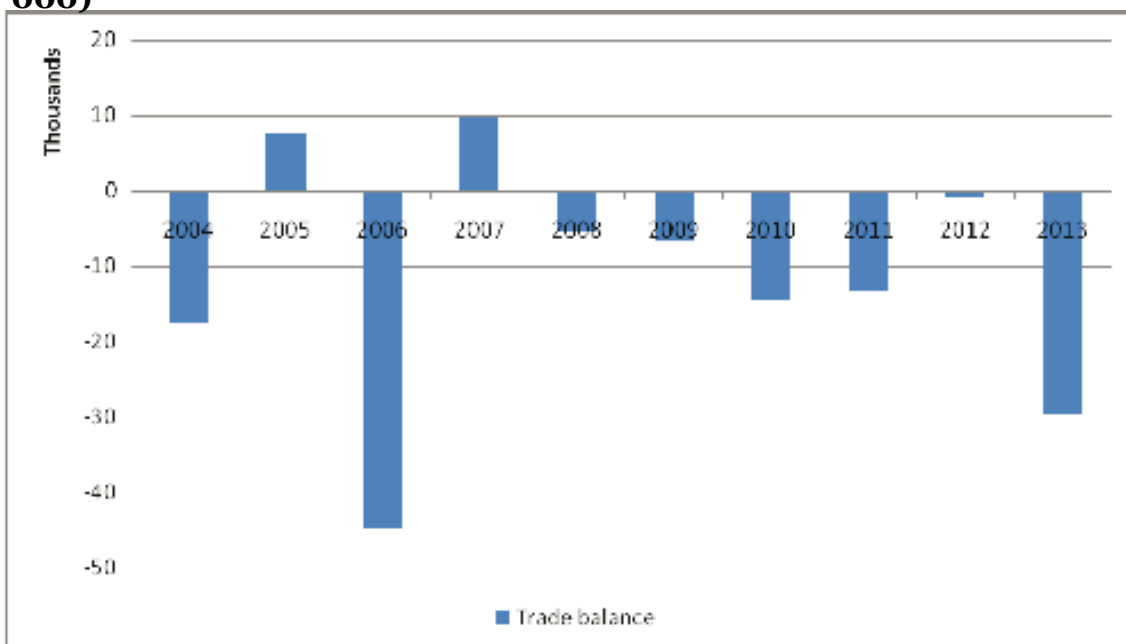
Dar es Salaam is the main domestic market for Tanzanian maize followed by Zanzibar, the Mtwara-Lindi region, and northern cities of Moshi and Arusha. There are two main bulk markets located in Makambako and Kibaigwa that collect and distribute maize from and to further regions. Generally, external markets for Tanzanian maize include Kenya, Comoro, Rwanda and Burundi and to a lesser extent Malawi and Zambia (Figure 2.3). The export market that exists can

Figure 2.1: Maize imports and exports in Tanzania (2004-2013) (US\$ '000)



Source: Barreiro-Hurle et al. (2014)

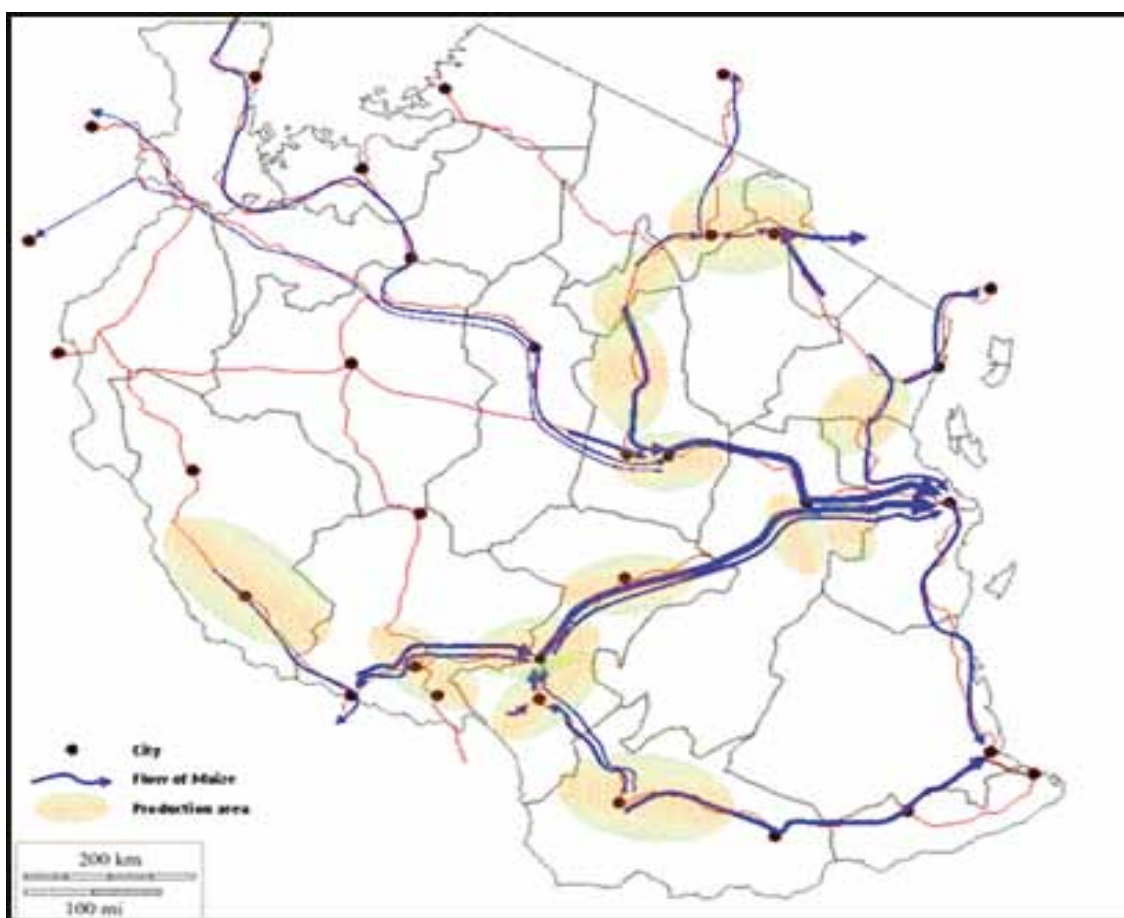
Figure 2.2: Maize trade balance (X-M) in Tanzania (2004-2013) (US\$ '000)



Source: Barreiro-Hurle et al. (2014)

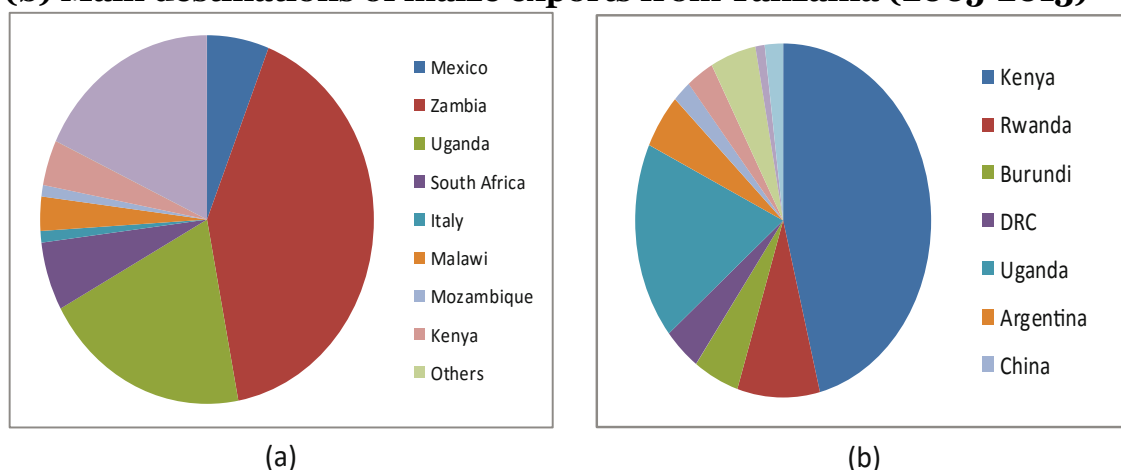
be divided into those of maize grains and flour. Grains are mostly exported by traders and store keepers while flour is exported by millers and flour wholesalers. Imports of seed are generally arranged and controlled by food security agencies.

Figure 2.3: Geographical flows of maize



Source: SAGCOT (2010)

Figure 2.4: (a) Main origin of maize imports in Tanzania (2005-2013); (b) Main destinations of maize exports from Tanzania (2005-2013)



Source: Barreiro-Hurle et al. (2014)

During the period 2005-2013, over 41 per cent of imports came from Zambia, USA and Mexico and only a minority from the partners of the EAC (24% from Uganda and Kenya) (Figure 2.4a).

As far as exports are concerned, nearly over 78 per cent go to EAC countries and to be more specific, the large percentage (46%) to Kenya (Figure 2.4b). On average, Tanzania has been a net importer of maize but annually this has varied between a positive export balance of 82,493 tonnes in 2005, 80,467 tonnes in

Table 2.1: Maize trade in Tanzania, 2005-2013

Maize (corn)	2005	2006	2007	2008	2009	2010	2011	2012	2013
Import (Tonnes)	18,901	252,632	6,609	20,468	6,415	18,588	11,930	74,531	75,981
Export (Tonnes)	101,394	23,507	87,076	12,096	1,731	776	2,942	175,302	40,449
Net exports	82,493	(229,125)*	80,467	(8,373)	(4,684)	(17,813)	(8,988)	100,771	(35,532)
Import (US\$ '000)	3,320	51,273	2,312	8,694	8,341	15,676	15,423	39,433	38,364
Export (US\$ '000)	10,857	6,397	11,953	3,236	1,675	1,185	2,181	38,510	8,857
Net trade (US\$ '000)	7,537	(44,876)	9,641	(5,458)	(6,666)	(14,491)	(13,242)	(923)	(29,507)
Implicit value exports (US\$/tonne)	107.08	272.13	137.28	267.55	967.82	1,527.60	741.33	219.68	218.97
Implicit value imports (US\$/tonne)	175.67	202.96	349.89	424.78	1,300.40	843.32	1,292.79	529.08	504.92
Maize (corn), seed									
Import (Tonne)	4,298	23,427	1,684	3,686	6,363	14,390	11,739	12,588	27,109
Export (Tonne)	22,113	700	17,498	4,192	1,524	2	850	64,704	1340
Net exports	17,815	(22,727)	15,813	506	(4,839)	(14,388)	(10,889)	52,116	(25,769)
Import (US\$ '000)	1,120	6,077	1,583	4,527	8,310	14,173	15,384	12,506	23,230
Export (1,000 US\$)	2,197	82	2,135	1,251	1,238	8	1,530	11,864	347
Net trade (US\$ '000)	1,077	(5,995)	552	(3,276)	(7,073)	(14,166)	(13,854)	(642)	(22,883)
Implicit value exports (US\$/tonne)	99.35	117.76	122.00	298.42	812.39	3,515.00	1,800.00	183.36	258.96
Implicit value imports (US\$/tonne)	260.57	259.41	939.70	1,228.3	1,306.1	984.96	1,310.50	993.49	856.91

*Figures in closed brackets represent negative

Source: Barreiro-Hurle et al. (2014)

2007, and 100, 771 tonnes in 2012. The biggest net import balance was in 2006 where 229,125 tonnes were imported (Table 2.1).

