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## THE MAIZE VALUE CHAIN IN TANZANIA

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A report from the Southern Highlands  
Food Systems Programme

R. Trevor Wilson  
J. Lewis



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In fond memory of David Kenneth Hitchcock

## EXECUTIVE SUMMARY

This report analyses and reviews the maize value chain in Tanzania, with a special focus on the Southern Highlands and the private sector. The report was used to support the development of a maize sub-sector strategy: the latter being discussed at the Southern Highlands Agricultural Forum held by the Food and Agriculture Organization of the United Nations (FAO) in January 2014 in Dar es Salaam, United Republic of Tanzania.

Maize is the staple food for the majority of Tanzanians. Most maize is produced by small-scale farmers and is usually grown under low input, rainfed conditions. It is both a subsistence and a cash crop. The maize value chain is fragmented and poorly coordinated. There are many layers and inefficient connections between producers and consumers. Trust, reliable information systems and the benefits of economies of scale are not well established. The result is considerable uncertainty, which discourages investment by both resource-poor, risk-averse small-scale farmers and commercial investors. There is little market 'pull' to stimulate improvement. As a result, up to 80 percent of all maize is consumed within the producing households. Changes are needed to help millions of small-scale farmers — who currently make little or no profit from maize — become profitable.

In 2011, an estimated 6.59 million metric tonnes (MT) of maize was grown in Tanzania. Of that, 6.4 million MT was consumed and 114,100 MT was exported. Approximately 12,000 MT was imported and 73,800 MT was used for next season's seed. These figures show a marked increase on previous official figures. It is expected that domestic and regional demand will significantly grow in the coming years, with additional demand for yellow maize for stock feed. Once the right incentives and a positive business environment are in place there is a huge opportunity to develop the maize sub-sector using available technology.

Current constraints include uncertain land tenure, little access to affordable finance, poor rural infrastructure, periodic bans on cereal exports, corruption, local taxes on farm production, the limited availability of improved seed, weak business skills and inadequate institutional and technical capacity. Many constraints are now being tackled on a sector-wide level.

Of special importance to maize will be improving linkages between producers and processors. There are opportunities to help large-scale millers develop better, more equitable commercial links with farmers' groups, as well to support the further development of Warehouse Receipt Systems (WRS). Formalization and increased efficiencies in small-scale millers are also needed.

A new, credible and widely accepted National Maize Development Strategy must be created to lay the foundation for future partnerships and well-coordinated progress. This should be prepared jointly by both private and public sector actors, and ensure that well-meaning interventions from the Government, donors and international foundations do not stifle private sector initiative in the field. At the same time, national and international private sector actors and their organizations must become better organized and more capable of pushing for change. New domestic and export markets also need to be developed, and environmentally friendly 'Green Growth' options encouraged.

## ACRONYMS

ACT	Agricultural Council of Tanzania
ANSAF	Agricultural Non-State Actors Forum
ASDP	Agricultural Sector Development Programme
CIMMYT	International Centre Maize and Wheat Improvement Centre
CIP	Commodity Investment Plan
CTI	Confederation of Tanzania Industry
FAO	Food and Agriculture Organization of the United Nations
FIPS	Farm Inputs Promotion System
GoT	Government of Tanzania
Ha	Hectare
IFPRI	International Food Policy Research Institute
Kg	Kilogram
LGA	Local Government Authority
MAFC	Ministry of Agriculture, Food Security & Cooperatives
MFI	Microfinance Institution
MT	Metric ton
MVI WATA	Mtandao wa Vikundi vya Wakulima Tanzania
NARI	National Agricultural Research Institute
NAFAKA	Tanzania Staples Value Chain
NFRA	National Food Reserve Agency
NGO	Non-Governmental Organization
pH	Measure acidity/alkalinity
QPM	Quality Protein Maize
PELUM	Participatory Ecological Land Use Management
R & D	Research and Development
RUDI	Rural Urban Development Initiative
SACCO	Savings and Credit Cooperative
SAGCOT	Southern Agricultural Growth Corridor of Tanzania
SHFSP	Southern Highlands Food Systems Programme
SWOT	Strengths, Weaknesses, Opportunities and Threats analysis.
TAP	Tanzania Agricultural Partnership
TIC	Tanzania Investment Centre
TSh	Tanzania Shilling (1US\$ = c. TSh 1,560)
TWLB	Tanzania Warehouse Licensing Board
USAID	United States Agency for International Assistance
WFP	World Food Programme
WRS	Warehouse Receipt System

## 1. INTRODUCTION

### 1.1 Background

This report analyse and reviews the maize value chain in Tanzania, with a special focus on the Southern Highlands. There is a particular focus on the role of the private sector. It is the Government of Tanzania's policy to encourage private sector-led agricultural growth. This has guided public sector support for operations such as FAQ's Southern Highlands Food Security Programme(SHFSP), and initiatives such as Kilimo Kwanza and the Southern Agricultural Growth Corridor of Tanzania (SAGCOT). It is also the driver behind the recent G8 Cooperation Framework, which supports the New Alliance for Food Security and Nutrition in Tanzania. The G8 meeting at Camp David in the United States of America resulted in substantial, practical agreements on policy improvements and investments that will have significant impact on the maize value chain.

There is an increasingly clear route for private sector initiatives in agriculture. However, although new frameworks are important steps, they need to be accompanied by mind-set changes leading to action. For Tanzania, private sector led agricultural growth is still something new. This is why 'business as unusual' is required from all involved. This will take time: experience so far shows that although the intentions are there, implementing and achieving results on the ground with new ways is difficult. Translating high-level international agreements into sustainable, field-based improvements presents a major challenge for the agricultural sector, and the maize sub-sector.

The current set of reports from the SHFSP<sup>1</sup> — together with the 2013 Forum — are intended to contribute to a process of practical change and evolution, and define roles and responsibilities in the process. They will do this by summarising the overall value chain process in each commodity, and proposing a limited number of focused strategies to support future progress. This particular document does this for maize.

Although several previous reports have looked at the Maize Value Chain in Tanzania<sup>2</sup> (and continued value chain studies takes place), most cover the same ground and use the same background information. In the absence of any inclusive and informative national plan for the maize value chain, each new actor undertakes a new value chain study. While each study adds new information and insight, the overall impact in the field is limited. A single, authoritative national strategy is therefore urgently needed.

### 1.2 Methodology

A consultant undertook fieldwork for the mission in 2012. Meetings were held with the government and its agencies, agricultural universities, the private sector, development projects and donors. A half day maize value chain workshop was held and a draft report was finalized in December 2012.

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<sup>1</sup> There are additional reports on the maize, soybean, white and red meat value chains.

<sup>2</sup> Including ASDP 2008;JICA, 2009; TAP, 2010; USAID, 2010; SAGCOT, 2011b, and USAID 2011



### 1.3 Overview of the maize value chain

Maize is the staple food for the majority of Tanzanians. Most maize (80 percent) is produced by small-scale farmers and is grown both for subsistence and as a cash crop. Between 65 and 80 percent of all maize is consumed within the producing households: only 20 percent to 35 percent enters commercial channels. Maize comprises an average of 16 percent of national household food expenditures, though there are big regional variations.

Maize is usually grown under low input, rainfed conditions. The choice to grow maize, even in areas of insufficient rainfall, is driven by a strong dietary preference for maize over the more drought-adapted traditional cereals such as sorghum and millet. Efforts are being made both to develop more drought tolerant varieties and to increase the amount of irrigation available to Tanzanian farmers.

Despite the importance of maize to Tanzania and Tanzanians, the value chain is fragmented and poorly coordinated. There are many layers and inefficient connections between producers and consumers. Trust, reliable information systems, and the benefits of economies of scale are not well established.

Past public sector support to maize has focused mainly on production, and policies to encourage a market-based economy and private sector leadership have been slow to take effect. There are examples of excellent progress in site-specific value chain development, but they are not widely replicated.

The majority of marketed maize is delivered to local collection hubs, accumulated by traders who sell on to local, regional and urban markets. Some is also sold to processors and grain traders who accumulate and export. This works to the advantage of larger-scale operators in the business and to the disadvantage of most farmers. There are only a limited number of larger roller mills that produce high quality flour products, and all operate well below capacity. Small-scale hammer mills are mainly used throughout Tanzania to convert grain to low-cost and low-quality flour, although their economics are not transparent, and profit — where it exists — is on volume trade, with no real traceability on final products.

A series of generic issues impact on the maize value chain and create concerns across the board for agricultural growth. These include land tenure, land administration and land-use planning; local production taxes ('cesses'); corruption; a difficult business environment; inadequate rural infrastructure; high transport costs; difficult access to affordable finance; limited trade opportunities, and periodic export bans. There are also some important maize-specific issues, which include: availability of suitable varieties; availability of seed; management of soil nutrients and soil moisture; maize markets and market information; and processing capacity and efficiency.

The result is a background of considerable uncertainty, which discourages investment by both resource-poor, risk-averse farmers, as well as large-scale commercial investors. Aware of these problems, the private sector is working to play a stronger and more organized role in agricultural development. However, to date, farmers, traders and processors in the value chain have not yet shown the coordinated determination needed for sector leadership. Key interventions in the sub-sector are dominated at present by government actions, donor interventions and a few large-scale operators.

Chapter 1 provides the background to the review and the maize value chain. In Chapter 2 various maize markets are described, with important new analysis from the United States Agency for International Assistance (USAID). Chapter 3 describes the different elements in the value chain, and in Chapter 4 existing constraints and future opportunities are presented. In the final chapter (5) a vision for future maize value chain development is presented and the initial steps towards a future maize development strategy are outlined.

## 2. END MARKETS

Official statistics on maize production and marketing have not been very accurate. There are several reasons for this. First, the different sources do not correlate or crosscheck their numbers. Second, there has been little demand for up-to-date reliable information from the authorities in decision-making. Third, there is significant illegal trade through Tanzania's porous borders that escapes being counted. Recent analysis by USAID has provided a new set of reliable information and analysis that is already beginning to stimulate change (see Table 1, Ahmed *et al* 2012; IFPRI, 2012; and USAID 2012a and 2012 b).

The links between the potential demand, processors and producers is constrained by structural, political and administrative factors. As a result, there is little 'pull' in the value chain to stimulate improvements in production. At the political level, the Government is simultaneously trying to ensure adequate returns for maize producers while maintaining low prices for consumers (Temu and Ashimogo, 1998). The focus on domestic self-sufficiency and affordable prices for urban consumers has blocked the vision of a more productive and profitable commercial maize sub-sector that looks to develop and expand markets, and 'pull' further growth in production.

Maize marketing is characterized by a lack of trust, information and goodwill between producers and traders and processors. Although, there are some successes — such as the Kibaigwa Maize Market and the work of the Rural Urban Development Initiative (RUDI) — to strengthen farmers' groups and their market position there is little sign of a new overall way of looking at the relationships between farmers, traders and processors. These groups are more often in conflict than working in competitive harmony. And while price, quality and quantity are issues that need competitive discussion, this can best be done within a fair and open framework. This is not currently the situation.

While up to 80 percent of Tanzanian maize is consumed and traded locally, the commercial maize market is controlled by a small number of very strong, influential dealers and processors that are well adapted to handle irregular and opportunistic trade. They have the finance and networks to set prices, especially immediately after harvest when many farmers are short of money.

Maize availability and affordability in urban areas is perceived as politically critical, and long-standing worries about self-sufficiency have been compounded by global uncertainties of supply and price. One result has been periodic export bans on cereals. These issues are currently being reviewed by the Government of Tanzania with the support of USAID's 'Feed the Future' SERA initiative, and other operations. This work will be discussed in more detail in Section 2.2. However, the USAID work has reviewed and revised information on the quantities of maize that are involved in the Tanzanian maize value chain. These are summarized in Table 1.

The above numbers show dramatic changes to conventional figures. Levels of production, consumption and export are all significantly higher than previously thought. The consequences of this will be discussed in later sections of the report. But the figure of 114,107 MT exported is far greater than the official figure of about 3,000 MT. This shows not only the weakness of current official figures, but also the failure of the export ban.

The weak market ‘pull’ on maize is not clear, strong or consistent and provides little incentive for farmers to invest in producing a surplus for an uncertain end market. This generates a cycle of underperformance with negative impacts on rural incomes, future national food security and trade opportunities. In addition, the current perceived and actual constraints to yellow maize production mean that a potentially important end market for livestock feed remains undeveloped. This has implications deep into the livestock sector, where potential local and international end-markets for quality animal feed and animal products are growing the whole time. With Sub-Saharan Africa’s second largest cattle herd, and a huge under-developed potential in poultry and beef, there is a huge market potential for yellow maize in Tanzania.

**Table 1: Revised Tanzania maize value chain information**

	Consumption (MT)	Imports (MT)	Exports (MT)	Seed (MT)	Production (MT)
<b>2001</b>	4 755 472	31 045	25 579	34 000	4 784 006
<b>2002</b>	4 863 412	63 373	152 310	69 000	5 021 349
<b>2003</b>	4 985 629	77 991	156 193	63 000	5 126 831
<b>2004</b>	5 099 543	128 374	53 747	62 000	5 086 916
<b>2005</b>	5 249 170	18 901	101 394	60 000	5 391 663
<b>2006</b>	5 465 791	252 632	23 507	62 000	5 298 666
<b>2007</b>	5 649 835	6 609	87 076	62 000	5 792 302
<b>2008</b>	5 816 739	20 468	93 834	59 226	5 949 330
<b>2009</b>	5 974 396	6 415	100 592	62 000	6 130 572
<b>2010</b>	6 145 037	18 588	107 349	69 605	6 303 403
<b>2011</b>	6 418 248	11 931	114 107	73 827	6 594 251

Source: USAID, 2012a

## 2.1 National markets

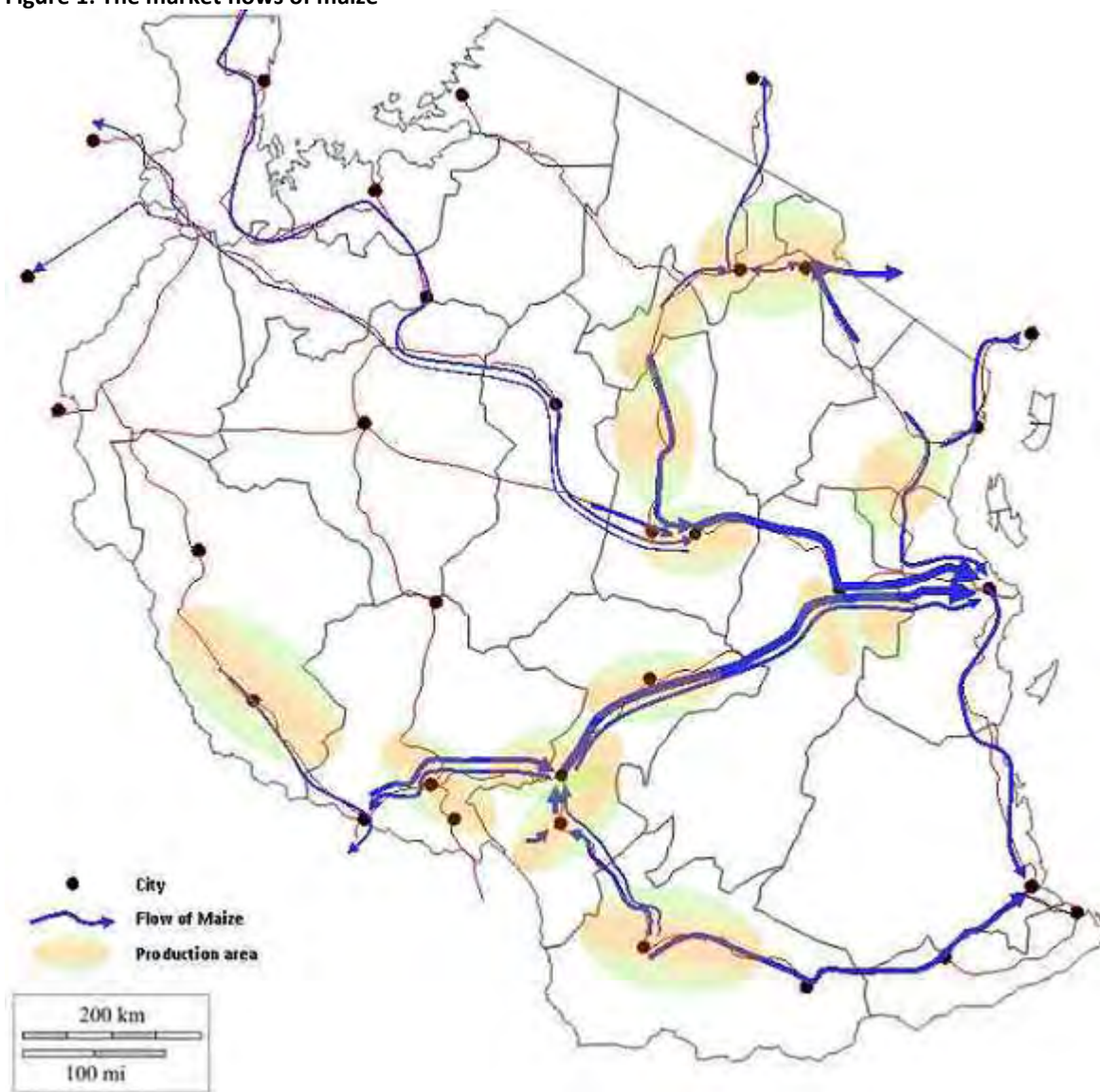
Between 85 to 90 percent of Tanzania’s population, about 40 million people, eat maize. Of the 6.5 million MT produced in 2011, between 3 and 4 million MT would have been marketed. Producers and their families ate the rest. Figure 1 shows the geographic flows of marketed maize in Tanzania.

There are four recognized market channels:

- A myriad of small-scale farmers who sell to local traders and millers mainly in the rural areas and nearby cities;
- Medium-sized grain traders and millers who serve rural and urban centres;
- A few well-established, large-scale millers and traders based in Dar es Salaam, operating in both national and export markets;
- Institutional buyers including The National Food Reserve Agency (NFRA), the World Food Programme (WFP), prisons, the armed forces, hospitals and schools.

The internal maize market usually has many different transactions between the farmgate and the consumer. At each stage a margin is taken which reduces overall financial efficiency. It is clear that changes in market structure are needed if a more efficient value chain is to be developed.

Figure 1: The market flows of maize



Source: TAP 2010

National demand for maize will continue to grow in the future. Estimates suggest there might be 150 million Tanzanians by 2050. They will all need to be fed. In addition, with national Gross Domestic Product (GDP) growing at nearly 7 percent *per annum*, increased national prosperity will stimulate demand for quality food. For maize, this means better quality farm produce, higher quality milling and better packaging. For livestock production, it means increased demand for yellow maize.

There is increasing awareness of the potential and the need to find market-based responses to both the challenges and the opportunities. For example, three relatively recent innovations have emerged which are geared to getting farmers a fairer and better deal in the market place:

- Professional Maize Growers' Associations — such as those supported by RUDI and other grassroots organizations;
- Kibaigwa Maize Market — exerts a 'pull' on maize produced over a very large area (see box 1);
- Warehouse Receipt Systems — enable farmers to get some cash at the end of the season without having to accept a low price (see Box 3).

However, for any of these improvements to have a lasting impact, farmers must be prepared to continue to work together in a responsible and coordinated manner, and respect the conditions of commercial contracts.

**Box 1: Kibaiwa market operations**

- Over 100,000 MT of maize is traded each year.
- Peak trade is from May to August.
- Throughput: 50% direct from farmers, 50% from traders.
- The market levies a small fee for sellers and buyers (2.5 TSh/kg): 30% of that income goes towards running the market, 70% goes to the council that owns the market.
- The market employs 13 permanent staff and 6 temporary staff during peak season.
- Staff perform quality checks on the maize for sale.
- Market information (yesterday's average price) is sent out via text message (SMS) every morning to farmers, and traders can decide whether to take their goods to market.

Information, standards and quality assurance present a major challenge at many points in the maize value chain, including marketing. Although mobile phone market information systems are being developed, most local maize markets still have little or no indication of standards or current prices. There are few quality checks (e.g. for the percentage of moisture, the grain quality, or storage pests) and seldom any traceability of origin. In the villages, sale quantities are determined by volume, usually a plastic bucket. Where scales are used, they are often inaccurate beyond 80 kg, and it is not unusual for a bag weighed in at 100 kg actually to weigh 120 kg (this gives a traders' advantage). Maize passing from one district to another in a vehicle will be liable to local government 'cess' — a tax based on the volume being moved rather than profit or margins<sup>3</sup>.

**Box 2: Farmer benefits from improved markets**

- The market makes transparent current market conditions — village representatives receive prices via SMS and farmers can make rational decisions on whether to sell.
- Farmers who can transport maize and sell directly at market will earn fair market prices, rather than take a low price from a local trader.
- The market provides two weeks of free storage to sellers, and affordable long-term storage.
- The stability of the market promotes increased maize production.
- The market provides a single point for buyers from around the country and region.

Source: USAID, 2010

Improvements are underway, but it is unrealistic to expect widespread immediate impact. Similarly, the Occupational Health and Safety (OH&S) aspects of bag weight and other maize trading processes are not receiving much attention. On the other hand, the extent to which most local consumers would be willing to pay the additional costs resulting from improvements in these areas is far from certain.

**Warehouse Receipt Systems** are being developed for a number of different crops, including maize. The objective is to enable resource-poor small-scale farmers to get some cash at the end of the

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<sup>3</sup> At the recent 68 summit and associated meeting of the Alliance for Food Security, the Government of Tanzania undertook to review the use of local government 'cess' (see Box 4).

harvest as well as to store some of their crop until prices rise following the post-harvest low. The system requires farmers to become organized, work together, locate a suitable store and employ a suitably skilled store manager to run the system. Once set-up, the WRS group tries to obtain credit from a commercial bank or Microfinance Institution (MEI). However, even though the maize in store can be used as collateral, commercial banks often require three years of financial accounts from the WRS group. This makes it difficult to start WRS without some external support.

The Tanzania Warehouse Licensing Board (TWLB) is the official agency for licensing warehouses. It is limited in operational funding, and delegates where possible to the regional authorities, which are also faced with capacity and operational limitations. It is estimated that about 4 000 warehouses are still to be licensed: just over 50 licenses have been issued so far in 2012. TWLB's inadequate capacity is an important issue in relation to maize marketing, as banks will not lend to groups without a TWLB license.

The vast majority of the primary, local trade in maize in Tanzania is unregulated, unregistered and untaxed. The organization and improvement of this market presents a massive challenge for Local Government Authorities (LGAs), the Tanzanian Bureau of Standards (TBS) and the Tanzania Revenue Authority (TRA). There are some six million tons of maize being traded — and much is traded several times — with very little account or quality control.

### **Box 3: Warehouse receipt systems**

A typical WRS involves a farmers' organization borrowing money from a commercial bank, using the warehoused produce as collateral. The loan is recovered at a later date when the produce has been sold to a buyer at a favourable price.

- An organized, well-run WRS obtains access to credit from a MFI or bank.
- It provides farmers with cash advances against crop delivered to the warehouse.
- It provides an opportunity to hold crops at the end of the season until prices increase.
- There is improved bulk storage in a well-managed WRS.
- Bulking of different farmers' maize provides negotiating strength in the market.

## **2.2 Export markets**

Since the turn of the century, official figures for annual maize export covered a huge range — from 2,000 MT to 251,300 MT. Tanzania's export trade is largely opportunistic, often illegal and depends on many internal and external factors. Periodic export bans have discouraged traders from seeking large export contracts and encouraged illegal routes: either by bribing at customs posts or through bush '*panya*' routes across Tanzania's highly-permeable borders. Neither the uncertainties nor the illicit trade are good for Tanzania in the long term.

Recent calculations of maize exports (see Table 1) show a range of between 23,000 MT and a 156,000 MT. The countries receiving Tanzania maize are Zambia, Malawi, Rwanda, Burundi, the Democratic Republic of Congo (DRC) and Kenya. The important trade with Kenya, where prices are about 20 percent higher, is not usually supplied from the Southern Highlands. The Trade Intelligence Network recorded illegal exports of 88,000 MT and 77,000 MT in 2004 and 2005 (ASDP, 2008).

In addition to other factors, the legal export of maize is a complex process. It entails permits approved by the district, regional and central authorities of the Ministry of Agriculture, Food Security and Cooperatives (MAFC). This requires five letters from government officials, and represents a considerable additional cost to the exporter.

The recent analysis by USAID reinforces long-standing concerns about unreliable information and provides a more solid information base for revising policy and planning the future. For example, it appears that in 2011 maize exports from Tanzania were about 114,000MT (95,000 MT of which went to Kenya), rather than the official estimate of 3,000 MT. But even with this apparent increase in export numbers, the new data also show that overall maize imports are not more than 3 percent of total production.

**Future Export Potential** — Tanzania has the natural potential to feed itself and export maize to neighbouring countries and elsewhere in the region. Estimates suggest that by 2020 the regional demand for imported maize will rise to 8 million MT. These prospects are very positive and with the right decisions and support it is possible that by 2020 Tanzania could be exporting about 2 million MT of maize.

**The Export Ban** — The importance of reliable information for planning the development of the sub-sector cannot be underestimated: especially as misleading figures have been used to justify cereal export bans. The new information, and additional analysis on the weakness of export bans to achieve their objective, are now being used to help the Government reassess its approach and policy (USAID 2012b; IFPRI, 2012).

For example, it has been concluded that the potential development of maize exports “is being hampered by the periodic use of export bans to address food security concerns, despite strong evidence that export bans are not very effective at ensuring food security, controlling food prices or even preventing exports” (USAID 2012 b). These arguments, supported by new data and analysis (USAID, 2012a; IFPRI, 2012; Ahmed *et al*, 2012), have convinced the Tanzania authorities that the policy needs to change. The result has been a commitment by the Government of Tanzania “to implement alternatives to the export ban by July 2014” (G8 Cooperation Framework, 2012). If the initial success is followed up, it will not only have a major impact on the maize sub-sector, but also strengthen national food security, develop a legal export trade and offer a major opportunity to improve the livelihoods of Tanzania’s maize farmers.

Once there is a consistent, clear and supportive set of policies, regulations and practices to underpin increased maize exports, the private sector would be more willing to invest in procuring export contracts, better storage, transport and handling arrangements and other market-based improvements. These will help improve the quality and increase the quantity of production.

**Climate Change Export Opportunity** — It is possible that future climate change may further improve Tanzania’s maize export advantage. Recent analysis, undertaken for the World Bank, indicates that “some of Tanzania’s trading partners will experience severe dry conditions that may reduce agricultural production in years when Tanzania is only mildly affected” (Ahmed *et al*, 2012). Tanzania needs to be prepared to take advantage of this opportunity.



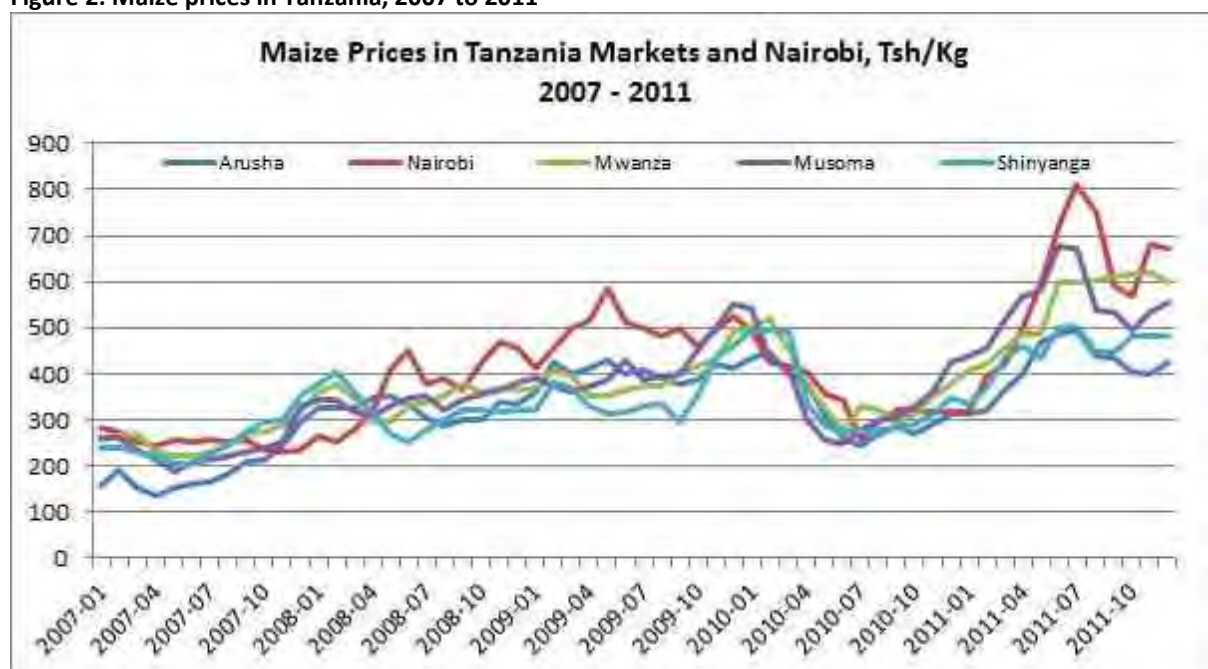
## 2.3 Imports of maize and maize products

Annual maize imports since 2001 have varied considerably: from 6,600 MT to 252,000 MT. There is no apparent correlation between annual production and annual imports for the same or subsequent years (see Table 1). In addition to maize, maize oil and other maize products are sometimes imported to Tanzania. They usually come through the United Arab Emirates, Dubai or the United Kingdom, none of which are important maize exporting countries, so the country of origin is difficult to determine. However, the volume of this trade is limited.