The performance of the maize market, therefore, has a significant impact on the welfare and food security especially for poor people. It has been ascertained that with growing urbanization and high rates of poverty that limit dietary upgrading, market demand for food staples will grow steadily to US\$ 11.2 billion in 2015 and US\$ 16.7 billion in 2030 (World Bank, 2009). This is a great emerging market opportunity for countries such as Tanzania (Table 2.2).

Table 2.2: Maize demand projection

Market Demand		2015	2030
Local demand ('000 tonnes)	Tanzania demand	3,800	5,500
Imports ('000 tonnes)	Tanzania imports	0	0
	EAC imports	500	850
Consumption ('000 tonnes)	Global consumption	910,000	1,400,000
Export demand ('000 tonnes)	EU demand	50,000	70,000
	Other export demand	860,000	1,330,000

Source: SAGCOT (2010)

2.3.3 Rice sub-sector

Rice is the second most important crop in Tanzania, and is used as a cash crop after maize. It is among the major sources of employment and income for many households (Barreiro-Hurle, 2012). Rice is mainly produced by small-scale farmers while marketing is dominated by middlemen and traders (Kilima, 2006; Barreiro-Hurle, 2012). The Tanzanian productivity is lower than most neighbouring countries, and one of the lowest in the world. Furthermore, Tanzania hardly meets its own demand and imports large quantities mostly from South-East Asia. However, Tanzania is the second producer in Southern-Eastern Africa. Tanzanian's total production is 900,000 metric tonnes, from which a small part is exported to neighbouring countries (MMA, 2010; SAGCOT, 2010). Northern Tanzania (Lake Victoria and the Southern Highlands) is the main rice producing area. Around 90 per cent of Tanzania's production is sourced from small-scale farmers with an average farm size of 1.3 ha (Barreiro-Hurle, 2012).

There is a growing demand for rice from Tanzania's major markets. The demand by urban medium-high consumers is increasing for quality and branded aromatic rice, which is primarily produced in Tanzania. Likewise, most neighbouring countries have rice deficiencies, which make the regional block a highly attractive

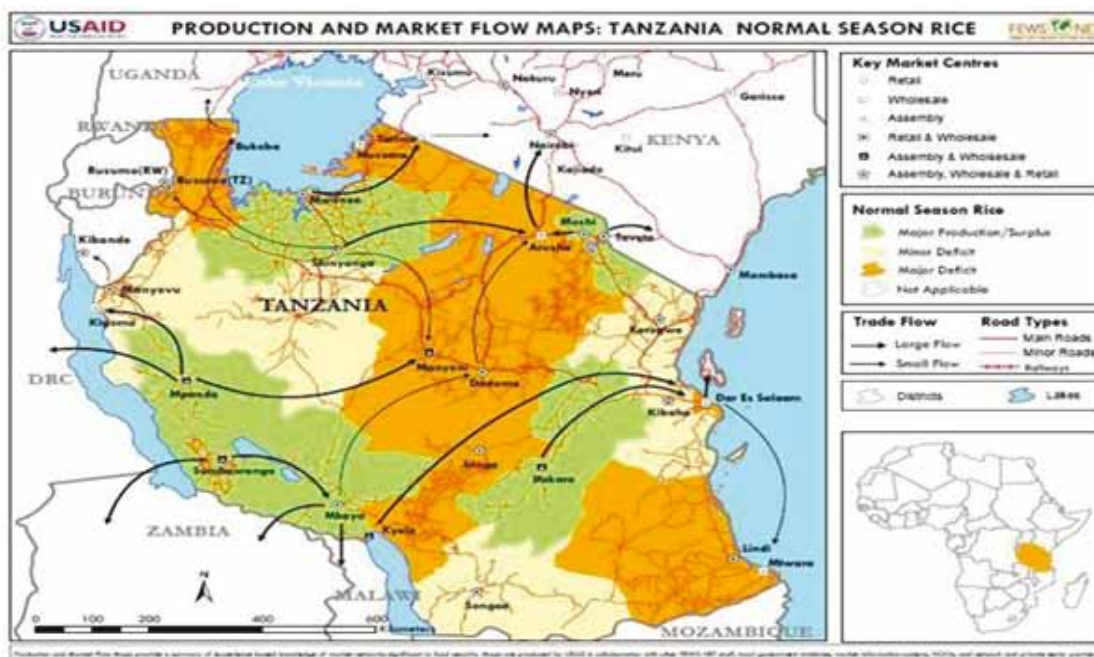
market if efficient supply chains can be developed. The export ban was lifted in 2010 and this could motivate more structured supply chains to penetrate this market segment (SAGCOT, 2010).

Normally, in Tanzania, one paddy is harvested by local traders who either trade it at the regional market or send it to a mill for processing. The rice sub-sector is highly fragmented with millers and brokers. The milled rice is then sold at the wholesale level to traders from the local markets/retail shops or the paddy might be sold to larger millers, who export large quantities of processed rice. Rice surplus produced in the south is transported and sold mainly in Dar es Salaam, but the smaller share of production is also exported to markets in Malawi and Zambia. On the other hand, the northern region tends to direct its surpluses to Kenya, Rwanda and Uganda (Barreiro-Hurle, 2012; SAGCOT, 2010).

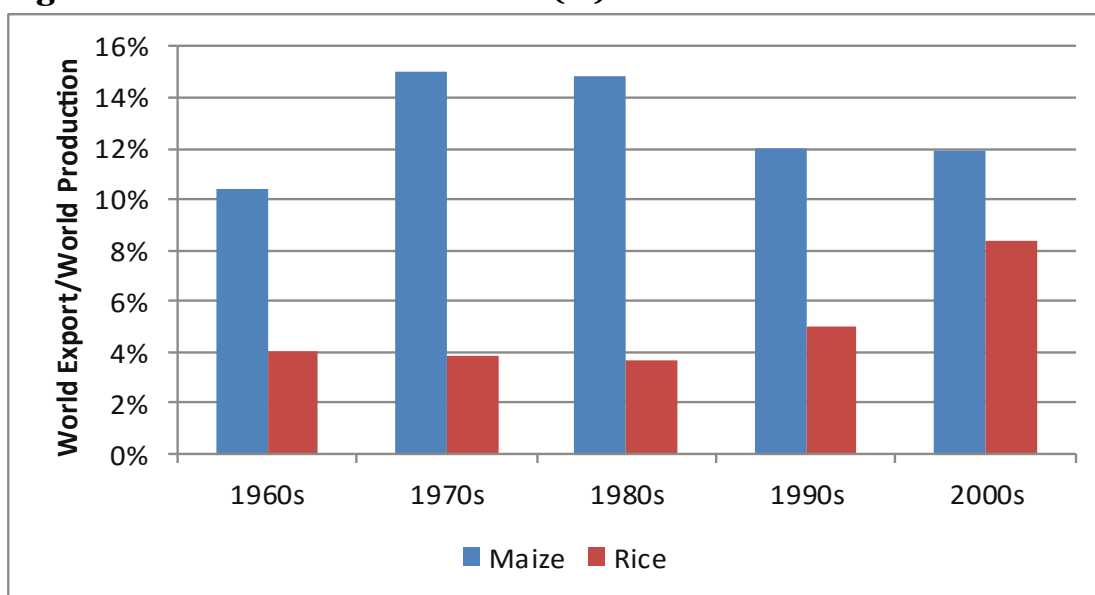
Rice trade flows

Figure 2.5 demonstrates that trade flows for rice mainly go through local markets and across the border. Rice is mainly transported from Arusha to the regional market in Nairobi, which offers higher prices. There is also a smaller trade flow that goes from Musoma to Nairobi through the Silale border (Figure 2.5). Local traders in regions bordering other countries often find it cheaper to export than to transport the same rice to major domestic markets. This is mainly due to high transport costs affecting both internal and export trade of agricultural crops. Therefore, high transport costs are often an impediment to the competitiveness of

Figure 2.5: Rice production and trade flow map for Tanzania



Source: Barreiro-Hurle, 2012

Figure 2.6: Maize and rice traded (%)

Source: SAGCOT (2010)

exports (Mkenda and Campenhout, 2011). Alternative sources (SAGCOT) include south of Shinyanga and/or Tabora as a surplus area, which seems to be in line with the importance of the region in total rice production.

Rice traded across borders represents about 8 per cent of global production (Figure 2.6). The rice trade is a residual activity in most countries with almost all rice being consumed domestically in the producing country and only a small share either imported or made available for export. Although 8 per cent is a significant improvement over the 4-5 per cent traded in the 1960s and 1970s, it still leaves the rice market vulnerable to large price responses and small changes in quantities. The biggest rice exporters are Thailand, Vietnam, the US and India. These four countries made up more than 70 per cent of global rice exports between 2006 and 2008. This concentration makes rice prices very sensitive to changes in the export plans of these four countries, as it was seen during the rice export ban from India in 2007.

The local market demand for rice is expected to increase by 1.15 million tonnes and 1.75 million tonnes by 2015 and 2030, respectively. Rice imports are said to be 85 MT by 2015 and 45 MT by 2030 (Table 2.3). The demand for aromatic rice is anticipated to increase with growing urbanization and income levels.

Table 2.3: Rice demand projections

Market demand		2015	2030
Local demand ('000 tonnes)	Tanzania demand	1,150	1,750
Imports ('000 tonnes)	Tanzania imports	85	45
Consumption ('000 tonnes)	Global consumption	730,000	1,150,000
Export demand ('000 tonnes)	Middle East	8,000	
	EU demand	3,500	5,000
	Other export demand	718,500	1,145,000

Source: SAGCOT (2010)

2.3.4 Other crops sub-sectors

Wheat: Wheat is grown almost exclusively as a commercial crop, with 97 per cent of the output being marketed. Total wheat production in Tanzania is estimated at 100,000 MT contrary to the local demand (local consumption) which is projected at 780,000 MT in 2015 (USAID, 2010; SAGCOT, 2010). Wheat imports averaged 643,000 MT per annum between 2005 and 2007; 91 per cent of the stated wheat consumption is in the country. Small volumes of flour are exported through cross border trade. Wheat and bread are a relatively expensive source of calories compared to other staple foods such as maize. As a result, per capita consumption of wheat products is much higher in urban areas and among high-income households. Wheat imported in Tanzania is mainly from FSU, Canada, Australia, USA and Germany; it is imported by millers through Mombasa and Dar es Salaam. Bakhresa, the largest miller and importer, also transits wheat to its mills in neighbouring countries and wheat flour to DR Congo.