## 2.4 Prices and profits

The market price of Tanzanian maize in August 2012 was between TSh 317 and 370 per kg in local markets in rural Mbeya, and TSh 510 per kg delivered Dar es Salaam. This is the equivalent of US\$197–237 per MT in Mbeya, and US\$325 per MT delivered to Dar es Salaam. Recent prices are shown in Figure 2.

Figure 2: Maize prices in Tanzania, 2007 to 2011



Source: USAID, 2012a

Using the lower essentially farm gate price (averaged at US\$200 per MT), and the 6.6 million MT produced in 2011 this gives a gross maize market value of about US\$1 300 million: although volumes and values vary. The margins for maize farmers also vary greatly — depending on year and production systems. However, recent analysis by the Uyole Agricultural Research Institute in Mbeya indicates that farmers in the Southern Highlands are not likely to make a profit growing maize under the current husbandry and market conditions.

### 3. THE MAIZE VALUE CHAIN

Tanzania's maize value chain is disaggregated and disorganized. Although this works against the interest of most farmers, there are some traders and processors in the middle who do well. The situation can be improved, as most of the elements for potential success are known and available, even if not yet well established in Tanzania. For example, appropriate maize varieties do exist, as do the necessary inputs, the agronomic technologies, the models for farmers' organizations, market information systems and potential markets. These now need to be organized, mobilized and applied in a manner that makes money for the Tanzanian farmer and the whole nation. This can best be done by establishing opportunities and incentives for the private sector, so that it can lead the development of more efficient and effective value chains. However, it also needs to be carried out in a realistic and practical manner that is based on an understanding of the current situation. Farmers have heard too many slogans and news of grand initiatives in the past to believe that any improvement will come easily, if at all.

Given the national importance of maize, the growing demand for export, and the strong natural resource base in the Southern Highlands, a critical but creative review is needed that leads to a broad consensus on key improvements in the value chain. While some will entail removal of generic blocks to development (such as land tenure, land-use planning, better infrastructure, access to finance and the general ease of doing business) others will be specific to maize (such as access to the best available varieties and crop-specific inputs, the end of maize export bans, removal of local government cess on maize, improved maize producer-to-miller linkages, better processor organization and regulation).

None of this will happen easily, and little at all will happen unless most of the key players are prepared to cooperate. Through a number of different organizations and initiatives (such as the Tanzania Investment Centre, SAGCOT and the New Alliance for Food Security and Nutrition) national and international investors are being encouraged to invest in Tanzanian agriculture. Many are concerned by existing constraints and difficulties in doing business. Very few investors are putting their money into maize. This is partly because of the potential of other crops, but also because of the high levels of uncertainty in the maize market. As already shown, progress is being made in this area, but the pressure must be maintained until trade is more efficient, reliable and profitable for all involved.

#### 3.1 The value chain map

A summary of the value chain is presented in Figure 3. Maize accounts for around 30 percent of total food production, over 75 percent of cereal consumption, 30 percent of the country's crop production value and 10 percent of the total 'value added' in the agricultural sector in Tanzania (Ternu *et al*, no date). Approximately 30 million Tanzanians (65 percent of Tanzania's population) rely on farming and 70 percent of the population eat maize as their staple food. All 21 regions of Tanzania produce maize, though about 50 percent is produced in the Southern Highland regions of Morogoro, Iruya, Mbeya, Rukwa and Ruvuma.

Smallholders produce over 95 percent of Tanzania's maize. The majority of smallholders operate at a subsistence rather than commercial level, with an average land holding of about 0.7 hectares (ha). There are only a few large-scale farms in the Southern Highlands, and none of them are currently growing large amounts of maize, though many would if the market conditions were favourable.

As shown in Figure 3, the maize value chain is complex. It is also not well connected. Lack of trust, poor communications and structural disaggregation has led to weak horizontal and vertical linkages. In addition to the technical and market-based improvements, institutional strengthening, better value chain information and clearer business-based linkages between producers and processors could greatly improve value chain function. And while the Government can help in some of these areas, much of the improvement needs to come through private sector initiative. Some progress is being made in this area, but a lot more is needed. This is important as slow private sector progress in key areas exposes the value chain to the risks of unsustainable public sector intervention.

### 3.2 Technology generation

Maize production in Tanzania is mostly under low-input rainfed conditions. Simple hand hoes, farm-recycled seeds, little use of chemical fertilizers or agrochemicals and minimal weeding is the usual technological package. In parts of the Southern Highlands where rainfall is low, farmers grow maize because of a dietary preference rather than wise agronomy. The result is frequent crop failure because of insufficient soil moisture. Irrigation is not usually available or selected option for maize, and on-farm water harvesting techniques are not yet well known. Current technology levels can be summarized as:

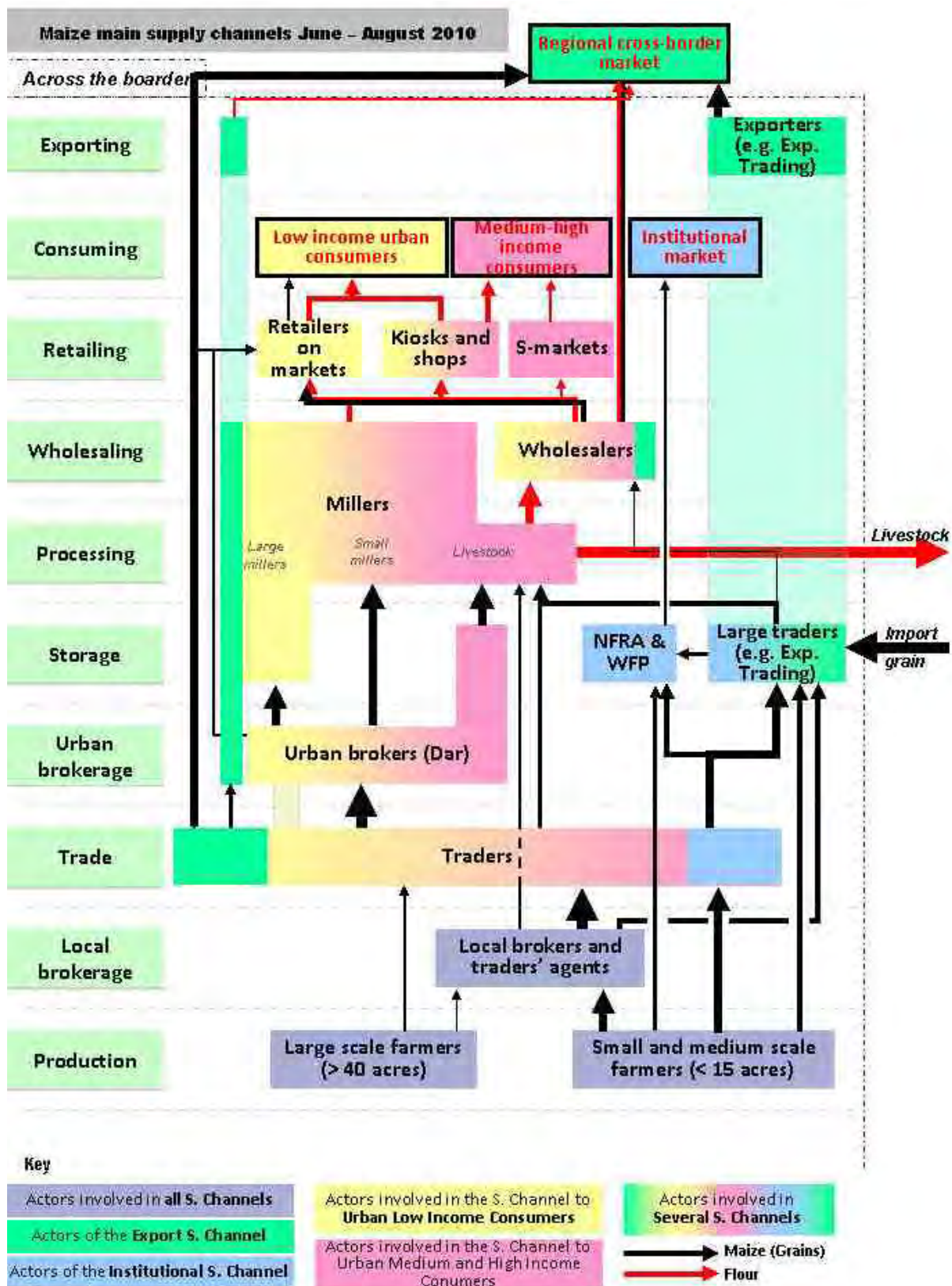
- Low levels of technology: hand hoes for land preparation, and manual inter-row weeding.
- Medium levels of technology: ox-ploughs for ploughing and weeding; some use of power tillers for land preparation and planting; some use of zero or minimum tillage, using pre-emergent herbicides; and inter-row cultivation for weed control.
- High technology: tractor drawn implements, zero or minimum tillage using pre-emergent herbicides, and inter-row cultivation for weed control.

Many technological improvements are possible. However, their application will depend on market opportunities that encourage resource-poor farmers to justify the additional risk in adopting new technologies. The private sector is taking an increasingly strong and pro-active role in reaching out to Tanzanian farmers. Input companies are increasingly involved in local retail, demonstration and extension work. Extension and demonstration is now often undertaken in conjunction with LGA agents. The Tanzania Agricultural Partnership (TAP) has been active in encouraging this type of partnership at the district level, working with Non-Government Organizations (NGOs) such as Farm Inputs Promotion System (FIPS).

The Uyole Agricultural Research Institute at Mbeya leads maize research for the Southern Highlands. The major focus is on productivity, but as farmers want to grow maize in low rainfall areas, an important element must also be drought tolerance and short-duration to maturity. The links between the current research and market demands need to be clarified.

**Irrigation and Water Harvesting** — Overall irrigation potential in Tanzania is estimated at 30 million ha, of which 70 percent is of low potential and less than 10 percent is high potential. Currently, Tanzania irrigates only 332,000 ha of land. Rice is the main irrigated crop in Tanzania and very little irrigated land is planted with maize.

Figure 3: Tanzania's maize value chain



Source: TAP, 2010

Through the Agricultural Sector Development Programme (ASDP), the Government is making a major investment, and using its own funds to improve irrigation. About 75 percent of the ASDP budget is for irrigation. There is a widely held assumption that Tanzania has virtually unlimited land and water available for irrigation. However, there are increasing cases of water shortages and natural resource

conflict related to irrigation and water use<sup>4</sup>. So while there is certainly potential to increase significantly the irrigated area, it must be very carefully and wisely planned and managed. Overall, irrigation development should not be a major focus for the maize value chain in the immediate future.

Simple on-farm water harvesting techniques cost a great deal less than irrigation systems, are relatively easy for farmers to install and would be very suitable for maize in many parts of the Southern Highlands. They can substantially increase the available moisture for plant growth. This is a low-cost, simple technology with great potential; and is also an important soil conservation methodology.

**Mechanization** — has considerable theoretical potential to increase the efficiency of maize production in the Southern Highlands. It is little used at the moment, and both the small field size and unconsolidated structure of most village farmland will present technical challenges to widespread mechanization. Small two-wheel power-tiller units are gaining some local popularity, as are tractor-mounted maize shellers that dehusk and shell on a contract basis. Once the market ‘pull’ of maize is increased, a rapid expansion of private sector-led mechanization can be expected.

### 3.3 Input supply and demand

Maize production makes limited use of modern inputs. The crop is usually grown with a larger dose of hope than inputs and agrochemicals. Farmers’ natural reluctance to take more risk than they already have, uncertainties in the market and experience of negative returns on growing maize all mitigate against moving into a more productive, higher-risk system. As elsewhere in the value chain, there is substantial theoretical potential for growth by applying improvements. But it will require increased incentives, reduced risk, and more reliable and profitable markets.

**Fertilizer** — Historically, Tanzania has had a low level of fertilizer application, among the lowest in the world. In 2010, this averaged only about 9 kg/ha/year (TAP, 2010), but is likely to have recently grown since then as a result of the input subsidy. About 87% of farmers in the Southern Highlands do not use any form of chemical fertilizer, and farmers in marginal areas are less likely to use fertilizer than those in higher potential areas. Lack of nitrogen is the principal limiting factor to maize production, but other nutrient deficits, especially phosphorus and potassium, are also important. This highlights the need and opportunity for increased use of nitrogen-fixing legumes in the maize-based farming system.

An additional factor in soil fertility in the Southern Highlands is that many soils have a low pH. These acidic soils show reduced uptake of chemical fertilizers. The need for widespread application of agricultural lime on these acidic soils has not yet received the attention or support it deserves. It will be a critical factor in increasing the yields of economically sustainable maize. There is a private lime mine near Makumbako (between Iringa and Mbeya) that, with further development, could provide considerable quantities of agricultural lime.