Sunflower: Sunflower is one of the most important oilseed crops in Tanzania. The crop is gaining popularity and current data shows that local production for both factory and home extracted oil contributes to about 40 per cent of natural edible oil requirement with imported oils occupying a significant portion of the remaining 60 per cent (SAGCOT, 2010).

When harvested, the sunflower crop is usually sold to local traders either at the farm gate or at the local markets. These traders are either on commission from local processors or are acting independently. The independent traders may then locate buyers for the seeds or negotiate with the processors while the commissioned collectors usually work on an order from the processor. In a small number of cases, farmers take their seeds to the processors themselves. The processors are the pivotal point for the sunflower oil sub-sector, as all the seeds must pass through these actors. They, therefore, come into contact with a wide

variety of actors and have different types of transactions. The processors can either be involved in buying oil seeds and/or simply offering pressing services to processing customers; i.e. traders and farmers. Once the oil is produced, the owner (farmer, trader or processor) may then sell directly to the rural market, rural retailers, or to other traders for distribution to the urban market.

The local market for sunflower product(s) is expanding and there is significant potential for import substitution. Exporting of sunflower oil has already begun to large markets such as the Netherlands, and there is considerable scope from the world market.

Beans: In Tanzania, beans usually comprise about 80 per cent of the overall pulse crop. It is grown in areas of sufficient rainfall and is typically intercropped with maize. In low beans producing areas such as the Lake Zone, farmers retain about 45 per cent of total beans produced. It is, therefore, expected that domestic consumption of beans as a source of plant protein will increase in line with population growth. Kenya and Uganda are the major markets for Tanzanian beans. A larger volume is delivered to Kenya but in both cases the rate of export seems to have declined from the peak year of 2005/2006 (USAID, 2010). The market is interested in the large bean while the consumer producers prefer the small beans.

Sorghum: Farmers grow sorghum primarily for home consumption. The results of the 2002-03 NSCA indicate that just 17 per cent of sorghum output is marketed, with many suggesting that international trade in sorghum is practically non-existent (USAID, 2010). Smallholder production of sorghum for the domestic brewing sector has failed to meet adequate and consistent quality supply.

Cassava: Cassava is the third most important food crop in Tanzania after maize and rice. It provides energy from its roots, and protein, minerals and vitamins from its leaves. Cassava is not imported in any real quantity by Tanzania and is only exported in fairly small volumes. Cassava is mainly consumed by low-income earners both in rural and urban areas because it is affordable.

Pulse: Like beans, pulses are mostly consumed by the producers and thus production meets the requirement to significant levels. Only a surplus pulse production leads to a small but consistent export market. In terms of imports, dry peas are imported in the greatest volume and at a considerable cost. When looking at exports, it is chick peas alongside dried peas that make up the bulk of the exports (USAID, 2010).

Irish potato: In Tanzania, Irish potatoes are essentially a food security crop with growing domestic urban demand. About 90 per cent of the national crop is grown in the Southern Highlands and predominantly around Iringa and Mbeya. Due to

increased demand, particularly urban demand, potato production is expanding within the Southern Highlands region, and is spreading into Central (Morogoro) and North Eastern Tanzania (Kilimanjaro, Arusha and Manyara). The bulk of potatoes are sold into the ware market as an ungraded product. The marketing system is not well organized with most farmers being price takers, and retailers and subsequent consumers paying high prices due to the high transaction costs of farmers and traders. Most potatoes in Tanzania are consumed as food at household level and through food service outlets such as restaurants and street food vendors. It has been established that significant volumes of ware potato in major urban centres are consumed as French fries (chips) through food service outlets and mainly through street food vendors. Urban and semi-urban market retailers sell directly to household consumers (SAGCOT, 2010).

2.3.5 Livestock

The livestock sector contributes about 4.1 per cent of Tanzanian GDP and 8.9 of agricultural GDP (SAGCOT, 2010). The meat industry contributes 40 per cent, the dairy industry 30 per cent and the balance represents the contribution of pigs, poultry and other products and services from the sector (URT, 2007).

In Tanzanian, livestock is traded through two main channels, namely small scale and the larger scale. The small scale channel is championed by traditional pastoralists and agro-pastoralists who command over 98 per cent of meat production in the country. It is estimated that 335,000 tonnes of meat are produced annually in Tanzania (SAGCOT, 2010). The meat produced by the small scale channel is almost entirely for local consumption. Typically, producers are hardly involved in upstream sub-sector functions. Traders of different sizes and specialization dominate the interface between producers and slaughterhouses/butchers.

In the 1980s, the large scale channel was dominated by state-run commercial ranches. However, divestiture of state run ranches has been ongoing. Thus, the importance of state-run commercial ranches is declining. With 11 state-run ranches, there was a potential to carry up to 90,000 cattle and produce 1,500 tonnes of beef per annum. The government has also invested in a number of abattoirs, two of which are large scale modern enterprises able to process meat to export market standards. The private sector is also slowly penetrating the market with integrated large scale ranching and fattening operations combined with modern abattoirs where they process red meat for urban and export markets. Currently, there are large scale integrated ranches in Morogoro, Sumbawanga and Arusha.

The main official export destinations for Tanzania’s mainland live animals include Kenya, Comoro, Burundi, Uganda and Zanzibar. The mainland also exports red meat/carcass to various countries including Oman, Kuwait, United Arab Emirates (UAE), Muscat, DRC and Zanzibar. On the other hand, many Tanzanian cattle are sold live in Kenya markets through illegal/unofficial trade (Table 2.4). The Kenyan market attracts Tanzania traders because of its high prices and robust export-driven meat industry. Indeed, some of the exported cattle from Tanzania to Kenya are re-imported back to Tanzania as processed meat.

Table 2.4: Export trend of live animals and meat products from Tanzania, 2002-2007

Live Animals					Red Meat/Carcass				
Year	Cattle	Goats	Sheep	destination	Year	Beef	Goat	Mutton	Destination
2002	382	140		Kenya	2003				Oman, Kuwait
2003	1,724	411	2	Comoro	2004	1,080			Dubai (UAE)
2004	5,263	1,199	2	Burundi	2005	600			Muscat
2005	4,075	2,177		Zanzibar	2006	163	16,774	20,335	DRC
2006	6,231	2,753	11	Uganda	2007	10,737	23,345	76,592	Zanzibar
2007	3,849	736							

Source: SAGCOT (2010)

Between the year 2002 and 2006, red meat production in Tanzania increased by 14 per cent, which was mainly for local markets. If this is the proxy of how the local market has been growing, then there is every indication that the market for red meat will continue to grow in Tanzania. This is also influenced by the growth of urban towns and cities such as Dar es Salaam and Mwanza, Mbeya, Arusha and Tanga. The meat demand projections also bring a promising market (Table 2.5).

Table 2.5: Livestock demand projections

Market Demand		2015	2030
Local demand ('000 tonnes)	Tanzania demand	290	480
Consumption ('000 tonnes)	Global consumption	77,000	125,000
	EU demand	10,000	15,000

Sources: SAGCOT (2010); World Bank (2009)

3. Policies in Agricultural Production, Food Security and Trade

3.1 Policies Governing Agricultural Production and Food Security

3.1.1 Agricultural-related policies

a) The 2013 National Agriculture Policy

The National Agriculture Policy of 2013 (URT, 2013) aims at developing an efficient, competitive and profitable agricultural industry that contributes to the improvement of the livelihoods of Tanzanians and attainment of broad-based economic growth and poverty alleviation. The policy aims to address some of the key challenges facing the agriculture sector, such as over-dependence on rain-fed agriculture; inadequate agriculture support services; poor infrastructure; weak agro-industries; low quality of agricultural produce; inadequate participation of the country's private sector in agriculture; environmental degradation; and crop pests and diseases. It also emphasizes on the need for increased investment in agriculture, greater involvement of the private sector in the production, and provision of support services to the farming community.

The policy addresses the concern and trade-offs between food and bio-fuel crop production. This is because converting land currently used for food crop production into bio-fuel production may pose a new threat to national food security. Moreover, the policy has put a strong emphasis on increasing crop production, productivity, and profitability through risk mitigation mechanisms. Some of the key policy objectives on crop production include:

- Strengthening agricultural research services to enhance production, productivity, competitiveness and profitability of the agricultural sector;
- Promoting plant breeding, variety protection and availability of improved plant varieties for agricultural development in the country;
- Using agricultural biotechnology techniques and strengthening agricultural extension services to increase agricultural production, productivity and profitability;
- Enhancing crop productivity and profitability in irrigated agriculture in a sustainable manner to ensure food security and poverty reduction; and
- Promoting efficient utilization of farm machinery, implements, equipment and agro-processing machines.

The policy emphasizes the need to liberalize all agricultural markets and remove state monopoly in export and import of agricultural goods and produce,

and the government to withdraw from agricultural production and focus on food security at the national and household levels. This is in line with the policy's mission of transforming the agricultural sector into a modern, commercial and competitive sector to ensure food security and poverty alleviation.

With regard to climate change, its mitigations and adaptations, the policy sets out some policy objectives and strategies for addressing climate change-related risks and vulnerabilities. Examples of the strategies include: i) Strengthen coordination of sustainable environmental early warning and monitoring systems in collaboration with the relevant ministries; ii) Improve adaptation measures to climate change effects and deal with all the risks involved; iii) Promote public awareness on sustainable environmental conservation and environmental friendly crop husbandry practices (sustainable agriculture); iv) Enforce environmental laws and regulations that minimize environmental degradation as a result of agricultural activities; v) Up-scale activities that enhance the carbon storage capacity such as conservation agriculture and agro-forestry; vi) Establish public awareness on the opportunities of agriculture as potential carbon sink and mechanism to benefit from carbon market according to international protocols; and vii) Strengthen efficient use of renewable natural resources.

The policy aims to enhance profitability and productivity of irrigated agriculture to achieve better yields and production under changing climate. Climate change may also result in increased crop and livestock pests and diseases due to a rise in temperatures in some parts of the country. Therefore, the policy has set strategies to address pests and diseases. For example, pest and disease surveillance system and control mechanisms will be strengthened. The government will collaborate with neighbouring countries, international organizations and other institutions dealing with plant health services in combating pests and diseases outbreaks. Pest free areas will be protected from introduction of pests of quarantine importance, and the government will strengthen sanitary and phytosanitary, quarantine and plant inspectorate services.

With regard to bio-fuels, the policy has put clear emphasis on production and use of bio-fuels while guaranteeing food security to the nation. The policy has encouraged private sector participation in commercial production of horticultural crops. The flower industry has been leading in this initiative and a few small and medium enterprises (SMEs) through efforts of some interested entrepreneurs, and promoting production of tropical fruits and vegetable for the export market. Nevertheless, the policies on land and government/private sector partnership need to be revised to support this initiative (URT, 2002).

b) The 2006 National Livestock Policy

The 2006 National Livestock Policy (URT, 2006b) that revised the 1997 National Agricultural and Livestock Policy was formulated to encourage the development of commercially-oriented, efficient and internationally competitive livestock industry. This revision was to enable the sector to support the emergence of a more diverse structure of production with a large increase in the numbers of successful smallholder livestock producer enterprises. Further, the policy was geared to conserve livestock resources and put in place policies and institutions for sustainable resource development and use.

The livestock industry is a source of income and livelihood to majority of Tanzanians, especially those living in arid and semi-arid areas of Tanzania such as Arusha, Manyara, Shinyanga and Simiyu regions. It has an important role to play in building a strong national economy and increasing incomes and employment opportunities while nurturing the natural resources. Tanzania has the third largest cattle population in Africa after Ethiopia and Sudan. Out of the total 94 million ha of land resource, 60 million ha are rangelands used for grazing 18.5 million cattle; 13.1 million goats and 3.6 million sheep. Other livestock kept in the country include 1.2 million pigs, 30 million indigenous poultry and other species (URT, 2006b).

Despite its high potential, the industry faces some major constraints that limit its development. The policy underscores the main challenges as: i) Lack of proper arrangement to allocate land and give ownership of grazing areas; ii) Low genetic potential of the indigenous livestock coupled with limited supply of improved livestock; iii) Livestock diseases; v) Inadequate infrastructure for processing and marketing of livestock and livestock products; vi) Inadequate livestock farmers' knowledge and skills; and vii) Unavailability of credit facilities to large, medium and small-scale livestock entrepreneurs and low capital investment, limiting the expansion and commercialization of the industry. The industry is also facing a challenge of meeting the sanitary conditions for the regional and international livestock trade.

While the policy does not directly discuss the climate change effects on the livestock sector, it highlights the need for having a diverse and favourable climate and agro-ecological zones for livestock development. Further, it points out the fact that the quality and quantity of tropical pastures depend, among other factors, on the weather conditions of a specific place. Therefore, a policy objective has been set to promote forage conservations to ensure feed availability during unfavourable conditions and scarcity in order to increase livestock productivity.

The policy highlights that majority of Tanzanians will continue living in the rural areas. Therefore, adoption of micro-livestock production such as rabbit, guinea pigs, camels and guinea fowls will be of importance for poverty reduction, self-employment and food security. The policy also stresses on having a commercially-run, modern and sustainable livestock sector using improved and highly productive livestock breeds. This will ensure food security, improved income for the household and the nation while conserving the environment. Specifically, the policy also targets to contribute towards national food security through increased production, processing and marketing of livestock products to meet national nutritional requirements.

Examples of policy objectives addressing food security are: i) To promote commercial and sustainable production of sheep and goats to meet domestic demand and export market; ii) To promote pig production in order to contribute towards food security, improved nutritional requirements, increased incomes while conserving the environment; iii) To promote production and consumption of non-conventional meat for increased household food security, income and improved nutritional status of the people; and iv) To promote peri-urban livestock farming in order to provide employment, improve household income and food security. Therefore, proper implementation of the livestock policy will assist the nation to improve livestock production, thereby improving the living standards of pastoralists and enhancing food security.

c) The 2009 National Irrigation Policy

The 2009 National Irrigation Policy (NIP) aimed to direct development in the irrigation sector. Prior to the enactment of this policy, irrigation matters were being directed through other sector policies that constrained growth. The main goal of the policy is to ensure sustainable availability of irrigation water and its efficient use for enhanced crop production, productivity and profitability that will contribute to food security and poverty reduction in Tanzania (URT, 2009a).

Specifically, some of the objectives of the policy are to: i) Accelerate investment in the irrigation sector by both public and private sector players; ii) Ensure that irrigation development funds are established with a legal status; iii) Promote efficient water use in irrigation systems; iv) Abide by the Integrated Water Resources Management Approach in irrigation development; v) Ensure that irrigation development is technically feasible, economically viable, socially desirable and environmentally sustainable; vi) Ensure reliable water for irrigation so as to facilitate optimization, intensification and diversification of irrigated crop production to supplement rain fed crop production effectively; vii) Strengthen institutional capacity at all levels for the planning, implementation and management of irrigation development; and ix) To empower beneficiaries

for effective participation at all levels in irrigation planning, implementation, operation and management (URT, 2009a).

The policy underscores the fact that the agriculture sector contributes about a quarter of Tanzania's GDP and about 30 per cent of its export earnings while employing over 80 per cent of the nation's work-force. Accordingly, the sector continues to drive economic growth in the country. Despite its importance, agriculture is very much affected by unreliable rainfall and periodic droughts. It is for this reason that irrigation is considered necessary for providing protection against drought, a means of stabilizing crop production and assurance of household food security.

The policy also underlines the fact that dependency on rain-fed agriculture, which is greatly affected by the impacts of climate change, has led to low production and productivity, necessitating the need for reliance of the country on irrigated agriculture. The policy, however, outlines some of the challenges in developing irrigated agriculture as: i) Inadequate funding for irrigation investments; ii) Low capacity and participation of private sector in irrigation development; iii) Low level of irrigation skills by the farmers; iv) Low production and inefficient marketing systems; and v) Low agricultural water use efficiency.

Some of the key policy objectives on agricultural production include:

- To improve both the hardware and software aspects of the traditional irrigation systems for achieving a reliable irrigation water supply and raising the water utilization efficiency;
- To promote reliable irrigation water supply and high water use efficiency for increased production, productivity and profitability;
- To ensure reliable water supply for water harvesting irrigation schemes;
- To ensure effective performance of improved RWH schemes for increased and stable production, productivity and profitability; and
- To increase crop yields and production per unit volume of water and per unit area under irrigation through sustainable, economically viable and ecologically sound crop protection measures in irrigated agriculture.

The line ministries responsible for agriculture and food security are urged to ensure proper implementation of the national irrigation policy so that development of irrigation interventions leads to high crop production and productivity.

Once implemented, the policy is expected to bring, among other results, a reliable and sustainable crop production system that will have more contribution to food security, poverty reduction and the overall economic growth of the nation;

and ensure the direction for the implementation of irrigation interventions for optimal availability of land and water resources for agricultural production and productivity. The fact that majority of Tanzanians are subsistent farmers depending on unreliable rainfed agriculture calls for implementation of the irrigation policy as a strategy towards adapting to the changing climate.

d) The 1997 National Land Policy

The 1997 National Land Policy aimed to promote and ensure a secure land tenure system and encourage optimal use of land resources for economic development without affecting the environment. Water and land are critical inputs in agricultural production. Some of the specific objectives of the policy were to: i) Promote an equitable distribution and access to land to all citizens; ii) Ensure that customary rights of smallholders are recognized, clarified and secured in law; iii) Set ceilings on land ownership to avoid land grabbing; iv) Ensure that land is put to its most productive use; and v) Promote land resources from degradation for sustainable development.

There are several policy statements within the land policy that are supportive of agricultural production. Examples include: citizens to have equal and equitable access to land; demarcation of village land; and specific common resources titled to the village.

The land policy of 1997 resulted in formulation of two new land laws that were enacted in 1999 (URT, 1997); the Land Act No. 4 of 1999, which covers land in general; and the Land Act No. 5 of 1999, which addresses issues on land that falls within village boundaries.

With regard to climate change and agricultural production, the policy vowed to ensure that permits, licenses, claims and rights for exploitation of natural resources are issued in line with land use policies and environmental conservation policies and programmes. Therefore, proper implementation of the land policy and associated Acts will ensure sustainable land resources management, hence mitigating the country against the impacts of climate change. This will be achieved through enforcement of bylaws such as those preventing shifting cultivation, deforestation and bush fires in reserved lands.

3.1.2 Policy frameworks and plans

a) Agriculture Climate Resilience Plan (ACRP 2014)

The Agriculture Climate Resilience Plan (ACRP) of the Ministry of Agriculture, Food Security and Cooperatives aims to identify and respond to the most urgent impacts posed by climate variability and climate change to the crop sub-sector.

The ACRP is supposed to mainstream climate change within current agricultural policies, plans and practices and identify gaps where new investments may be needed. It underscores the fact that smallholder agriculture in Tanzania is predominantly rain fed and depends mainly on livestock and food crop production for survival (URT, 2014).

The ACRP has proposed some policy interventions for different actions to improve agricultural production as follows:

- Increase water use efficiency: Develop guidelines to ensure that irrigation expansion and rehabilitation plans and designs consider water availability, climate variability and climate change; and develop policy briefs to update policies to emphasize water use efficiency improvements and embed climate change.
- Improve catchment management in agricultural planning: Develop an agricultural land and water coordination mechanism between the Ministry of Water (including Water Basin Offices), the DITS, MAFC-Division of Land Use Planning, and other key stakeholders to participate in catchment ecosystem management.
- Adopt sustainable agricultural land and water management to reduce degradation: Develop guidelines and principles on sustainable soil and water management.
- Accelerate uptake of climate smart agriculture: Develop clear guidelines and policy briefs for CSA technologies and practices so that they can be better mainstreamed into agricultural programmes such as ASDP-2.
- Reduce impacts of climate-related shocks through improved risk management: Strengthen integration of pests and diseases into monitoring protocols and early warning systems, and develop research programmes on the links between climate change and pest and disease outbreaks.

The ACRP has identified some of the key issues to be addressed on food security as:

- Unreliable weather patterns causing instability in food supply and periodic shocks;
- Lack of early warning and weak system of social protection and disaster preparedness and response;
- High post-harvest losses depleting food stocks;
- Hiking food prices;

- Low productivity of food crops, livestock and fisheries;
- Low capacity of current food reserve structures, and inadequate and poor food storage facilities at household levels (TAFSIP, 2011); and
- Poor and limited rural storage preservation facilities.

Therefore, the ACRP provides a roadmap on how agriculture in Tanzania, especially the crop sub-sector, can respond to the impacts of climate change.

b) Tanzania Agriculture and Food Security Investment Plan (TAFSIP) 2011-12 to 2020-21

TAFSIP is Tanzania's 10-year investment plan for comprehensively transforming the agriculture sector to achieve food and nutrition security, create wealth, and reduce poverty. It is a result of roadmap programmes of the CAADP target to achieve 6 per cent annual growth in agricultural sector GDP. Its main goal is to contribute to national economic growth, household income and food security in line with national and sectoral development aspirations (URT-TAFSIP, 2009).

TAFSIP summarizes lessons from various on-going poverty reduction initiatives. Using these lessons, TAFSIP set targets to ensure the nation's food security as follows: (i) Increase crop production to improve food security; (ii) Maintain a strategic grain reserve of at least four months' supply; (iii) Develop and promote crop and livestock varieties adaptable to climate change; and (iv) Strengthen early warning and natural disaster response capacity.