The National Agricultural Input Voucher Scheme (NAIVS), supported by the World Bank, has recently been extended with additional finance. It is reported to have reached 2 million farmers with subsidized inputs. While the system has had a significant short-term impact, the economic benefits,

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<sup>4</sup> For example, conflict on the Ruaha River (part of Ruaha National Park) over water for wildlife; conflict on the Usangu Flats over land and water for agriculture and pastoralism; conflict in the Kilombero Valley over land, water and the RAMSAR wetlands.

replicability and long-term sustainability are not yet clear. There are also concerns about corruption in the administration of the voucher system at a local level.

A further concern is inappropriate fertilizer recommendations. These can be in the form of blanket recommendation made irrespective of soil types or crop requirements. This may be because of a lack of appropriate technical knowledge, but is also sometimes the result of political or administrative interference. There is a need for more science to be applied to fertilizer management, especially at the level of local government.

**Seed** — It is estimated that over 70,000 MT of maize seed is used each year in Tanzania. Of this, about 80 percent is seed that has been retained by the farmers from the previous harvest. Of the remainder, approximately 12 percent are hybrid seeds and 9 percent are non-hybrid seeds purchased by farmers, mainly from local sources. The current grower-purchased seed market is valued at US\$18 million. There are around 50 seed companies registered in Tanzania, although not all are active. There is great potential — and an urgent need — for this specialized trade to increase and become more successful. Not only should this include white maize varieties for human consumption, but also the introduction and expansion of yellow maize for stock feed. The latter would have far-reaching benefits throughout the nation's agriculture.

The seed industry — for most crops, not just maize — faces a series of challenges that restrict growth and participation by foreign investment. There is a range of powerful and restrictive regulations that do not encourage innovation or the rapid, widespread adoption of suitable varieties — even if they are already commercially released in neighbouring countries. The potential for rapid, commercially based bulking and release of improved appropriate maize varieties needs to be developed and supported as a matter of priority. While a certain level of regulation and oversight is necessary and prudent, the private sector has a crucial role to play and is led by the Tanzania Seed Traders Association (TASTA), the private sector apex organization for the seed industry.

Policy issues here include: greater private sector participation in foundation seed; procedures for the commercial release of varieties already available in neighbouring countries; and improving seed export possibilities — including accreditation by the International Seed Testing Association (ISTA) and the Organisation for Economic Cooperation and Development (OECD). Recent agreements within the New Alliance for Food Security in Tanzania have opened up possibilities for the improved movement of seed (see Box 4 and the G8 Cooperation Framework of 2012).

**Crop Protection** — With the current agrochemical market valued at about US\$30 million, Tanzania is the third largest user in East Africa. Only about 5 percent of all purchased agrochemicals are used for maize in Tanzania. And although agrochemical use in Tanzania has grown by 30 percent since 2009, there has been no significant growth for maize. This is another indication of how maize is perceived by farmers in their investment choices. Maize ranks fifth in the use of agrochemicals by crop type so that much of Tanzania's maize production is, by default, organic.

Some crop protection and storage products are banned in Tanzania, based on the latest international best practice and standards. However, the current pesticide legislation and registered product list needs to be reviewed, as there may be a need to withdraw some existing products and register some

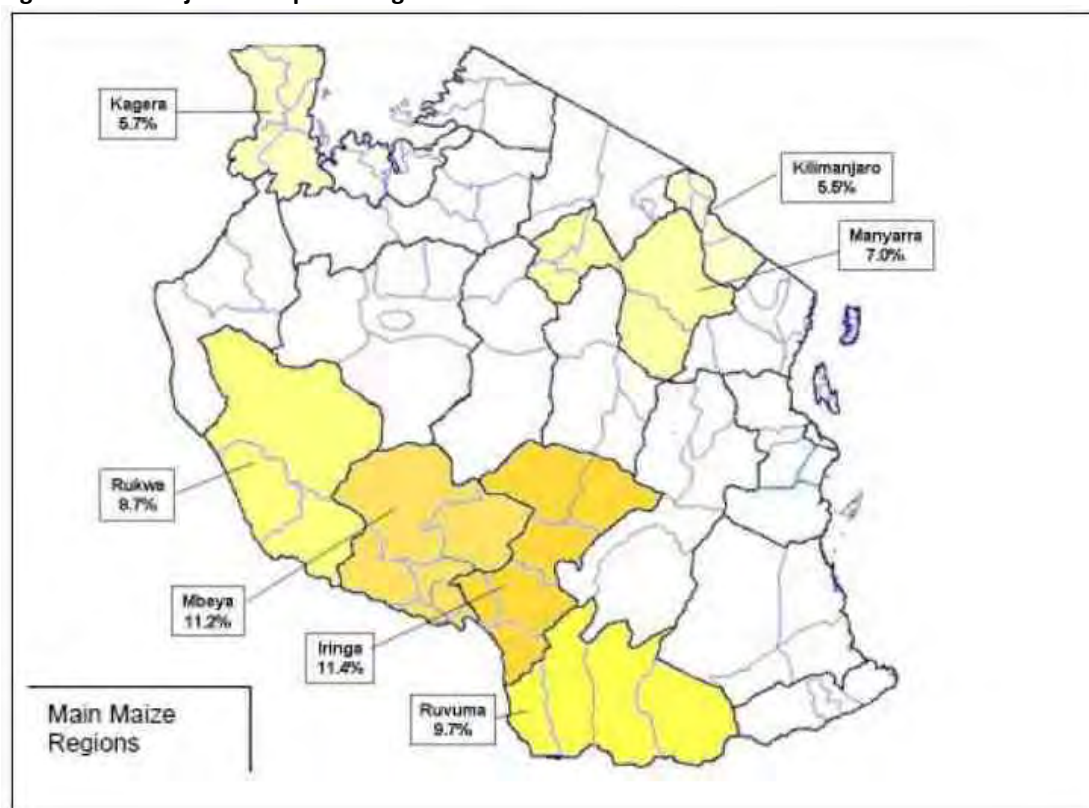
additional new products. Similarly, an assessment has to be made of products that are incorrectly labelled, fake, adulterated or which otherwise don't meet standards.

At the time of writing, a new disease, Maize Lethal Necrosis, is spreading through East Africa. It was reported in Mwanza in August 2012. It is an insect-borne plant disease caused by two viruses working together which may pose a serious threat to production<sup>5</sup>.

### 3.4 Production

The main maize growing areas are shown in Figure 4. With about 5 million ha, Tanzania has the largest planted area of maize in all Southern and East Africa. Maize production has significantly increased over the past 10 years, largely through expansion of planted areas rather than increased yields. Over the past 50 years, maize production has kept pace with population increase. Currently, about 4 million Tanzanian farmers produce over 6.6 million MT of maize: most is for home consumption rather than commercial use. Although growing conditions are often good for maize, the average yields are low, averaging about 1.4 MT/ha. Approximately half of all the maize produced in Tanzania comes from the Southern Highlands. Although principally grown for home consumption, it is also a cash crop on which farm families depend for income. Small-scale farmers contribute over 80 percent of Tanzania's total production.

Figure 4: The major maize producing areas of Tanzania



Source: ASDP, 2008

**Maize in the Farming system** — Integrated farming systems, including maize, are generally poorly developed, though in some areas maize is often grown in rotation or intercropped with beans or pigeon peas. There is considerable potential for introducing soybeans into the cropping system in

<sup>5</sup>For more information see [http://www.cimmyt.org/en/index.php?option=com\\_content&view=article&id=1510](http://www.cimmyt.org/en/index.php?option=com_content&view=article&id=1510)

many parts of the Southern Highlands. This would have benefits for soil nitrogen levels, as well as providing an additional income source for farmers. There is a need to reposition maize so that it is no longer just seen as a ‘traditional food security crop’ but a ‘profitable cereal crop within a farming system’.

### 3.5 Processing

White maize processing in Tanzania — to produce flour for human consumption — is separated into two key categories (though there is a middle ‘medium scale’ that is difficult to define):

- Small local milling operations in rural and urban areas: Small-scale mills (in both rural and small town locations) produce over 90% of the country’s milled maize as well as the majority bought by Tanzanian consumers. Millers at this level complain of insufficient throughput to make money.
- Larger, sophisticated milling operations: A limited number of larger mills provide a higher quality product for middle and upper income urban consumers. With the growth of Tanzania’s economy, this market level will continue to grow in the foreseeable future (see Box 4).

Hammer mills are the most common milling equipment in rural areas. The larger capacity operations use roller mills. Most small mills are not licensed or registered and don’t pay tax. If these operators had to enter the formal systems, many would go out of business as their meagre margins and small volumes could not sustain the additional costs.

**Milling Yellow Maize** — There is growing interest in feed milling for livestock, especially for poultry and for finishing cattle<sup>6</sup>. As Tanzanian livestock keepers come to understand the importance of quality and productivity, and urban meat consumption increases with growing incomes, there will be more demand for improved animal feeds<sup>7</sup>. Maize, especially yellow maize, has a key role in this system. If Tanzania seriously wishes to become a competitive player in domestic and international agricultural markets — and develop a more sophisticated integrated agricultural industry — it needs to develop modern, private sector stock feed milling capacity using yellow maize. The lessons from this experience need to be understood and built upon.

The large-scale millers are well organized, politically influential and financially secure. Should they so choose, they could lead the development of new and more equitable relationships between producers and processors. They have the capacity to lead and innovate, and they have the resources needed to take a few well-calculated risks. To do this, they must look beyond their immediate financial interests and develop a wider view of their corporate role in the maize value chain and national wellbeing.

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<sup>6</sup> This is also related to increased interest in growing soya, which is an ideal companion to yellow maize for stock feed.

<sup>7</sup> Investors are already getting involved. For example, C. J. Sembe Safi Ltd. is already using yellow maize for poultry feed. In addition, a major stock feed plant is planned for Dar es Salaam; it will need 1,200 MT of yellow maize and 600 MT of soya each month.



#### **Box 4: The big millers**

Mohammed Enterprises Tanzania Ltd (MEL) — was established in the 1950s. It is one of Tanzania's largest businesses involved in trading, import and export, manufacturing, agriculture and distribution. Its products include maize flour and milled rice. MEL has agroprocessing units in Dar es Salaam, Mbeya, Mwanza and Ta bora, 27 branches and a network of paid and contracted agents who purchase crops from small-scale farmers.

Export Trading Company Ltd (ETC) — is a multinational company based in Tanzania and operating in ten African countries. ETC deals with distribution (inside and outside the country), importing and exporting agricultural commodities and processing (including maize, rice, cashews, pigeon peas, sesame, groundnuts, soya and beans). ETC also imports various types of fertilizer.

Said Salim Bakhresa & Co Ltd — The Bakhresa Group is based in Tanzania and comprises eight companies spread over Africa. It processes maize, rice and wheat sold under the brand name of AZAM. Its plants include the Kipawa Flour Mill, the Mzizima Flour Mill, and the Buguruni Flour Mill, in Dar es Salaam. Bakhresa Food Products is the largest miller of wheat and maize flour and manufacturer of processed food products in Tanzania.

This small but elite group of maize industry leaders could play a key role in transforming Tanzania's maize value chain. While some might benefit from guidance on working with smallholder farmers, they could champion and support reorganization of the maize trade. Their immediate margins might initially be reduced, but the benefits from long-term increases in trade volumes could be considerable. Some leaders in this group are aware of this potential role and appear to be prepared to take action<sup>8</sup>.

**Storage** — Insufficient and low quality grain storage is a constraint to efficient maize marketing in the Southern Highlands. The availability of suitable local storage is a major factor in the potential expansion of WRS. Farmers can lose up to 30% of their crop in on-farm stores, which in the absence of a WRS option is an additional incentive to sell soon after harvest, even though the prices are low. Many of the old government stores that were built by cooperatives have been informally 'privatized'. Others have fallen into disuse. Externally supported WRS projects often work on restoring stores as part of their package, but rural storage capacity needs considerable expansion. Low-cost, short-term alternatives to expensive stores and silos are becoming available. For instance, Kilombero Plantations Ltd is using specially constructed plastic bags to store its rice. These types of bag can hold 200 MT<sup>9</sup>. Management of the WRS stores is not always of high quality. A basic question arises as to whether farmers and farmers' organizations are actually the best managers of grain stores. This is a specialized business that needs properly trained management.

The large-scale millers have considerable storage capacity, which enables them to buy cheap maize immediately after harvest. The National Food Reserve Agency (NFRA) and WFP have about a 250,000 MT capacity between them.

**Nutritional aspects of maize** — Maize currently provides about 60% of Tanzanian's dietary calories and 50 percent of their protein. The private sector is already responding to the opportunity to improve

<sup>8</sup> A statement by Mahesh Patel, Chairman of the Export Trading Group, in the *Africa Report*, No 46 of December 2012.

<sup>9</sup> See, for example, [www.aasptrust.org](http://www.aasptrust.org).

the nutritional value of maize meal. For example, a local company, Powerfoods Ltd., has a soya-enriched maize meal product on the market. This will be particularly important for the old, the infirm, children and those battling HIV/AIDs<sup>10</sup>. Currently there is no premium in the market for quality maize protein (QMP) flour. Consumer education will be required to develop this market. Also, under USAID's 'Feed the Future' initiative, the Tuboreshe Chakula Projects will work to support fortified maize flour (though they will not focus on QMP).

### 3.6 Wholesale and retail distribution

The vast majority of trade in Tanzanian maize passes through informal, unregistered and unregulated channels. The trade has many different facets. At the village level, farmers take a part of their surplus to the local miller either to be milled and sold, or milled for home consumption. The sale of maize at this level is often triggered by a specific family cash requirement (school fees, a funeral, a wedding, or a land dispute) rather than being part of a longer-term commercial strategy.

An advantage of the Warehouse Receipt System is that it enables poor farmers to get some cash immediately after harvest and to retain most of their grain until prices rise later in the season. If linked to organized domestic budgeting, this approach could significantly improve rural livelihoods. Further up the chain, maize passes through traders, often several traders. Some maize will move to millers in nearby urban centres, other will be purchased by an agent and go to an accumulation point or on to one of the large-scale millers.

**Transport** — The distribution of maize consumption within Tanzania is more evenly distributed than the distribution of production. Transport is consequently crucial to the smooth operation of the value chain. Although the infrastructure backbone in the Southern Highlands is relatively good (though much more use needs to be made of the railway), the feeder roads and last mile infrastructure is not. Transport costs are also very high. Significant investment will be required if farmers are more easily to get their crop to market. Linking areas of high agricultural production to improvements in rural infrastructure was one of the initial aims of the Southern Agricultural Growth Corridor of Tanzania (SAGCOT, 2011a).

### 3.7 Target group considerations

The size and complexity of the maize value chain means that there are many different steps and many different groups involved, each with their own needs and concerns. There are substantial differences in information, knowledge and resources between the different levels of value chain actors. This results in poor farmers (not poor deals) in a competitive market that farmers do not fully understand and which does not effectively reach out to them. Improving trust, farmers' options, information and market access remains a major challenge.

Population growth will continue to reduce per capita land availability. This, together with social changes and the arrival of a consumer-oriented culture, mean that not all the children of current maize farmers will want — or indeed be able — to be maize farmers. As elsewhere in the world, increased efficiencies in the economic function of the value chain will be accompanied by a reduction in the number of active farmers. Equally, formalization of the milling industry will result in small and

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<sup>10</sup> Currently Tanzania produces about 5,000 tons of soya each year. There is great potential to increase its use in cooperation with maize: (a) as a nutritional additive to maize for human consumption, (b) as an addition to maize (especially yellow maize) for stock feed, and (c) in a maize/soya crop rotation to enhance soil fertility.

inefficient millers finding it increasingly difficult to operate under an increasingly competitive environment. When they arrive, these changes will have a significant social and economic impact in rural areas. They also highlight the importance of a balanced, wide-reaching national strategy for rural development that does not assume automatic increase in on-farm employment.

**Gender** — both men and women work on maize production, though women undertake the majority of the field-labour. Men are more involved in the trade of maize grain, while women are the main traders in maize flour.

**Public Private Partnerships** — an increasing amount of work is underway to develop partnerships. For example, TAP works at a district level through Commodity Investment Plans (CIP) to bring the private and public sector together to develop a locally important crop. TAP has six maize CIP operations in the Southern Highlands. At a national level, SAGCOT has been established to ‘transform the area’s productivity’, better link agriculture to infrastructure and improve the capacity and commercial operations of value chain actors. Experience to date shows that these innovative operations, which require business as unusual from all involved, take time to establish. It is difficult to establish and maintain the essentially independent nature of the sector-neutral coordination process. There is a tendency for some partners — especially the Government and leading donors — to try to dominate the process. This creates an imbalance within the partnership, which then risks evolving into an operation of personal and political preferences; this is the wrong sort of public-private partnership, if real progress is to be made.

Many projects and organizations are working on maize in the Southern Highlands. For example, several members of the Agricultural Sector Non-State Actors Forum (ANSAF) have projects, often supporting farmers’ groups with site-specific projects. Organisations working with maize farmers include: RUDI, Participatory Ecological Land Use Management (PELUM), FERT and Mtandao wa Vikundi vya Wakulima Tanzania (MVIWATA). The USAID-funded Tanzania Staples Value Chain (NAFAKA) is also involved; TAP has maize-based CIPs underway; and ASDP has operations in all districts. A major challenge now is to take the many small-scale local successes and translate them into a coordinated plan for implementing widespread improvements at a large scale.

Helping small-scale farmers get better organized and more effective in the market is a crucial step and a major challenge. Farmers’ groups often lack the entrepreneurial skills, the internal discipline and the organizational capacity to be effective. Changing the way they operate, building skills and understanding takes time. Also, the culture of ‘*mjanja*’ admiration (thinking it is smart to get away with cheating, especially outsiders) in some areas can make it difficult to maintain reliable standards to meet contract quality and quantity<sup>11</sup>. However, the WFP’s Purchase for Progress (P4P) initiative has worked with a number of farmers’ associations to help them supply quality products and honour contracts. The success has come through ‘learning by doing’, with practical as well as theoretical training. The lessons from this positive experience need to be further developed.

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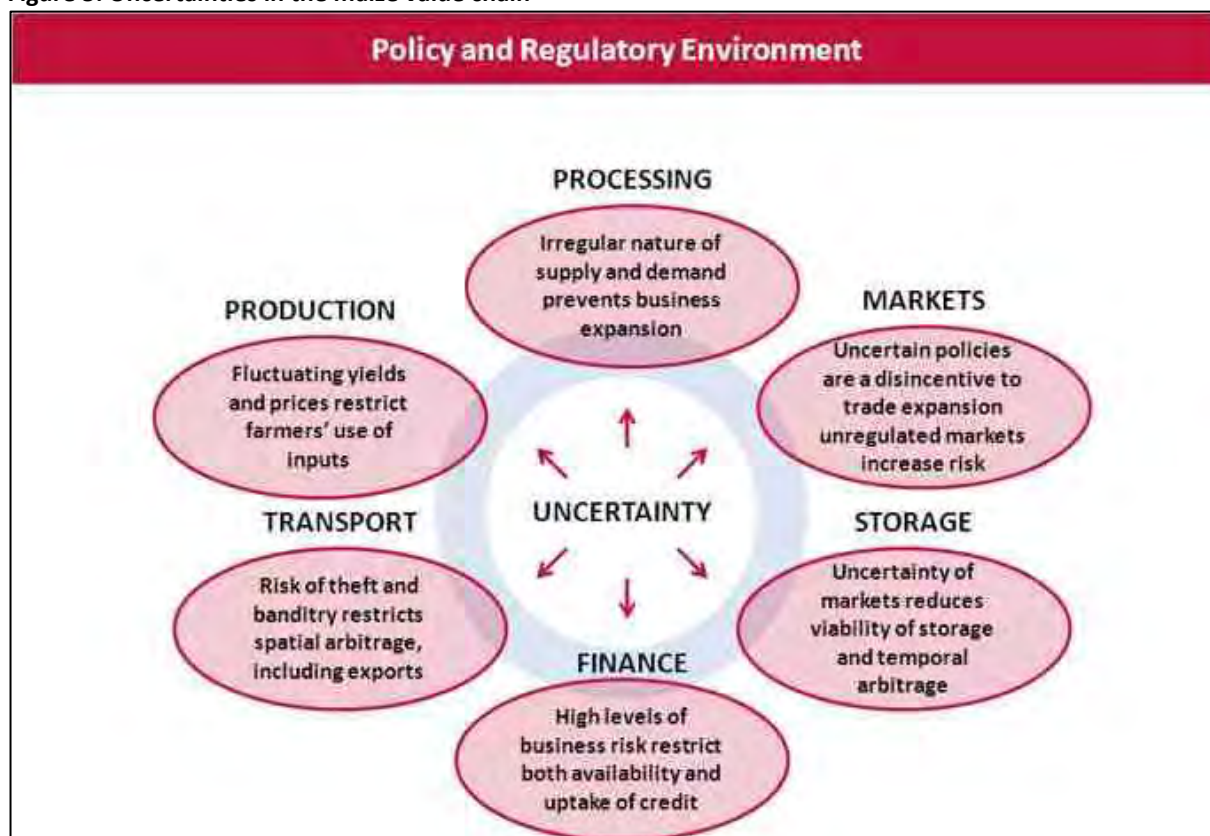
<sup>11</sup> Some NGOs working with rice farmers have found that groups do not honour their contracts with traders. In some cases individuals hijack the trading process; in others the group intentionally fails to comply with the contract in terms of quality.

## 4. SYSTEMATIC CONSTRAINTS AND UPGRADING OPPORTUNITIES

Tanzania’s maize value chain has great potential for future development. But to achieve this, a series of constraints need to be addressed and overcome. There are generic constraints (which apply to the agricultural sector as a whole) and maize-specific constraints (which restrict maize production, market flows and profitability). In combination, they present a formidable set of issues. However, consistent identification and frequent assessment of these problems is now leading to serious efforts to tackle them. There are a number of names for these initiatives, as well as considerable laxity in their use. Operations are sometimes considered part of ‘Tanzania’s Green Revolution’; sometimes part of *Kilimo Kwanza*; sometimes part of SAGCOT; and more recently part of the New Alliance for Food Security and Nutrition in Tanzania. This diversity of initiative titles perhaps indicates a greater interest in developing frameworks than in achieving results on the ground. And most Tanzanian farmers view each new initiative with the same cynicism as they did the previous one.

An underlying sense of uncertainty is a major factor holding back progress in the maize value chain. As shown in Figure 5, many ‘uncertainty factors’ inhibit the realization of Tanzania’s impressive natural potential. This discourages commercial investment in the maize sub-sector. Without such investment there will be little movement from subsistence to commercial level operations. Generic issues include challenges with land tenure, land-use planning, access to affordable finance, wise use of water and other natural resources, poor rural infrastructure, administrative blocks, unfavourable taxes on agriculture, periodic cereal export bans, inadequate government support for local and national business development, and widespread corruption.

Figure 5: Uncertainties in the maize value chain



Source: USAID, 2010

This requires the Government to develop more strongly the objective of making Tanzania an investment-friendly country priding itself on agribusiness innovation and success. But the private sector also has a key role to play in getting better organized and better able to be more pro-active at all levels. In this way they can play a valuable role (currently led by the donors) in pushing for generic improvements in the enabling environment for successful private sector-led agricultural growth.

Additional problems that have a direct impact on maize include:

- Farmers' cash supplies run low at critical points in the year. Since farmers have limited or no access to loans, this leads to difficulties in covering critical expenses:
  - This creates a vicious cycle with farmers' inability to afford improved inputs resulting in poor crop yields, low incomes and inability to afford inputs for the following harvest — in short, a repeating cycle of hardship.
  - This in turn leads to farmers selling crops immediately after harvest, when prices are lowest, in order to have cash to cover expenses.
- Most maize farmers have no direct access to markets or means of transporting large quantities of maize to market. They also have limited (or no) access to market information:
  - Farmers are consequently subjected to the low prices offered at the farmgate by local traders.
  - Traders capture a disproportionate amount of profit compared with farmers.
- Many farmers are poorly educated, and the limited reach of extension and business development services further reduces their access to new technologies and innovations:
  - This leads to limited understanding of the benefits of financial services, improved input usage, and the value of farmer groups or Savings and Credit Cooperatives (SACCOS).
  - This drives many smallholders to struggle year after year.
- Weak farmers' organizations, lack of business skills and traditional attitudes to markets, leads to the disaggregation of supply and a limited ability to meet the quality and quantity of maize required for commercial contracts.
- Maize yield depends on good rainfall, with little use of irrigation or water harvesting:
  - Rainfall varies from year to year and this unpredictably adds to farmers' uncertainty.
  - Because of dietary preferences, some farmers plant maize in areas unsuitable for the crop.
- Widely varying prices for maize from year-to-year:
  - Creates significant additional uncertainty.

#### 4.1 The business environment and regulations

There are many potential issues related to the Business Enabling Environment for maize in Tanzania — and a great deal of legislation and regulation that exists but which is not necessarily enforced. Many priority areas are currently being worked on by specialized groups, initiatives and operations such as USAID's 'Feed the Future' initiative, SAGCOT, and others.

Many regulatory bodies intervene in the maize value chain, including TWLB, TBS and the Tanzania Food and Drug Authority (TFDA). In addition, a Cereals Board has been established under the recent Cereals and Other Produce Act. The Board is allocated wide-ranging authority, including legal provisions to intervene in markets and set prices. The extent to which this will compromise the free-market values and trade in maize remains to be seen.

## 4.2 Vertical and horizontal linkages, and value chain governance

Much remains to be done to improve linkages and overall value chain performance. For example, there is still considerable mistrust between the public and private sector. More dialogue is now taking place and there is increasing recognition of the roles and responsibilities of different organizations, with increasing emphasis on private sector initiative. Nonetheless, fully equitable and balanced public-private partnerships are proving difficult to develop and sustain.

Although a highly delicate issue, with some notable exceptions, the attitude of local and national government to private sector led agricultural development remains negative. Partnership is a new concept that poses a direct challenge to the traditional authority and role of the Tanzanian Government and its officials. Many government agencies and agents remain reluctant to support the private sector in agricultural development. Others feel the need to 'step in and take over' when new initiatives reach a certain level of competence. Changing this mind-set and practice will take time, and is a major challenge for doing business as **unusual**.

The private sector has very few effective, fully representative organizations. Institutions such as the Agricultural Council of Tanzania (ACT), Mtandao wa Vikundi vya Wakulima Tanzania (MVIWATA), the Tanzania Chamber of Commerce, Industry and Agriculture (TCCIA) and the Confederation of Tanzanian Industry (CTI) do have increasing influence: but still do not yet represent or speak for the majority of Tanzanian farmers, traders or processors. Although these apex organizations are trying to work together more, this weakens the potential power of private sector lobbying and advocacy. In the absence of widely acknowledged and effective private sector institutions, it is often left to the donors to push for change. While in the short term this can be very helpful in working towards a more balanced system of agricultural development, it is dependent on foreign goodwill, donor funding and technical capacity. It is not sustainable in the long-term.

SAGCOT has the potential to change long-term agricultural growth, if it can: pull together public-private partnerships, develop value chains, upgrade corridor infrastructure, coordinate public and private sector finance, and achieve a critical mass of commercial agriculture and agribusiness. SAGCOT has considerable high-level political support. This now needs to be transformed into equally impressive action and impact in the field.

## 4.3 Support services

Despite the continued influence of more traditional public sector control, there has been progress in developing a stronger role for the private sector (rather than Government) in the provision of agricultural services. In some cases, the concept of partnership (as set out in provisions of the Public Private Partnership Act) is based on a contractual relationship between the Government and a commercial service provider. This does not represent a true partnership where there are shared objectives and risks between equals.

**Agricultural Extension** — is gradually becoming more open to private sector initiative. At the district level this is particularly strong when private sector companies work with LGA extension agents. This is an approach being used by many ANSAF members and organizations such as TAP and FIPS, which brings together many different commercial input companies and LGA extension staff to set out and run field demonstrations.

**Financial Services** — are crucial and need considerable further development to support agricultural development. A constant concern of most farmers who want to make progress is access to affordable finance. However, with current levels of technology and market prices, many farmers find it difficult to make money from growing maize. It is not therefore surprising that commercial banks are reluctant to lend money for maize production, especially to small-scale farmers. There is significantly more interest in financing the WRS operations, where the maize stock in store can be used as collateral and the risk is thus reduced. With a potential client base of some four million farmers, an economically viable maize value chain offers a huge potential market.