Tanzania has a significant amount of arable land (44 million ha) that is suitable for agriculture production. It also has available water resources in form of rivers, lakes, ocean and streams which can be used for both irrigation and fisheries. Therefore, there is need to harmonize policies and pull down efforts in order to effectively use the nation's land and water resources for irrigation and sustainable agricultural production (URT-TAFSIP, 2009).

With regard to agricultural trade, markets and market barriers, efficient and well-regulated marketing systems are required to ensure better marketing of the agricultural products. Reducing marketing costs and trade barriers will allow farmers and traders to harness the opportunities of expanded domestic, regional and international markets for agricultural products.

Various agricultural-related policies have been reviewed in the TAFSIP and their areas of improvement have been highlighted. Examples are shown in Table 3.1.

Table 3.1: Agricultural-related policies: Strengths, gaps, and proposed areas of improvement

Policy	Strengths	Policy Gaps/ Weaknesses	Proposed Areas of Improvements
National Agriculture Policy (2009)	The policy recognizes the low capacity for irrigation; the need for improving rural infrastructure; and supports strengthening of agricultural support services	Inadequate coordination of sectoral policies in formulation and implementation Weak involvement of private sector in policy implementation Poor linkage with infrastructural development	Strengthening coordination of implementation of agricultural policies through greater sectoral linkages and enhancing private sector involvement Strengthening institutional collaboration for the exploitation of high potential areas Linking rural roads, electrification, communication and agricultural markets to the regional networks
National Livestock Policy (2006)	The policy promotes protection of water catchments areas and supports construction and maintenance of water sources for livestock and the role of the livestock sector in national food and nutrition security	The policy is weak in promoting trade facilitating infrastructure and services, especially in rural areas caused by poor feeder roads, limited livestock haulage and holding facilities as well as underdeveloped market chain for livestock and livestock products	Proposed interventions include: making policy provisions for improving rural and urban infrastructure and trade-related capacities for improved livestock market access, as well as developing livestock and livestock products and related commodity value chains
The National Irrigation Policy (2010)	The policy recognizes the potential of irrigation to promote agricultural productivity, increase food security and stimulate economic growth	Inadequate integration of water resources management systems and limited material, financial and technical support services for irrigators	Developing integrated water resources management systems for agricultural production Providing backup support for small-scale and commercial private irrigation developers including promotional activities, guidelines, regulation, standards, design and manuals, and technical assistance Providing private leverage/ equity fund for investment in irrigation

National Trade Policy (2003)	The policy recognizes the need for harmonization of trade policies and the importance of value addition to promote competitiveness in agriculture	Weak implementation of the policy, especially in participation in regional and international trade	Streamlining the trade regime to address agricultural commodity trading locally and internationally Providing trade facilitation services in areas of transport, communication and technology transfer
National Environment Policy (1997)	The policy advocates the need for improving land husbandry through control of soil erosion and improvement of soil fertility	Trends and impacts of climate change are not well articulated in the policy	Monitoring climate change and variability in terrestrial and aquatic ecosystems
The National Water Policy (2002)	The policy recognizes the development of equal and fair procedures in conservation, access, allocation and utilization of water resources so that all social and economic activities are able to maximize their capacities	Issue of water management plan not clearly addressed and there are insufficient technical and financial resources for implementation of the policy	Increase resources (technical and financial) mobilization for implementation of the water policy with increased focus on institutional strengthening for sustainable utilization and management of water resources
National Microfinance Policy (2000)	The policy provides a guide for coordinated interventions in the microfinance system	The policy does not provide incentives to offset the high cost of delivering financial services to rural areas, especially to farm communities	Strengthening the implementation of the policy in the context of the Tanzania Rural Financial Services Strategy
Food and Nutrition Policy (1992)	The policy raises the importance of food and nutrition in social well-being and national development	The policy does not capture emerging food and nutritional problems due to changing lifestyles in rural and urban areas The policy is outdated	The policy needs to be updated to take into account current food security and nutrition problems including the changing population dynamics in rural and urban areas
National Investment Promotion Policy (1996)	It recognizes the importance of fostering research and development, encourage adoption of new production technology, improving extension services for the agricultural sector	The policy is silent on the promotion of rural power investments such as electricity and other sources of energy	Extend promotion of investment of other infrastructure such as rural electrification given that only 12% of the population has access to power

Source: URT-TAFSIP (2011)

Therefore, the TAFSIP review has given a good summary of various policies related with agricultural production and food security, strengths, gaps and areas that needs to be improved to ensure that the agriculture sector is transformed to achieve food and nutrition security, create wealth, and reduce poverty.

c) Climate Change Policy and Institutional Review on Tanzania's Agricultural Sector

This is a policy review synthesis document that aims to give baseline information on how sectoral policies address climatic vulnerabilities and risks. Specifically, the review provides an understanding of responsibilities of relevant decision making on climate change in agricultural-related activities, and the contribution of Tanzania's key agricultural policies in meeting climate change objectives as outlined in the National Climate Change Strategy.

Tanzania has endorsed the Comprehensive Africa Agriculture Development Programme (CAADP) which provides a framework for Africa to be more productive in agriculture (Yanda, 2013). Within the framework, there are seven priority investment areas for agriculture: i) Irrigation development, and sustainable water resources and land use management; ii) Agricultural productivity and commercialization; iii) Rural infrastructure, market access and trade; iv) Private sector development; v) Food and nutrition security; vi) Disaster management, climate change mitigation and adaptation; and vii) Policy and institutional support reform (Yanda, 2013).

The government has set priority areas for investment in the agricultural, livestock, and fisheries industries and the responsible institutions both at national (agriculture sector-lead ministries) and sub-national level.

Institutional recommendations for implementing strategic interventions on mitigation and adaptation options in the agriculture sector are outlined as follows:

- Strengthen the public private partnership (PPP) taking advantage of the presence of the 2009 PPP policy;
- Attract and involve insurance companies to undertake climate change-related risk mechanisms in agriculture;
- Government to implement the 2003 Maputo Declaration to allocate at least 10 per cent of national budget for agriculture and rural development; and
- Establish climate change coordinating unit across government sectors.

Some of the key findings from the review of food and agricultural trade policies in the United Republic of Tanzania 2005-2011 show that:

- i) Producers of imported commodities received price incentives while those of exported commodities received disincentives. Producers of exported commodities received lower prices than they could have obtained because of policies, traders' high market power and inefficient processing facilities. Moreover, some commodities were protected at wholesale (processed) level, but penalized at farm gate (raw) level. This has had a negative impact on food security by making food less affordable and more scarce.
- ii) Most of the incentives for imported commodities were due to trade policies, while disincentives for export commodities related to taxes and inefficient processing industries. In addition, some of the protection for imported goods offered by trade policies was eroded by excessive marketing costs along the value chain.
- iii) Farmers producing commodities that the URT imports to cover domestic consumption received incentives. The common external tariff which the URT applies to imports from outside the EAC helps to keep prices higher for producers. The only exception is sugar, whose producers face strong disincentives. For all imported commodities, protection at the farm gate was eroded by high transport and marketing costs due to lack of market integration and inefficiencies in the value chain.
- iv) Farmers producing export commodities would have obtained higher prices in a policy-free environment and with better market performance. The factors that kept producer prices low included taxes on cotton and cashew nuts; poorly functioning value chains for coffee and cashew nuts; and inefficiencies in the cotton processing sector.
- v) From 2005 to 2010, producers of pulses received higher prices but those of traditional exports were penalized. Average domestic prices for pulses were higher than export prices. This would usually be considered as an incentive for producers. However, in this specific case, lack of storage facilities forced traders to export pulses when prices were low. Producers thus missed the opportunity to benefit from higher non-seasonal prices in domestic markets.

In general, agricultural policies and their policy frameworks have emphasized on improving agricultural production and promoting irrigation as a means for the agriculture sector to cope with the impact of climate change and enhance the nation's food security.

3.2 Policies in Agricultural Trade

Since independence, Tanzania has experimented different policy regimes on agricultural markets. It went through unregulated markets before the Arusha Declaration (1967), cooperative-based marketing, centralized crop authorities, and the current liberalized markets (Amani et al., 1983). The key challenges facing agricultural marketing and trade are: inadequate access to markets, insufficient market information, limited access to finance, and lack of capacity of agricultural marketing institutions. Other are lack of entrepreneurial skills, non-existence of product standards, high transaction costs, poor coordination and integration of marketing channels, and policy uncertainties (ESRF, 2000). These challenges need to be addressed through various trade and marketing policy reforms.

a) The 2003 National Trade Policy

The National Trade Policy of 2003 aimed at identifying ways and means of ensuring a viable and steady path towards competitive export-led growth, which will fulfil the goal of poverty eradication. Its main goal was to raise efficiency and widen linkages in domestic production and build a diversified competitive export sector as the means of stimulating higher rates of growth and development (URT, 2003).

Specifically, the policy aimed to stimulate a process of trade development as a means of triggering higher performance and capacity to withstand intensifying competition within the domestic market; transform the economy towards an integrated, diversified and competitive entity; and to simulate and encourage value-adding activities on primary exports as a means of increasing national earnings and income flows.

The critical issues facing the Tanzanian economy addressed in the policy include (URT, 2003):

- Consolidate consensus on trade development measures on policy shift from a protected and controlled economy towards a competitive market one;
- Highlight the central role and contribution of the trade function to the attainment of the primary goal of poverty eradication under the National Development Vision 2025;
- Identify measures for the development of the domestic market as a tool of inclusion and broad-based participation in economic activity based on improved market-infrastructure, technology diffusion and access to market information;
- Align national development agenda with regional and international trade

obligations and maximize the benefits of participation in regional and international trade arrangements;

- Adopt an appropriate framework of measures for the interim safeguarding of domestic industry and economic activity threatened by liberalization, including identification of sectors to be protected, the rationale and costs of protection, and the maximum duration for protection; and,
- How best to address the supply-side constraints that inhibit expansion of trade within the domestic and global market as the route towards rapid economic development.

The policy underscores major challenges on trade policy, including: establishing and sustaining an enabling business environment; development of hard and soft infrastructure; building capacity for market supporting institutions; creating an internal ability to participate in and influence changes in the world trading system; and promotion of private sector development in the context of supply-side capacity.

Some of the key policy statements supporting trade include: expansion and modernization of the services industry with priority on tourism and transit trade sectors; ensure transparent application and predictability in use of tariffs and further liberalization and rationalization of the tariff structure; Government to review and strengthen the institutional framework for efficient refund of import taxes under the duty draw back (DDB) scheme; and the government to ensure that the tax regime is supportive of increased exports with a view to responding to the problem of a domestic market that is too small for the realization of the economies of scale in modern industry.

With regard to movement agricultural products, and trade barriers, the policy underscores three factors that are necessary for development of trade within the domestic market: i) Enhanced economic efficiency based on wider participation; ii) Improved market access based on development of physical marketing infrastructure; and iii) Access to market information. The policy stresses the need for removing intra-district trade barriers and encouraging cross-border official trade, particularly for food products.

While the trade policy does not underline direct ways of increased agricultural production, it has emphasized on the link between increased production and economic growth. It has underscored the fact that low agricultural production is a constrain to trade expansion and growth. Improvement in the commodity value chain, including production, will result in positive effects on trade. The policy has emphasized the need for the government to channel investment resources in the agriculture sector to transform its production capacity. This will in turn increase

efficiency in export trade. There is need for the government to also encourage investment in commercial farming to increase production; agro-process to minimize post-harvest losses; and promote out-growers and contract farming schemes.

Implementation of the National Trade Policy will assist the nation to attain a competitive economy and export-led economic growth. Growth of the economy implies that smallholder farmers who are the majority will earn more income out of crop production, thereby improving their living standards and enhancing both household and national food security.

b) The 2013 National Agriculture Policy

This policy emphasizes on capturing emerging trade opportunities brought about by trade integration among partner states of the EAC and the Southern Africa Development Community (SADC). It has also emphasized the need to eliminate intra-regional trade barriers and to strive for intra-regional cooperation in standardization, quality management, metrology and testing of agricultural products to facilitate intra-regional trade. Both the EAC and SADC trade protocols call for members to harmonize their sanitary and phytosanitary (SPS) measures with international standards and to seek synergies in building up regional capacities in SPS management.

The policy, however, underscores the fact that quality and standard conditions for fresh agricultural produce limit the intra-SADC agricultural trade in horticultural produce.

On agricultural marketing, the policy emphasizes that agricultural product markets are crucial for the development of agricultural commodities and stimulating agricultural production. Furthermore, the whole set of supportive infrastructure from production, transportation, storage and processing is vital in enhancing agricultural marketing.

The key challenges facing the marketing of agricultural products have been outlined as inadequate quality standards; weak inspectorate mechanisms at various levels; weak enforcement of agricultural marketing regulations; inadequate agricultural marketing infrastructure; inadequate agricultural marketing risk management; inadequately organized primary, secondary and tertiary markets; and inadequate agricultural market information systems.

The agricultural policy has statements for improving agricultural product market, infrastructure, information, and quality standards as follows:

- (i) Capacities of agricultural marketing actors shall be enhanced in meeting quality, grades and standards for the domestic, regional and international markets;

- (i) The government in collaboration with other stakeholders shall promote the establishment of Price Stabilization Funds;
- (iii) The Government, in collaboration with farmers, farmer groups, associations and cooperative societies shall enforce regulations governing utilization of designated buying posts and centres for agro-products;
- (iv) The Government, in collaboration with other stakeholders, shall strengthen and upscale Warehouse Receipt System (WRS) as a basis for the establishment of commodity exchange; and
- (v) Collection, analysis, storage and dissemination of agricultural marketing data shall be strengthened at all levels.

With the liberalization of trade in 1993, new markets are now available outside the country where vegetables, fruits and flowers from Tanzania are steadily gaining export market. Policies on trade liberalization have had their negative effect on agricultural inputs; for example, some traders have taken advantage of trade liberalization to import ineffective, experimental chemicals or chemicals that have long expired or are banned in the industrialized world. The chemical overflow confuses farmers. There is need to provide education on proper use or non-use of pesticides and to monitor adherence to set standards (URT, 2002).

c) The 2008 Agricultural Marketing Policy (AMP)

This policy aims to facilitate strategic marketing of agricultural products that ensure fair returns to all stakeholders based on a competitive, efficient and equitable marketing system. Its main focus is on crops and livestock due to the fact that other components of agricultural marketing (fisheries, forestry and beekeeping sub-sectors) are guided by the National Fisheries Policy, 2003; National Forest Policy, 1998; National Beekeeping Policy, 1998; and, Wildlife Policy of Tanzania, 1998.

The AMP underscores key constraints to agricultural marketing as inadequate institutional, legal and regulatory framework; poorly developed and maintained marketing infrastructure; limited agro-processing and the need to enhance quality and standards; weak entrepreneurial skills; limited access to finance as well as inadequate inter-institutional coordination.

The policy has resulted in several benefits such as establishment of a fair, competitive and sustainable marketing system; improved marketing infrastructure; accessibility of financial services to agricultural marketing actors; and provision of incentives to the private sector for increased investments in agricultural marketing. Emphasis is also given on the government to create a conducive environment for the private sector to take the lead in marketing of agricultural inputs.

Some of the key policy objectives include:

- Promote and support value addition in agricultural produce;
- Ensure improved quality and standard of the agricultural products produced and marketed;
- Improve the legal and regulatory framework for efficient, effective and transparent performance of the agricultural marketing systems;
- Develop an effective and harmonized institutional framework to enhance the performance of various stakeholders in agricultural marketing activities;
- Enhance entrepreneurial and marketing skills of agricultural marketing actors;
- Improve and develop agricultural marketing infrastructure; and
- Improve access to financial services for agricultural marketing.

The policy has set out the institutional framework and coordinating mechanism that ensures various stakeholders, public and private sectors as well as development partners actively participate and have a role to play in implementing the policy.

d) The 2009 National Public Private Partnership Policy

Public-Private Partnership (PPP) frameworks provide an important environment for attracting investments. Appropriate PPP frameworks can provide an effective alternative source of financing, and management and maintenance of public sector projects (URT, 2009b). The policy on PPP aims to promote private sector participation in the provision of resources for PPP enterprises in terms of investment capital, managerial skills and technology. Specifically, the key objectives of the policy were to: i) Develop an enabling legal and institutional framework to guide investments in PPPs; ii) Implement an effective strategy showing specific obligations and rights for various stakeholders; iii) Introduce fair, equitable, transparent, competitive and cost-effective procurement processes for PPPs; iv) Adopt operational guidelines and criteria for PPPs; v) Attract resources for development of PPPs; vi) Develop institutional capacities for technical analysis and negotiation of PPPs and associated contracts; and vii) Establish efficient and quality socio-economic PPPs.

With regard to trade, the policy states that participation in PPPs may take place in both productive and socio-economic services sectors, including trade, among others. PPPs constitute a cooperative undertaking whereby each partner participates to ensure that public needs are best met through the most appropriate allocation of resources, risks and rewards. Therefore, a national PPP policy will serve as an important intervention to accelerate economic empowerment

by ensuring that Tanzanians are adequately empowered in various PPPs interventions, including the trade sector (URT, 2009b).

The agriculture sector, therefore, is an important sector in driving the economy of the nation. Its importance is indicated by its contribution to the nation's GDP, employment of over 75 per cent of the population, and contributing to export trade. The sector, however, being dominated by rain-fed smallholder farming is very vulnerable to the impacts of climate change. Improvement in the sector through efforts such as promotion of irrigated agriculture and investing in the improvement of various components of the food value chain will help increase agricultural productivity, thereby enhancing food security. This will also in turn improve export trade.

4. Climate Change and Its Implications on Agricultural Production, Food Security and Trade

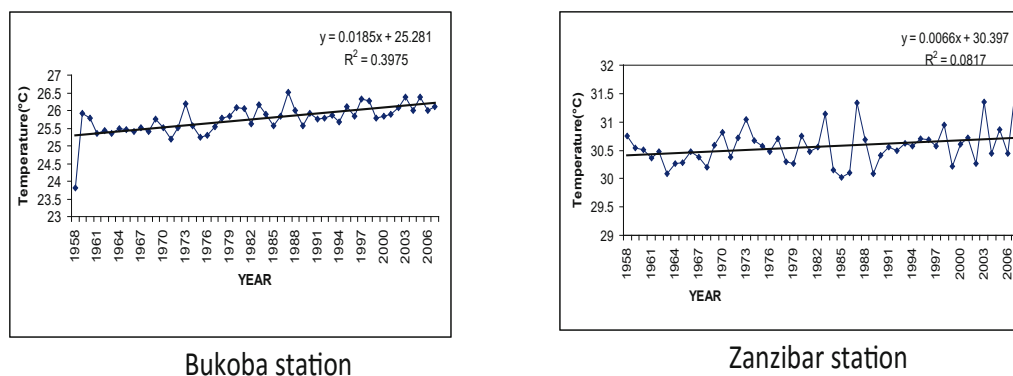
4.1 Climate Change and Its Implications on Agricultural Production

Current climate variability and change

Reported observations by local communities and the recent analysis of climatological information have signalled increased variability of climate in Tanzania (URT, 2012). There has been a notable increase in temperature in the highland areas, and shortening of the growing season because of late onset of rainfall and early cessation of the same. Decreasing rainfall amount and the shift of the rainfall patterns are a common phenomenon (URT, 2012). Mean annual maximum and minimum temperature trends have had significant increase in all meteorological stations in the country. Figure 4.1 depicts increasing temperature for Bukoba and Zanzibar stations.

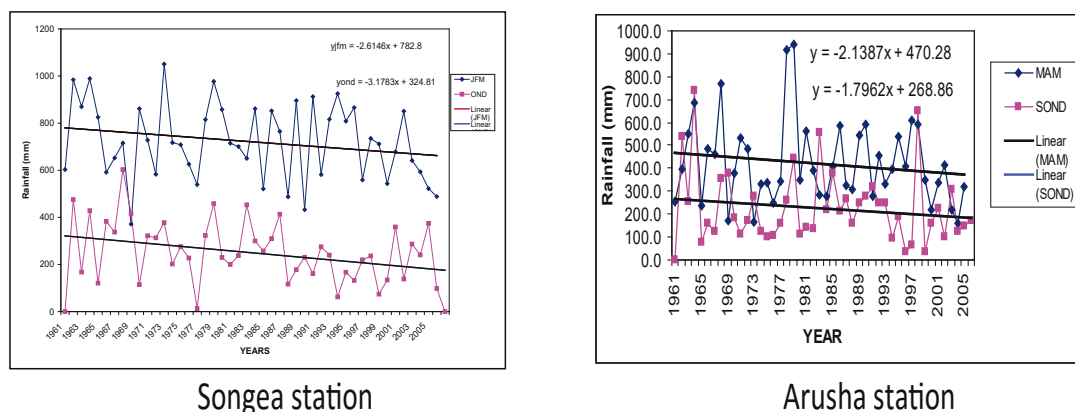
The empirical analysis conducted by Mary and Majule (2009) shows that there was a decreasing trend of rainfall between 1922 and 2007 and an increase in the minimum and maximum temperatures by 1.9°C and 2.0°C, respectively. Matari et al. (2008) noted that intra-seasonal and inter-annual rainfall variability manifests through late onset, early cessation, and increase in dry spells. The study by Matari et al. (2008) indicates that one common feature of the rainfall pattern is the greater variability in cycles (Figure 4.1). The intra-seasonal variability was also observed by Zorita and Tilya (2002) in which they found that October-November-December (OND) season in the north-eastern highlands of Tanzania had high variability, which is related to changing large-scale patterns of rising surface temperature, sea-level and winds. Furthermore, there is a slightly weak decreasing trend in the mean annual rainfall time series over most of the meteorological stations (Figure 4.2). However, the observed rainfall trends are not statistically

Figure 4.1: Mean annual maximum temperature time series for Bukoba and Zanzibar stations (1958-2005)



Source: Matari et al. (2008)

Figure 4.2: Year to year rainfall fluctuations for Songea and Arusha stations



Source: Matari et al. (2008)

significant. Overall, the changes in the mean temperature and rainfall and the increased variability of rainfall have resulted into prolonged length of dry seasons and increased severity of periodic droughts (URT, 2012), which have affected crop production in the country.