Commercial banks are more ready to lend to large-scale farmers, traders and processors. But the interest rates are very high. The two leading lenders to agribusiness are National Microfinance Bank (NMB) and CRDB. Other banks — including FBME, Stanbic, Standard Chartered and EXIM — also express a cautious interest in the sector. In general, however, the banks can find reliable, profitable investments outside agriculture and have little in-house technical capacity to assess and process agricultural investments. Local SACCOs are gradually getting stronger, and will have an important role to play in future growth.

The Government is aware of the situation, and is getting support from the Financial Sector Deepening Trust to extend commercial lending into rural areas. Also, an agricultural window has been established at the Tanzania Investment Bank (TIB), and there are plans to develop an Agricultural Development Bank. This should be approached with some caution, as experience elsewhere suggests that very high levels of transparency and good governance are required to protect an agricultural bank from misuse by influential individuals.

**Business Advisory Services and Agribusiness Support** — High quality advice is available from well-established international and national companies: but only to those who can afford it. This certainly does not include most maize farmers, traders and processors. At the other end of the scale, there are projects, NGOs and small companies providing business development skills to farmers and local agribusiness. Many more are needed. This is a level of service that is critical if maize is to move from a subsistence crop to a commercial crop for many millions of Tanzanians.

**Input Subsidies** — have been discussed in earlier sections. Subsidies tend to be targeted at the poorest farmers rather than where they might achieve maximum impact. They might therefore be expected to have greater social than economic benefits. The medium-term impact of the nationwide subsidy programme needs further detailed economic analysis.

These are not areas where the key maize industry leaders are likely to invest or act. So it will require external support in the foreseeable future. But it is unlikely that small-scale farmers and agribusinesses would initially be able, or willing, to pay the full cost of support, advisory services and training. Although every recipient of this sort of support will need to pay something, full cost recovery would not initially be a realistic goal.

For maize, activities should be focused in the higher potential areas, where there is the greatest chance of subsistence-to-commercial evolution. However, as many of these skills are needed across different commodities, this work should not be limited to maize. Furthermore, it needs to be clearly understood that developing business skills (BDS) requires a different set of expertise to traditional

agricultural extension work. BDS work therefore needs to be designed and implemented by specialized groups and should not be an add-on to traditional agricultural extension work.

If successful, these measures would have political and social implications. The empowerment of large numbers of rural people in Tanzania — in this case the maize farmers — will have widespread benefits. But it will also create a massive new group with new expectations and influence.

#### **4.4 Farming systems and green growth**

Maize is a crop that has a major agro-ecological impact. Any growth in the maize value chain must be accompanied by an assessment of its environmental impact and identification of the options for Green Growth and related greening of the maize value chain. Aspects of Green Growth in the Southern Highlands have already been considered within the SAGCOT framework (SAGCOT, 2012). But a more systematic, science-based field assessment of these issues is now needed<sup>12</sup>. More care is needed to integrate maize into greener (environmentally friendly) farming systems, and there are already opportunities for doing this. For example, with support from the Bill and Melinda Gates Foundation — and working with National Agricultural Research Institutes (NARI5) — N2Africa is looking at legumes (mainly soya, beans, groundnuts and cowpeas) and ways of improving their nitrogen-fixation role.

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<sup>12</sup> These field based findings, among others, encouraged even further the Rural Infrastructure and Agro-Industries division (AGS), FAO, to conceptualize and develop the notion of green food value chain development.



## 5. VISION AND STRATEGY FOR IMPROVED COMPETITIVENESS AND GROWTH

### 5.1 Vision

Tanzania's Southern Highlands will have an efficient maize value chain that consistently contributes to national food security, moves 50 percent of maize farmers towards commercial maize farming, develops significant export markets, and contributes to the national economy.

### 5.2 Strategic issues synthesis

At the recent G8 meeting at Camp David in the United States of America, a group including the Comprehensive Africa Agriculture Development Programme (CAADP), Tanzania's key agricultural donors, the private sector, the Government of Tanzania and the 68 members committed to a 'New Alliance for Food Security and Nutrition' (G8 Cooperation Framework, 2012). The intention is to work together to generate greater private investment in agricultural development, scale up innovation, achieve sustainable food security outcomes, reduce poverty and end hunger. The focus is on implementing the Tanzania Agriculture and Food Security Investment Plan (TAFSIP). If this moves forward and has impact at the field level, it would play an important role in moving Tanzania's maize farmers from sustainable poverty towards something better. The initial agreement of key issues and specific commitments from the Government of Tanzania are summarized in Box 4.

#### Box 5: Tanzanian government commitments at Camp David, 2012

- By July 2014: to implement policy alternatives to the export ban (as identified in comprehensive food security study) in order to strengthen responses to food emergencies and minimize disruptions to the market.
- By July 2013: to reduce or lift the pre-profit crop tax paid at the farmgate ('cess').
- By July 2013: to reduce or lift VAT charges on spare parts for farm machinery and equipment.
- In staggered timeframe: to secure certificates of land rights for (a) smallholders and investors in Kilombero (by August 2012); (b) for all village land in SAGCOT demarcated areas (by June 2014); (c) for 20% of villages in SAGCOT, along with land-use plans and certificates of occupancy (by June 2016).
- By June 2013: to reduce or lift taxes on seeds and seed packaging.
- By December 2013: to review (and benchmark with international best practices) the time needed to release new varieties of imported seeds from outside the region.
- By December 2013: to authorize qualified private sector companies to produce foundation seed under proper supervision and testing conditions.
- December 2013: ISTA and OECD seed testing accreditations to enable regional and international seed sales.
- By December 2013: to review (and benchmark with international best practices) the time needed to register imported agrochemicals from outside the region.
- By June 2013: to update and align the National Food and Nutrition Policy with the National Nutrition Strategy.

Source: G8 Cooperation Framework, 2012

The Government's obligations are balanced by financial commitments from donors and the private sector. Donor commitments amount to US\$ 315 million over the next five years ("subject to the availability of funding"); the private sector has, through 'Letters of Intent' committed to invest in

agricultural development. Together, these promises establish a strong framework for future development that will help grow Tanzania’s maize value chain.

### 5.3 Value chain competitiveness strategy

Tanzania has a huge comparative advantage in maize production because of its natural resource endowment. It currently has less of an advantage in terms of current policies, the use of technology and the structure of maize markets. But these are areas where improvement is possible. Tanzania could produce a lot more maize than is now produced, even while using the same area. This would not only improve food security and farmers’ income, but also free up land for other productive and profitable operations. The most important issues related to this change are summarized in Table 2.

**Table 2: The swot analysis for Tanzania’s maize value chain**

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> <li>• A widespread and well-known crop</li> <li>• Well established national demand</li> <li>• Many different organizations already working on maize and supporting maize farmers’ development</li> <li>• A vast amount of appropriate technology already available that could be applied in Tanzania</li> <li>• Significant interest and support from the international community and private sector in involvement in improved maize value chains</li> </ul>	<ul style="list-style-type: none"> <li>• Disorganized value chain with weak links</li> <li>• No agreed National Maize Development Strategy</li> <li>• Perceived as politically important crop for food security</li> <li>• Local millers inefficient, unregistered and unlicensed</li> <li>• Farmers’ need to sell maize immediately after harvest to meet cash needs</li> <li>• Limited use of market information</li> <li>• Too many inefficient and costly steps between producer and consumer in commercial market</li> <li>• Most maize farmers operating at subsistence rather than commercial level</li> <li>• Inadequate rural infrastructure, especially access roads and electricity</li> </ul>
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> <li>• Technology available to increase production</li> <li>• Huge potential for export</li> <li>• Yellow maize demand for animal feed</li> <li>• Some large-scale processors showing interest in reaching out to producers to improve linkages</li> <li>• New varieties to be introduced to be more productive and better adapted to conditions</li> <li>• Improved use of legumes in Maize Farming Systems</li> <li>• Improved use of WRS, better local storage and market information systems</li> <li>• Increased use of simple on-farm water harvesting techniques</li> </ul>	<ul style="list-style-type: none"> <li>• The inability of the Government to implement changes to policies and regulations</li> <li>• The uncontrolled supply of counterfeit seeds and chemicals</li> <li>• Private sector decides to invest in other countries, not Tanzania</li> <li>• Unexpected impact of climate change</li> <li>• Negative environmental impact of increased maize production</li> </ul>

Growth in the maize value chain offers a wide range of private sector investment opportunities in horizontal integration. If the key actors will work together, this includes research and extension, information and technology, seed and other inputs development and sales, mechanization, post-harvest accumulation, storage, trading and exports. Additional vertical integration opportunities — especially resulting from yellow maize development — include feed milling, intensive livestock production, processing and export.

A key strategic element in a new approach to the maize value chain will be to map and understand the comparative advantages of each important actor. In response to heightened expectations and the

slow emergence of benefits from the new ‘partnership’ approach, there is a tendency for public-sector support and international foundations to intervene where private sector initiative should be at work. This is dangerous as it risks crowding out commercially driven enterprises with well-intentioned public sector and grant support.

There is an urgent need for a coherent, coordinated National Maize Development Strategy. This will (a) provide the framework for future value chain development; (b) enable the different actors to locate themselves and identify key partners within the sub-sector; and (c) identify key issues that require improvement over the next 10 years. It would build on existing knowledge and institutions, and bring together and scale-up the many small-scale successes underway. A focus on the ‘pull’ of market factors would be used as the way of stimulating innovation, investment and improved technology.

## 5.4 Proposed strategy components

It is, of course, not possible to do everything that is needed at once. An integrated framework and phased plan is required which identifies priorities and establishes the roles and responsibilities of the different partners. For the moment, it is possible to identify priority options to overcome key problems and develop new opportunities related to maize. The generic issues will also need to be addressed, but as part of a wider agricultural sector approach. The initial steps to improve the operation of Tanzania’s maize value chain are to:

- Develop a unique, acknowledged National Maize Development Strategy that is based on up-to-date sub-sector information and revised policies. The strategy should be prepared jointly by the public and private sector, and respond to concerns and aspirations of all involved. It must have a strong market focus, looking at the costs, benefit and incentives for different actors’ participation. It would be based on existing capacity, and the reality and economics of doing business in Tanzania. It should cover Green Growth opportunities, environmental impact, as well as the economic, political and social implications of the anticipated growth in Tanzania’s maize sub-sector.
- Strengthen existing maize value chains by priority interventions in more productive Agro-Ecological Zones, especially looking at improved market linkages. To focus on:
  - Opportunities to continue to improve the capacity, professional management and market understanding of farmers’ groups;
  - Opportunities to help large and medium-scale traders and processor reach out to organized small-scale farmers’ groups and develop contacts and contracts;
  - Opportunities to increase business formalization, and improve professional standards of small and medium-scale millers.
- Develop Green Growth approaches for the maize sub-sector. This includes better farming systems to improve soil fertility (with, for example, great potential for increased use of soya), on-farm water harvesting systems to improve available soil moisture, agroforestry, and improved tillage systems such as conservation agriculture).
- Develop new markets, including:
  - Opportunities to introduce yellow maize production and processing;
  - Opportunities to develop export markets to neighbouring countries.

The fundamental challenge for Tanzania is whether it will continue to have more value chain studies, identify the generic and maize specific issues, and continue to maintain the status quo: or whether — working together and in new ways — those who can make a difference will start to make a difference.

There is a great stimulus for change: by 2050 some 150 million Tanzanians will need to be fed and neighbouring countries will be looking for 8,000,000 MT of maize.

It can be done.

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## ANNEXES

### Annex 1. Rainfall, crop suitability and farming systems

#### Rainfall

The rainfall patterns are possibly more indicative of suitability for crop production where all other factors are more or less equal such as soils, temperature and humidity and logistics.

Maize is generally planted as soon as the main rainy season starts, with planting taking place over a period of almost six weeks (from the end of November through to early January). Researchers explain the wide variation as largely due to climate variability. The rainfall for Mbeya, where the Uyole Agricultural Research Station is based, can be seen in Table 3 below. The data highlights the seasonality of rain and drought of at least six to seven months.

**Table 3: Monthly rainfall (mm) for Mbeya, Southern Highlands, from 1991 to 2008**

	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
1991	151	129	136	126	7	-	0	-	3	28	5	216
1992	151	180	184	27	56	-	-	-	-	4	75	138
1993	332	125	200	104	22	-	-	-	-	-	43	20
1994	245	216	181	50	10	-	-	-	-	2	12	111
1995	247	223	224	60	-	-	1	-	-	-	20	107
1996	254	200	147	157	9	-	-	-	0	22	36	236
1997	137	190	41	192	-	-	1	-	-	23	246	372
1998	191	352	124	161	9	-	-	-	-	17	9	77
1999	331	125	330	170	53	3	-	5	2	3	12	145
2000	151	180	216	66	-	-	-	-	-	17	154	253
2001	451	107	103	96	24	-	-	-	9	33	33	175
2002	192	183	152	61	-	-	-	-	1	3	21	154
2003	248	111	167	44	-	-	3	-	-	17	24	162
2004	176	144	110	134	-	-	-	-	8	7	39	287
2005	164	128	133	55	-	-	-	-	-	2	47	113
2006	199	95	114	161	61	-	-	-	-	18	74	320
2007	240	141	142	70	12	8	-	1	-	18	11	209
2008	198	187	169	77	25	-	-	-	-	8	74	165

Source: Ministry of Agriculture, Food Security and Cooperatives, Government of Tanzania

There are not more than five effective rainfall months (assuming average annual rainfall reliability), with the optimum rainfall over four months (or 120 days) from December to March. This duration has to be compared to the rated maturity of varieties developed by the Tanzania agricultural research system — these are too long for optimum rainfall duration and interval, indicting the research system is not truly linked for what growers really need. Using the Mbeya rainfall example, varieties maturing between 110 and 115 days need to be introduced for rainfed production, and varieties maturing later than 120 days only promoted where full irrigation is available.

A grower level study by the Agricultural Research Institute, Uyole (Mushongi 2010) revealed that what 80 percent of growers from different socioeconomic backgrounds actually wanted from maize varieties — in addition to kernel dry down and stay green (drought tolerance) — were varieties maturing at between 60 and 90 days. This is actually more realistic for millet and very early grain sorghum varieties. The maize research programme has been adjusted with these findings in mind to at least develop varieties maturing earlier than current releases, and the leading private seed companies

are also developing and promoting earlier maturity varieties. The same growers interviewed by Uyole stated their maize requirements were for consumption (40 percent ranking), cash income (around 25 percent) and a portion retained for seed (17 percent). These findings imply that growers have little (if any) knowledge or consideration of cereal crops other than maize for household consumption, or as alternative incomes to then buy in maize.