Effect of current climate variability on agricultural production

Tanzania is highly dependent on rain-fed agriculture. Therefore, changes and variability in rainfall and temperature patterns have significant impact on the sector. URT (2007) indicates that some of the previous highly productive areas such as the southern and northern highlands have and will continue to be affected by declining rainfall, significant increase in spatial and temporal variability, and increased dry-spells that will have a long term implication in agricultural production. According to the Ministry of Agriculture, Food Security and Cooperatives (URT, 2008b), there are considerable changes in the types of crops grown in agro-ecological zones. For example, some farmers in Muheza District (in Tanga) and Muleba District (in Kagera) have switched to growing cassava and vanilla because of a declining trend in the productivity of maize and sorghum, respectively, because the two crops are more tolerant to drought.

Rainfall shortages and drought are critical risks for maize and upland rice farming. According to a study by the World Bank (2013), yields of maize and rice have been oscillating around an average of 1.4 tonnes/ha in the last 30 years with the exception of 1980s and 1990s due to rainfall shortages and drought. In general, during the period 2000-2007, maize production increased at a slow rate (2%) than the overall population growth rate (3%) mainly because of rainfall variability, even though other factors such as low application of fertilizers, low use of improved seeds, and pests and diseases have contributed to the slow growth (World Bank, 2013).

Pests and diseases have also contributed to low yields. In general, the observed changes in temperature that are increasing and rainfall that is slowly decreasing have paved way for prevalence of crop pests and diseases, thus posing more challenges to agriculture. The country is observing emerging diseases such as banana *xanthomonas* and cassava mosaic, which have become more prevalent (URT, 2008). Farmers have also noted that incidences of crop pests have increased over the past few decades. There is also emergence of some new plant species such as *striga spp* for cereal crops and vermin such as mole rats, which in turn have caused increased demand for pesticides and herbicides (URT, 2008).

The livestock industry is another agriculture sub-sector that has been affected by the current climate change as most of the livestock are concentrated in the semi-arid and arid areas of Tanzania, which are most vulnerable to climate change. There has been limited availability of pasture and water due to frequent droughts that have often resulted into conflicts between livestock keepers and crop farmers. Current climate change and variability has shifted geographical distribution of biodiversity and increased the frequency and intensity of wild fires. For example, palatable and nutritious plant species are replaced by non-palatable and sometimes toxic species. Biomass growth is also affected by the intensified wildfires, reducing availability of pasture. Seed cakes and molasses consumed more in urban agriculture have been affected by reduction in agricultural and industrial production due to climate change. This has affected availability of animal feed resources for poultry, non-ruminants and other non-conventional animals.

Future climate change

Several local studies have been conducted to project climate change by year 2050 and 2100; for example Mwandosya et al. (1998), Matari et al. (2008), Kilembe et al. (2013) and Wambura et al. (2014). Mwandosya et al. (1998) predicted rise in mean daily temperature, on average, by 3° to 5°C and a rise in mean annual temperature, on average, by 2°C to 4°C throughout the country. The study by Matari et al. (2008) indicates that mean annual temperatures are projected to rise by 1.7°C over north eastern areas of the country and 2.5°C over the western parts of the country by 2100.

The climate projection by Kilembe et al. (2013) expresses that the CNRM-CM3 and ECHAM 5 models project a median increase of 2.1°C. The CSIRO Mark 3 and MIROC 3.2 models also exhibit median temperature increases of around 1.0°C. The MIROC 3.2 model seems to exhibit spatial variability, which ranges from 0.5°C to 2°C across the country.

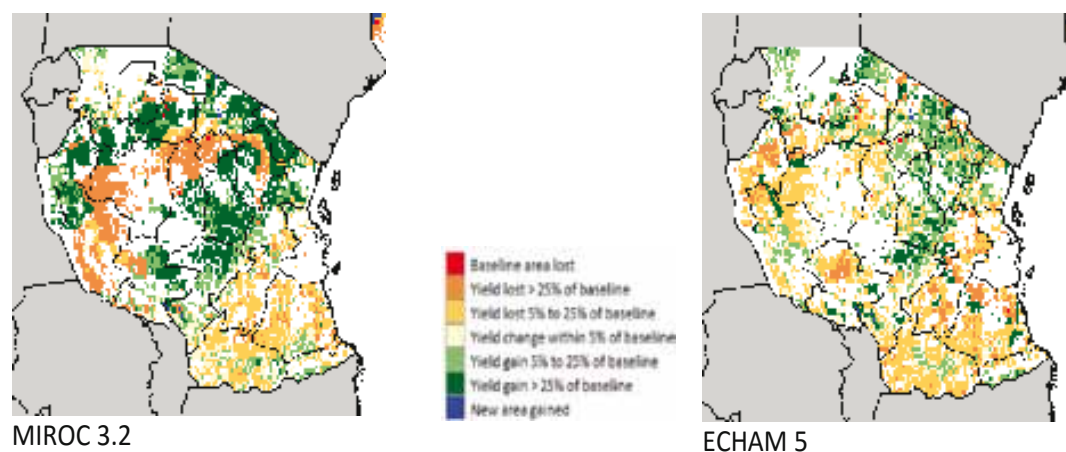
Wambura et al. (2014) predicted the mean annual temperature to rise by 0.70 to 1.0°C across the country. The study involved the use CMIP5 climate models with emission scenario RCP8.5. Despite the differences in climatology of projections, the changes from the baseline temperatures have been reduced, as the capacity of modelling the circulation systems increased from using 2CO₂ approach to CMIP5 projections.

The rainfall projection by Mwandosya et al. (1998) indicates that bimodal rainfall pattern will have an increase in rainfall ranging from 5 per cent to 45 per cent and the unimodal rainfall areas will experience reduced rainfall ranging from 5 per cent to 15 per cent. Matari et al. (2008) indicated that annual precipitation will increase by 10 per cent over the entire country. Using CMIP3 climate models, the projected change of rainfall in Tanzania ranges between -100 and 300 mm per year. Kilembe et al. (2013) reported that MIROC 3.2 model projects increase in precipitation of around 200 mm to 300 mm by 2050 (Figure 4.3). The ECHAM 5 model projects that most of Tanzania will not have significant change in rainfall except around Lake Victoria where rainfall is projected to increase by between 100 mm and 200 mm by 2050. The CRNM-CM3 model predicts a decrease in the rainfall amount by around 100 mm per year around Lake Victoria. The model also predicts an increase of 50-100 mm for the southern half of the country.

In general, the CMIP5 rainfall projection shows that rainfall will range from -4 per cent to 18 per cent throughout the country; equivalent to between -76 mm to 189 mm of rainfall. In comparison with 2CO₂, the prediction of rainfall decrease and increase do not differ much but CMIP3 results are comparable in the direction of change of rainfall but the magnitude is twice as much.

Therefore, there is a high level of variability, both geographically and between scenarios, making any generalization a challenge. This calls for more site-specific

Figure 4.3: Projected maize yield under climate change by 2050



assessments in order to design site-specific policy responses to climate change. However, even with lack of specific projections, there is a general agreement that the frequency and severity of extreme climatic events will increase with climate change. For example, the central and northern zones that are semi-arid are very vulnerable to climate variability and will be more vulnerable to the projected increase in frequency and amplitude of extreme climate events.

Future climate change and impact on agricultural production

Tanzania is highly dependent on rain fed agriculture. There is projected increase in temperature, reduced rainfall in some areas and shifts in rainfall patterns due to climate change, which will impact on the agricultural sector. There is a general agreement in the literature that climate change will have negative impacts on maize and other food crops that are important for domestic consumption even though there is regional variability (World Bank, 2013). Mwandosya et al. (1998) projected that maize yields will be lower than under a baseline climate projection by about 33 per cent across the country. The highest impact was projected to occur in Dodoma and Tabora with a decline of 84 per cent while the high potential areas such as southern highlands maize yields are projected to decline by 12 per cent. According to Kilembe et al. (2013), maize yield was expected to gain by as much as 25 per cent in many areas, and decrease by the same amount in others using MIROC model, with the southern Tanzania experiencing yield losses. However, in the same region, CSIRO model projected that yields will increase by as much as 25 per cent. Therefore, the projected yields differ significantly in some cases depending on the type of model used in the projection because of the underlying assumptions.

The IFPRI IMPACT model which takes into account technology development into the future projected that rice yields would roughly double between 2010 and 2050 and cassava yields will remain largely unchanged (Kilembe et al., 2013). However, since the model takes into account other socio-economic factors, then supply of rice and cassava will not meet demand because of the projected population growth by 2050. The same model found yields tripling for sorghum, factoring in both climate change and technological improvements.

Tumbo et al. (2014) conducted a more in-depth site-specific assessment of the impact of climate change on maize production in the Wami Basin Tanzania using 20 GCMs projections by mid and end century on both RCP4.5 and RCP8.5. The basin is comprised of semi-arid region in the upper part and sub-humid region in the lower part. The study found that there will be negative impact on maize yields. Simulation results with APSIM indicate that maize yields will decrease by up to 15 per cent towards mid-century under RCP4.5 emission scenario in the semi-arid areas. The increase in yield is also observed in the sub-humid region for both mid

and end-century under RCP 4.5. Under RCP8.5 scenario, yields declined by 20-30 per cent towards end of century using APSIM model. DSSAT indicate there will be substantial decline in yield in both regions of between 5-15 per cent under RCP 4.5 while under RCP 8.5 the decline is projected to be between 20 per cent and 40 per cent.

Limited research has been conducted to understand the impact of climate change on pests and diseases in both crops and livestock. Also, model projections on the impact of climate change on livestock production have not been done. However, warming due to climate change is predicted to increase disease vectors, which will consequently increase the incidences of vector-borne diseases of livestock such as trypanosomiasis and other diseases. The increases of livestock mortality due to diseases and starvation may have considerable impact on the local economies and the overall community livelihoods (Kangalawe et al., 2009).