Considering the farming system, maize production is rainfed, and often grown in locations more suited to other crops which use less water. Many of those now growing maize would be better off engaged in other agricultural pursuits, yet those willing to explore other opportunities just don't have the benefits of crop and livestock options or of supporting technologies. One major limitation is the heavy dependence on rainfed agriculture, highlighting the importance of addressing limitations in water availability for agricultural production, livestock and human uses. Lack of water largely precludes agricultural intensification and diversification, holding back Tanzanian agriculture and keeping rural producers poor.

### **Cereal crop suitability, cropping patterns and farming systems**

Cereal crops have different water use requirements, and in the more marginal locations growing maize alternatives should be introduced. The general water use requirements for selected cereals can be seen in Table 4. Uyole Agricultural Research Institute have confirmed that in the low-potential maize producing areas (with <600 mm I annum) it is risky to apply fertilizers. Growers in these areas just use composite cultivars and landrace varieties (i.e. farm-saved seed). Essentially, these must be considered 'subsistence growers', and they need to be given viable alternatives to maize production or off-farm income.

**Table 4: Seasonal crop water use (mm)**

<b>Crop</b>	<b>Low yield</b>	<b>Average yield</b>	<b>High yield</b>
Maize	750	875	1,000
Sorghum	400	600	800
Pearl Millet	250	500	700
Proso Millet	200	400	600

These indications of crop water use are almost the reverse of those quoted in a report by the Mlingano Agricultural Research Institute ('Rainfed Agriculture Crop Suitability for Tanzania', November 2006). The report authors state in appendix 1 that maize needs less water than sorghum and millet.

### **Irrigation and water use**

Apart from promoting maize in the higher and more reliable rainfall areas (e.g. those above 800 mm per annum), maize is grown under irrigation although the locations and precise production area (hectares) were not quantified, which is a future task. There is also a need to compare the gross margins of growing irrigated crops (such as rice, maize and vegetables) with other crops in rotation. For example, when 'irrigated rice' is discussed it is actually partially irrigated and usually only one crop per annum so there is a low intensity cropping system yet using a crop with a very high water requirement. Consideration also has to be given to the cost effectiveness of growing rice, maize or any other cereal crop under irrigation compared to importing from counties producing a large and often lower cost exportable surplus.



## Annex 2. Agricultural research funding

The broad maize market segments are for uses as grain, with the surplus occasionally exported. Fresh harvest is often also used as animal fodder with the latter estimated (in the absence of hard data) to be around 0.35 million tonnes per annum (TAP, 2011) — a very high allocation.

Given the huge challenges of becoming food-sufficient at the farm-level for most maize growers, it is considered good practise for farming systems to involve livestock (mainly assumed to be cattle). This enhances both on-farm and off-farm income and sustainability. Other alternatives are to introduce and promote as rapidly as possible fodder crops more suited to lower or uneven rainfall (e.g. forage sorghum, forage millet, pasture grasses and legumes that allow regular harvest or grazing and ratoon under good management).

A further reason to identify alternatives to maize is to mitigate effects of the parasitic plant Striga weed (*S. hermontheca*), which has become an intractable biotic stress. In places where infestation is serious, people have abandoned farms, with the total area abandoned estimated at around 0.6 million hectares. This may be another reason why the Tanzanian maize-planted area has increased over time to be a form of compensation to land lost due to Striga. One of the aggravating factors for Striga weed prevalence is very low soil fertility and particularly low nitrogen levels, reiterating the need for promoting maize on higher rainfall locations, applying optimum and not low fertilizer levels to mitigate Striga. Growers unable to compete against Striga must have alternatives to allow them to remain on their farms so long as they are sustainable.

The following table (Table 5) outlines the stated current and predicted needs of maize research for the Uyo Agricultural Research institute and estimated needs of research to fund a visionary Tanzania maize industry. Given the poorly-funded state of maize agricultural research in Tanzania (assumed situation to be verified) a 'rule of thumb' is around 15 percent and ideally 20 percent of the gross value of the market size. The higher level can be reduced on a sliding scale once positive research outputs start and performance is confirmed. A leading and fully integrated seed company will usually allocate around 13 to 15 percent of net sales income to research and development (R&D). This indicates that with a maize gross grain market value of US\$665 to US\$900 million, the Government of Tanzania should annually be providing (with no strings attached except accountability and key performance indicators) between US\$70 and 90 million (if using the 10 percent level), or between US\$130 to 180 million (if using the 20 percent level).

**Table 5: Funding levels at Uyole Agricultural Research Institute**

#	Donor	Duration	Purpose	Total value in US\$	Annual value in US\$
1	Agra Grant – over 3 years	2012-14	Plant breeding	185 000	62 000
2	AusAID grant		Aflatoxin		
3	GoT	Annual	Basic cover for overheads, operational, repair and maintenance costs		
Uyole estimated needs for a successful annual maize R&D programme					280 000
Maize R&D funding needed at 10% of estimated maize market value					70 — 90 million
Maize R&D funding needed at 20% of estimated maize market value					130 to 180 million
<ul style="list-style-type: none"> <li>Higher funding levels will allow Tanzania to (i) modernize facilities and equipment for market-oriented maize research across the value chain, (ii) facilitate the development of alternatives to maize in cropping patterns and farming systems, and (iii) support technologies, train existing and new scientists and remunerate research team. These interventions will give Tanzania a strategic boost compared to other most African maize- producing countries. Other market opportunities are also likely to emerge.</li> <li>Aflatoxin incidence can increase with the onset of drought; and importers increasingly specify aflatoxin levels (more so with markets for human consumption).</li> </ul>					

The major routine activities of the maize research programme include:

- Inbred line-hybrid development: the introduction of DNA based technology, biotechnology and Bt technologies are required for this activity;
- Variety evaluation: state-of-the art techniques are required including biotechnology and the use of marker genes;
- Population Improvement;
- Maintenance breeding: DNA based fingerprinting techniques are required;
- Seed production research;
- Initial variety promotion, among others.

These requests are by most modern standards ‘very modest’ and don’t include (for example) funding for training future scientists, international exchanges, remunerating scientists to international standards (or to the highest private sector remuneration standards), change frames to allow research institutes to generate and retain income as well as facilitate cooperation with public and private partnerships. There may be other examples.

### Annex 3. Maize growers' gross margins in the Southern Highlands

Table 6: Farm budget for maize at Mbeya Rural per hectare

Item	Quantity	Unit	Price	Total
<b>Receipt</b>				
Maize	4 769.5	Kg/ha	212.0313	1 011 283.285
<b>Total receipt</b>				<b>1 011 283.285</b>
<b>Variable cost</b>				
Seed	28.08325	Kg/ha	3 132.0455	87 958.01679
Fertilizer				
DAP	3.75	Bag/ha	43 764.7059	164 117.6471
Urea	5.00	Bag/ha	44 578	222 890
Herbicides	5.00	Litre/ha	13 000	65 000
Insecticides	2.5	Litre/ha	17 750	4 425
<b>Total input cost</b>				<b>544 390.6639</b>
Land preparation		TSh/ha	30 600*2.5	76 500
Harrowing		TSh/ha	26 125*2.5	65 312.5
Planting		TSh/ha	24 521*2.5	61 302.5
Weeding		TSh/ha	28 384.6154*2.5	70 961.5385
Fertilizer application		TSh/ha	7 666.6667*2.5	19 166.6675
Herbicide application		TSh/ha	3 000*2.5	7 500
Insecticide application		TSh/ha	5 000*2.5	12 500
Harvesting		TSh/ha	29 125*2.5	72 812.5
Transportation		TSh/ha	21 923.0769*2.5	54 807.639
Processing		TSh/ha	16 181*2.5	40 452.5
Storage		TSh/ha	6 125*2.5	15 312.5
Treatment agrochemical		TSh/ha	4 080*2.5	10 200
Marketing from home market		TSh/ha	9 000*2.5	22 500
<b>Total labour cost</b>		TSh/ha		<b>401 698.399</b>
<b>Total cost</b>		TSh/ha		<b>346 089.0629</b>
<b>Return over variable cost</b>		TSh/ha		<b>65 194.2221</b>

Source: Uyole Agricultural Research Institute, Mbeya

**Table 7: Farm budget for maize at Mbozi District per hectare**

Item	Quantity	Unit	Price	Total
<b>Receipt</b>				
Maize	4 978.75	Kg/ha	256.8270	1 278 677.426
<b>Total receipt</b>				<b>1 278 677.426</b>
<b>Variable cost</b>				
Seed	28	Kg/ha	2 838	79 464
Fertilizers				
DAP	3.75	Bag/ha	60 282.0513	226 057.6924
Urea	4.25	Bag/ha	44 150	187 637.5
Herbicides (roundup)	2.5	Litre/ha	13 500	33 750
Insecticides 1: selescron	3.75	Litre/ha	10 000	37 500
Insecticides 2: super actellic	2.5	Litre/ha	15 400	38 500
<b>Total input cost</b>				<b>572 529.1924</b>
Land preparation		TSh/ha	2 794.1765*2.5	6 958.44125
Harrowing		TSh/ha	26 111.1111*2.5	65 277.77775
Planting		TSh/ha	19 800*2.5	49 500
Weeding		TSh/ha	27 947.3684*2.5	69 868.421
Fertilizer application		TSh/ha	4 437.5*2.5	11 093.75
Herbicide application		TSh/ha	3 200*2.5	8 000
Insecticide application		TSh/ha	2 000*2.5	5 000
Harvesting		TSh/ha	21 583.333*2.5	53 958.33325
Transportation		TSh/ha	18 750*2.5	46 875
Processing		TSh/ha	31 866.6667*2.5	79 666.6675
Storage		TSh/ha	5 000*2.5	12 500
Treatment agrochemical		TSh/ha	4 100*2.5	10 250
Drying		TSh/ha	3 000*2.5	7 500
Marketing from home market		TSh/ha	15 000*2.5	37 500
<b>Total labour cost</b>		TSh/ha		<b>463 875.3908</b>
<b>Total cost</b>		TSh/ha		<b>1 036 504.583</b>
<b>Return over variable cost</b>		TSh/ha		<b>242 172.8429</b>

*N.B. The source of data for this farm budget come from a compilation of survey data collected from farmers in 2001*

**Table 8: Maize production gross margin per hectare in the Southern Highlands**

1. Gross income		Farmer practice under local			Farmer practice under improved practices			Improved practices		
Item	Units	Quantity	Unit price (TSh)	Amount (TSh)	Quantity	Units price (TSh)	Amount (TSh)	Quantity	Units price (TSh)	Amount (TSh)
Crop yield	Kg/ha	1 750	250	437 500	6 250	250	1 562 500	8 000	250	2 000 000
Straw yield	Bale/ha									
Total gross income	TSh			437 500			1 562 500			2 000 000
<b>2. Variable costs</b>										
<b>(a) Non labour input cost</b>										
Seeds	Kgs/ha	13	250	3 250	18	1 500	27 000	18	3 000	54 000
Fertilizers – Urea	Kgs/ha	-	-	-	174	540	93 960	260	540	140 400
DAP etc.	Kgs/ha				100	900	90 000	100	900	90 000
Farm yard manure	Mt/ha	5	20 000	100 000						
Insecticide	Litre/ha				2	15 000	30 000	2	15 000	30 000
Packaging materials	Bags	18	500	9 000	63	500	31 500	80	15 000	30 000
Sisal twine	Bales/ha	1	3 000	3 000	2	3 000	6 000	3	3 000	9 000
Shelling	Bags/ha	18	500	9 000	63	500	32 500	80	500	40 000
Transport cost	TSh			20 000			60 000			100 000
Insecticide (actellic) dust for storage	pct/ha	-	-	-	31.25	3 000	93 750	40	3 000	120 000
<b>Subtotal (a)</b>	<b>TSh</b>			<b>144 250</b>			<b>464 710</b>			<b>668 400</b>
<b>(b) Labour input cost</b>										
Clearing of field	Person Days (Pdays)	28	2 500	70 000	28	2 500	70 000	28	2 500	70 000
Ploughing (Oxen drawn)	Pdays				16	2 500	40 000	16	2 500	40 000
Harrow	Pdays	40	2 500	100 000	40	2 500	100 000	-	-	-
Levelling (pudding)	Pdays	40	2 500	100 000	40	2 500	100 000	-	-	-
Ploughing, harrow (Tractor)	Pdays									
1 <sup>st</sup> Weeding (Herbicide Spraying)	Pdays							2	2 500	5 000
2 <sup>nd</sup> Weeding (Herbicide Spraying)	Pdays							2	2 500	5 000
Fertilizer application (labour costs)	Pdays				12	2 500	30 000	14	2 500	35 000
Manure application	Pdays	6	2 500	15 000						
Insecticide spraying	Pdays				6	2 500	30 000	6	2 500	30 000
<b>Total labour costs</b>	<b>TSh/ha</b>			<b>441 250</b>			<b>463 250</b>			<b>408 750</b>
<b>TOTAL VARIABLE COSTS</b>	<b>TSh/ha</b>			<b>585 500</b>			<b>927 960</b>			<b>1 077 150</b>
<b>NET INCOME</b>	<b>TSh/ha</b>			<b>148 000</b>			<b>634 540</b>			<b>922 850</b>

*N.B. The data was collected by consulting some individuals who gave information of their experiences in 2010*

## Annex 4. The Tanzanian maize seed market

The Tanzania seed supply situation must be looked at from a seed industry and not just a maize seed supply company perspective. There are, however, some common issues and an overview includes:

- There are around 50 seed companies registered in Tanzania, although not all are active.
- The following table (Table 9) summarizes the key hybrid seed supply companies, their main products (varieties) and retail prices. The preferred variety in Mbeya is said to be Pannar 691, although Seed Co. has the highest national market share. All hybrid seeds have a seed treatment product applied and are sold in sealed transparent or non-transparent plastic bags.
- A maize gross margin assessment indicates hybrid seeds account for around 15 percent of total input costs (seed, fertilizer and crop protection chemicals) excluding labour. If labour is included, the percent allocation is around 2 percent, although this varies for non-hybrid or hybrid seed. Seed is mainly planted by hand.
- The situation is unclear in terms of variety development, evaluation, release, commercialization, and breeding lines availability outside the public sector or its direct links. For example, there is no clarity on material transfer agreements (MTA) from the public to the private sector, the sale of breeder or foundation seed, or royalty payments on commercial products.
- Tan Seeds International varieties, for example, are sourced from CIMMYT Zimbabwe, indicating this enterprise doesn't have access to Uyole or other Tanzanian developed varieties.
- Any sustainable seed enterprise should ideally have its own strong R&D programme unless it can confirm strategic tie-ups with researchers who can deliver products that are competitive. However, no international seed company has its own programme in Tanzania. There may be reasons for this, possibly associated with: (i) the lack of plant breeders' rights (PBR), (ii) the lack of protection from International Union for the Protection of New Varieties of Plants (UPOV), and (iii) the perceived difficulties in terms of legal determinations if a case were to be challenged.
- The Government of Tanzania has not ratified PBR legislation and this has held back modernizing the development of maize varieties by both the public and private sector. Similarly, the genetic modification policy is not clear. As a comparison South Africa has a vibrant and viable domestic seed industry and uses genetically modified maize, soybeans, canola and cotton.
- All varieties must follow the Government's seed legislation and follow a formal and non-market oriented process involving the Tanzania Official Seed Certification Institute (TOSCI) for variety release. The multinational seed companies are expected to have significantly higher standards, better equipped facilities, and staff trained to a higher level than the agency that is supposed to certify them.
- There is no commercial orientation for research institutes to allow (for example) licencing germplasm or varieties. Income from the sale of breeder or foundation seed goes to the Government of Tanzania and not to the agricultural research institute or programme developing the commercial products or technologies.
- The major suppliers are multinational and multinational linked companies. They need genuine incentives to establish fully integrated activities in Tanzania and to be assured that their investments are fully protected (though there are currently no clear indications that they are investing). The underlying reasons for this must be clarified and positively addressed by the Government of Tanzania, as the seed sector is recognized worldwide as an important

agricultural technology and innovation-driver, and is something which Tanzanian agriculture needs.