4.2 Climate Change, Food Security and Trade

Climate change and food security

Food security is one of the top ranked issues in Tanzania as explained in various policy documents such as Vision 2025 and MKUKUTA. Under the MKUKUTA, the Government of Tanzania is committed to ensuring food and nutritional security for all Tanzanians (World Bank, 2013). In the National Food Security Policy (1997), the government underscores the importance of food security, which must be mainstreamed in the development agenda to ensure a healthy and productive nation (URT, 2012). In Tanzania, maize and rice are the most important cereals for food security. However, they are the most climate-sensitive crops, and have far reaching impacts on food security and overall livelihoods (URT, 2014). Diets in Tanzania are heavily cereal based, with maize being the most consumed cereal (5.8 days per week) (URT, 2010b).

In Tanzania, food security and rainfall are closely linked because of dependence on rain fed agriculture, which accounts for 96 per cent of agricultural area (URT, 2013), and where over 60-70 per cent of cereals are grown in regions with uni-modal rainfall pattern (URT, 2014). There is a strong correlation between food security and rainfall as shown in Figure 4.4. Areas with higher levels of vulnerability to food insecurity largely align with semi-arid zones and arid lands.

Overall, Tanzania is fairly food secure. The MAFC conducts regular food security monitoring on the different elements of food security and finds that food availability forecast nationally for 2012/13 is overall satisfactory, with a food self-sufficiency ratio of 113 per cent, slightly higher than in 2011/12 (112%) (MAFC, 2012). However, major inter and intra-regional and councils variations exist due

in population. Kilembe et al. (2013) projects that the population level is expected to reach 95 million persons under pessimistic scenario and 125 million persons under optimistic scenario, meaning doubling population between 2010 and 2050. Tumbo et al. (2014) found that under adapted future climates, APSIM and DSSAT crop models show an increase in maize yields in Wami basin by between 29 per cent and 100 per cent, with DSSAT projecting much lower increase compared to APSIM. The adapted future condition is based on improved agronomic conditions of proper plant spacing, and increased use of fertilizer in the rain-fed agricultural systems.

Therefore, the food security situation under climate change depends on urgent technological and adaptation actions that the government has to undertake to improve agronomic practices. Most of the actions have been identified in the National Climate Change Strategy (URT, 2012) and Agriculture Climate Resilience Plan (URT, 2014). Business as usual practice will definitely undermine food security because of climate change, in which temperatures are expected to increase by at least 1°C by 2050 and country population is projected to reach at least 95 million.

Climate change and food trade

The effect of climate change on agricultural trade and especially food trade, which is directly linked to food security, will be seen in mainly imports, exports and prices. Under business as usual scenario, we expect yields to decline, area expansion to be limited but population to double. This scenario clearly implies increased importation of most cereals because of a rise in demand and prices of cereals. The IFPRI-IMPACT model showed that there will be a rise in maize imports and import prices (Kilembe et al., 2013). In the case of cassava, the model shows little change in yields but still the demand for cassava is expected to outstrip supply, leading to a dramatic rise in imports but minimal change in world prices is expected. Rice imports will also rise and so will the international price.

Using computable general equilibrium (CGE) model, the World Bank study found that under dry scenario, agricultural GDP will drop by 11.5 per cent compared to the baseline (2010) by year 2040 (World Bank, 2013). This will affect the supply of raw inputs such as grain for the agro-processing sectors such as milling. The agro-processing GDP will drop by 7.8 per cent compared to baseline. Food imports, however, are expected to increase, offsetting declined domestic production and potentially benefitting some traders. The model also indicates that households will be affected by climate change through consumer prices and agriculture incomes. However, the increase in consumer prices may attract some households to reallocate their resources to the affected agricultural sectors in order to benefit from the high prices.

In comparison to Tanzania's major trading partners, the country may mildly be affected by dry conditions, giving it a comparative advantage to export (World Bank, 2013). For example, area under sorghum is expected to expand by 40 per cent and the yield to increase, which will lead to quadrupling of production. The country is expected to export around 70 per cent of production by 2050 (Kilembe et al., 2013). Globally, the market for maize is projected to increase to 1.4 billion tonnes by 2030 from 0.9 billion tonnes in 2015 (SAGCOT, 2011). The country demand is also expected to increase from the current 3.8 million tonnes in 2015 to 5.5 million tonnes by 2030. In order for the country to feed its people and take advantage of external markets, farmers need to use improved seeds, relevant fertilizers, improved farming techniques, and the creation of economies of scale (SAGCOT, 2011). It is envisaged that a 20 per cent increase of both yields and planted area would produce about 1.3 million MT that could be consumed locally and by neighbouring countries.

5. Conclusion and Recommendations

5.1 Conclusion

Agriculture remains a mainstay of Tanzania's economy. The sector contributes significantly to the national GDP and export earnings, supplies raw material for agro-industries, supports the rural livelihoods and feeds the urban population. It is important in managing inflation as it constitutes over half of the inflation basket reflected in consumer price indices. However, the sector is dominated by smallholders managing small family farms of around one ha, with limited industrial inputs and access to modern farm technologies.

Over the past decade, the sector's growth rate has stagnated at around 4 per cent. Agriculture has to grow much faster (6%) than it has been over the past decade. The agriculture sector is accorded the highest priority in the national development policies as an engine of growth and poverty reduction. The main policy goal is to achieve food security and eradicate poverty and hunger through agriculture development and transformation.

Productivity in crop agriculture is still low at around 1-2 tonnes per ha for cereals and grain legumes that are central to the national food security. The sector is predominantly rain-fed, hence prone to the vagaries of weather that will intensify with climate change. Tanzania has a huge potential of advancing its agriculture sector. Less than a quarter of its arable land (44 million) is currently cultivated. Smallholders manage around 14 million ha and large-scale commercial farming accounts for 1.5 million ha. The country is using less than 2 per cent of its irrigation potential (450,392 out 29.4 ha suitable for irrigation). The use of productivity-enhancing inputs, particularly both organic and inorganic fertilizer, is overly limited. Productivity can also be upgraded in its rain-fed systems through better agronomic and soil-water management.

Tanzania has a huge potential in livestock production—ranking second in Africa after Ethiopia in terms of number of livestock heads (20 million cattle and 17 million goats and sheep). It was third before the split of Sudan into the now Sudan and South Sudan. However, the contribution of the livestock sector to the national GDP is still around 18 per cent - and to agriculture 15 per cent. The livestock sector is dominated by indigenous cattle (80%) kept mainly under agro-pastoral system for dual purpose of supplying meat and milk. Only around 6 per cent of cattle are under commercial and smallholder dairy production systems. Productivity in the livestock sector, especially in the traditional system, is low.

Amid a number of productivity challenges in the agriculture sector, Tanzania is fairly a food secure country. When food security is envisioned beyond the

pillar of availability – to access, stability and utilization – the country has miles to stride before achieving a sustainable food security. Over the vast country and across seasons, there is normally localized food insecurity due to locational crop failures of varying magnitudes. The food security risks made worse by a poorly integrated food system that does not enable movement of foods from surplus to deficit regions efficiently and affordably.

The Government of Tanzania has implemented a number substantial programmes of trade liberalization that started in the 1980s and by 1990 virtually all restrictions on private trade in grains had been removed. Since then, food trade was liberalized, encouraging private sector participation. However, trade of food crops is occasionally interrupted by export bans by the government in cases of anticipated food shortage mainly due to droughts.

Agricultural food trade has not grown to the anticipated pace to contribute to growth, livelihood improvements and food security. Due to fluctuations in domestic supply from local production and demand, Tanzania exports and imports food products. The major food products envisaged in the export and import trading portfolio are maize and rice. Others include wheat, sunflower, sorghum, beans and pulses. Over almost a decade, the annual growth in quantity and value of major food exports (e.g. maize and rice) has been fluctuating with net export balances in most of the years (6 out of 9 years). However, the global export share of Tanzania is infinitesimally low; for example 0.1 per cent for maize. In contrast with food exports, food imports increase during drought years. The terms of trade in food crops is sensitive to the quality of the growing seasons.

The impact of climate change on the performance of the agriculture sector is real. Climate change augments to the odds that the sector is already experiencing from climate variability. The future mid-century projections indicate that different agro-ecological zones will be warmer—with a temperature rise of 0.5°-2°C across the country. The impacts of climate change on rainfall over the country are mixed with respect to the amount of precipitation—with a decrease of up to 200 mm in some parts and an increase of up to 300 mm in other areas. Crop yields will increase in some parts and decrease in others. Food trade will be affected as well. With reduced yields, prices will hike and vice versa. In this regard, climate change will be associated with challenges and opportunities at the same time. With increasing precipitation in the currently drier areas, productivity might improve, *ceteris paribus*. A slight increase of temperature in cooler places of southern highlands could shorten the maturity period of maize.

Tanzania has a landscape of policies, strategies and programmes to improve agricultural productivity and enhance agricultural trade to deliver food security and poverty reduction. In the policy planning processes, efforts are normally

made to mainstream important cross-cutting issues such as climate change, HIV-AIDS, gender and ICT. The importance of mainstreaming climate change in the agricultural policies and plans has been increasingly acknowledged. The agriculture sector was the first to initiate the development of the agriculture climate change resilience plan, which has been recently endorsed by the sector management. The policy challenge around agricultural production, trade, climate change and food security is not lack of policies but how to coordinate policy plans and actions in different agriculture line sectors.

5.2 Recommendations

Developing smallholder agriculture is critical for economic growth and poverty reduction. This could be attained through improved productivity and profitability of small family farms. Productivity in agriculture has to be increased in both rain fed and irrigated smallholder farms. This can be attained through increased use of productivity-enhancing technologies such as fertilizer, improved seeds and best agronomic practices. Moreso, productivity of the livestock sector can be upgraded through breeding and progeny selection, animal husbandry, feeding and disease management programmes.

Given the predominant current small scale farming amid under-utilized agricultural land, there is potential in promoting medium and large-scale commercial agriculture with a working investment model that integrates smallholder farmers.

Achieving sustainable food security requires fostering efficient food systems that are fuelled by efficient and pro-poor food trade systems—smartly anchored on robust trade policies and governance. This would enhance food trade administration and governance, given problems associated with food export bans, food import permits and tariff regimes.

Fostering climate change resilience in the agriculture sector is central for ensuring sustainable growth of the agriculture sector. Cushioning the agriculture sector from climatic risks can involve promoting climate-smart agricultural practices such as irrigation, soil-water conservation, and adapted crop varieties.

The climate research has to advance in generating downscaled area-specific results to inform policies that address the challenges and exploit opportunities that will arise with climate change.

Better coordination of policies related with improvement of agriculture production, trade, food security and climate change is critical. The agriculture line ministries' plans have to be coordinated and harmonized through effective

platforms such as joint committees and meetings. The coordination should be extended to involve other sectors and departments whose policies and plans have implications on agriculture at large.

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