- Most seed companies don't produce hybrid maize seed in Tanzania and import for marketing purposes — not only although attributed to the weakness of the Government of Tanzania legal protection on plant breeder's rights or patent rights. There are exceptions, and the latest indications are that the volume of hybrid maize produced in Tanzania is around 3 500 tonnes. Leading companies have their own field and factory inspection teams and collaborate with the Tanzania Official Seed Certification Institute (TOSCI) to meet national standards prior to seed sales.
- There are issues of 'grain' being sold as 'seed'; this is termed 'fake seed'.

**Table 9: Tanzania seed market supply features and pricing indications**

Seed co. & seed production base			Retail selling price				Wholesale selling price		
#	Hybrid seed company (alphabetical by name)	Hybrid maize seed production base	Maize variety	Retail sales. Pack weight – Kg	Per pack – TSh	TSh/Kg	Retail selling price (assumed) less 15%. TSh/Kg	Forex – TSh to USD	USD/Kg
1	Non-hybrid seed	Tanzania	Various	N/A	-	580	551.00	1 565	0.35
2	DeKalb	Malawi	DK 8031	2	8 000	4 000	3 800	1 565	2.43
3	Highland Seeds	Uyole, Tanzania	UH 6303	2	7 000	3 500	3 325	1 565	2.12
4	Pannar	Zambia	Pan 691	2	8 000	4 000	3 800	1 565	2.43
5	Pioneer	N/A	Pioneer 3253	2	8 000	4 000	3 800	1 565	2.43
6	Seed Co.	Zimbabwe	SC 627	2	8 000	4 000	3 800	1 565	2.43
7	Tan Seeds International	Morogoro, Tanzania	H 611	1	3 500	3 500	3 325	1 565	2.12

Note:

- N/A = not available
- DeKalb: owned by Monsanto. Seed packet labelling states the cross brand registration of Monsanto Malawi Limited, Monsanto Kenya, and Monsanto Uganda — with “Tanzania” absent.
- Highland Seeds: Tanzania investors
- Pannar: privately owned, South African based
- Pioneer: owned by Du Pont
- Seed Co.: seed growers cooperative, Zimbabwe
- Tan Seeds International: Tanzania investors.

## Annex 5. Fertilize use

Fertilizer accounts for around 70 percent of all crop inputs (including seed, crop protection products etc.). When labour is included, it accounts for around 35 percent of total production costs making it the single largest cost component. The recommended retail prices of fertilizers available in the Mbeya market sold by Tanganyika Farmers Association (TFA) can be seen in Table 12. This data was gathered at harvest time and not maize planting season and so may not be representative of what maize growers purchase.

Although competitiveness has to be verified, the private sector has expressed concern that there has been restricted entry into the phosphate market. The Government of Tanzania has only allowed the Minjingu Mines and Fertilizer Ltd. Arusha to provide supplies, under the voucher scheme, to an annual market size of around 65,000 tonnes. In addition, the rock phosphate supplied was said to have a higher than appropriate cadmium level (this is disputed by other technical sources). Misunderstandings should be resolved within the industry, and the Government of Tanzania should strengthen and further develop a sustainable domestic fertilizer industry.

The volume and value of the fertilizer trade is increasing along with interest in the Tanzania fertilizer market. Anecdotal indications are that new participants are considering entry into the domestic market. The private sector has expressed its concerns that the Government of Tanzania recommendations are too broad and not specific to an agro-ecological zone, crop, soil type, or production system (e.g. rainfed or irrigated). For example, although Di-Ammonium Phosphate (DAP) is nationally recommended as a basal application, very few of the soils it is used upon are volcanic so that there is (to cite just one effect) not a recommended balance of basal fertilizer and micronutrients. Urea has been promoted for so long it has acidified soils and with no pH adjustments this is negatively affecting yields.

**Table 10: Retail price of fertilizer sold from a crop input supplier store, Mbeya, in August 2012**

#	Product name	Chemical composition	Pack weight – Kg	Recommended retail price				
		Nitrogen (N): Phosphate (P): Potassium (K)		TSh per sack	Forex TSh to US\$	US\$ per sack	US\$ per Kg	US\$ per tonne
<b>Nitrogen</b>								
1	Urea	46:00:00	50	65 000	1 565	41.53	0.83	831
2	DAP	18:46:00	50	75 000	1 656	47.92	0.96	958
3	NPK	20:10:10	50	65 000	1 565	41.53	0.83	831
<b>Phosphate</b>								
1	Minjingu	27 – 29% P <sub>2</sub> O <sub>5</sub>	50	25 000	1 565	15.97	0.32	319
		36 – 38% CaO						

Fertilizer recommendations from the public sector vary. The sector is more likely to recommend lower input levels, and this tends to become the sub-optimal agricultural extension message. A comparison of recommended inputs from the public and private sector can be seen in Table 11.



**Table 11: Maize fertilizer recommendations in the Southern Highlands of Tanzania**

Recommendation for maize production technology levels	Nitrogen – Kg N/ha (any N source)	Phosphate – Kg P/ha	Potassium	Manure – t/ha
<b>Uyole agricultural Research Institute</b>				
High technology	130 – 150 120 – 150	20 – 40 Mainly TSP, SSP	No	No
Medium technology	60 – 80 80 – 120	20 – 40	No	No
Low technology	50	20	No	No
Major fertilizer sources: CAN, Urea, SA, Yaramila Cereals, NPK, DAP, Minchingu				
Organic – manure	50	20		20
<b>N: split applications:</b> - 40 – 60cm tall - Based on rain, soils, variety and crop purpose				
<b>P: Factors:</b> soils, weather, grower practice. - Apply at planting; or - Emergence				
<b>Potassium needs investigation</b> - Now only used if compound fertilizer NPK is applied - Note: potassium is easily leached and support pollination and grain filling, so it's unclear why it's not now recommended				
<b>Trace elements:</b> no mention of trace elements. Their importance has to be clarified given production environment such as soil geology, pH and long maize monoculture history				
<b>Private sector - Yara</b>				
	<b>50 Kg bags/acre</b>			
<b>High technology</b>	<b>NPK: 3 bags</b>	<b>Planting</b>	<b>Top dressing</b>	
Smallholder2: 3 bags/acre of NPK	Option1: Option2:		2 1.5	1 1.5
<b>Medium technology</b>			1 – 2	1 – 2
<b>Low technology</b>	N/A			

Based on the private sector assessments applying the higher fertilizer rates will deliver a positive grower gross margin of around TSh 102,100 / acre (US\$160 per ha). This is based on a yield of 3 tonnes per hectare, applying 50 kg of urea, 50 kg of DAP, and a farmgate grain selling price of TSh 320/kg (TSh if delivered to Dar es Salaam). This maize gross margin is minimal and does not provide a viable proposition for a farm family of five to depend on the income from this crop for 12 months. Where maize growers don't apply fertilizer (or use low amount of fertilizer) they make a loss. The leading private sector enterprises have private extension services employing field agronomists to work across the distribution chain including targeting wholesalers, distributors, stockists and retailers. Tanzania has overall a low fertilizer use in maize production compared to a range of countries as outlined in Table 12 below, further illustrating the challenges to increasing farm productivity (Mushongi 2010).

**Table 12: Fertilizer use in maize production in Tanzania and selected countries and regions, 2006**

Region / Country	Grain production – million tonnes	Inorganic Fertilizer – Kg/ha
Industrialized countries	352.15	206
South East Asia	30.15	135
South Asia	N/A	100
Latin America	84.61	73
South Africa	7.13	50
Malawi	3.23	27
Tanzania	3.66	9

## Annex 6. Maize marketing

The Mbeya Zone includes the regions of Iringa, Mbeya, Rukwa and Ruvumba, which are all within the Southern Highlands Food Systems Development Project work areas. In 2008, the Mbeya Region had an estimated population of 2.5 million people, with 80 percent of those (2 million people) living in rural area and the remaining 500,000 in urban areas. Rural areas include the administrative districts of Chunya, Ileje, Kyela, Mbarali, Mbeya, Mbozi and Rungwe.

An example from Mlowo village (Mbeya Zone and Region) illustrates some of the demographics and logistics of rural Tanzania. It also demonstrates that although grain marketing is at ‘a very basic level’ it can be easily improved through successful groupings and the pragmatic education of participants. The ‘carrot’ of commercial success and profitability can sustain change. The table below shows maize grain prices in Mlowo Village; the table following shows maize grain prices in locations outside the Mbeya Zone and Region.

**Table 13: Maize grain prices, Mlowo Village market, Mbeya Zone, 15 August 2012**

Location	Sack weight — kg	TSh sack	Unit value — TSh/kg	USD			
				Forex TSh to USD	US\$/kg	Per tonne	Range US\$/tonne
Mbeya rural market prices for maize, August 2012	105	39 000	371	1 565	0.24	237	197 – 200 - 237
	120	37 000	308	1 565	0.20	197	
	120	38 000	317	1 565	0.20	202	
Dar es Salaam price	Mbeya market indicated price		489	1 565	0.31	312	312 – 325
	Dar es Salaam indicated price		510	1 565	0.33	326	

Source: Field findings from Mlowo Village, Mbeya, August 2012

The prices in Table 14 (see next page) represent maize that may have been cleaned in some way (although based on these figures, it does represent a defined 100 kg weight). The market price differentials represent freight, handling, and retail selling prices for food grain quality maize (with possibly a quite positive margin between wholesale and ex warehouse direct costs).

- The situation in Mlowo Village is broadly representative of the maize grain trade in rural Tanzania. All markets, however, will have differing nuances such as volume, value, complexity, structure and composition.
- Although some growers do sell from farms and some buyers collect from farms, a number of logistical issues complicate this. In this market, small traders and growers of differing sized farms tended to bring their grain to the market. There appeared to be significant trade between traders with some responsible for accumulating large volumes. Many people were involved in the Mlowo village grain trade ranging from male growers (sometimes with their wife and other family members), to people specializing in grain buying (who were at the same time active in the maize trade and other commodities including beans, oilseed sunflower grain).
- Casual labourers were used to load small lorries (with a capacity of between 30 to 70 sacks). These delivered to larger buyers or collection points in — or on the outskirts of — Mbeya City. The larger collection points served as accumulation points for local, regional and Dar es

Salaam trade, and — when exports are allowed — ease of delivering to neighbouring or other countries.

- There was evidence of investment in a more modern grain-buying station with a weighbridge, drying platform and open stowage areas sited near the market. This is on the side of a main side thoroughfare, indicating little town planning or control (there is a need to place grain markets away from urban areas but on main roads for ease of logistics).

**Table 14: Tanzania maize food grain prices, 16 July 2012**

#	Market	Maize				
		TSh/100kg	TSh/kg	Forex	US\$/kg	US\$/tonne
1	Arusha	54 000	540	1 565	0.35	345
2	Tanga	48 000	480	1 565	0.31	307
3	Dar es Salaam	70 000	700	1 565	0.45	447
4	Mwanza	70 000	700	1 565	0.45	447
5	Lindi	50 000	500	1 565	0.32	319
6	Mtwara	45 000	450	1 565	0.29	288
7	Shinyanga	54 000	540	1 565	0.35	345

Source: [www.thecitizen.co.tz](http://www.thecitizen.co.tz); Original information source: Ministry of Industry, Trade and Marketing.

Note:

- Prices in TSh per 100 kg sack weights
- Forex: US\$1 = TSh 1 565.00

## Annex 7. Maize flour mills

There are three main types of maize flourmills.

N.B. More information on maize milling and equipment can be found in a review of small-scale cereal milling equipment in Africa (Clarke and Rottger, A., 2006).

### Hammer mills

Hammer mills are the most common mill found in rural areas in Tanzania, and convert almost 99 percent of the grain to flour. Hammer milled maize meal tends to be an undefined class, but which is probably most closely associated with 'special-sifted maize meal'. It represents the lowest cost option and is suitable to many rural applications. This meal is often considered inferior by the trade, for the following reasons — all the bran, germ and endosperm are ground up and hammered through the aperture in the hammer mill screen. This has the following results:

- The meal has a short shelf life (the germ becomes rancid very fast after milling).
- Special-sifted maize meal has a great deal of 'powder' this results in a high absorption of moisture and the fast release of this moisture when cold. This results in a water layer over the 'pap' in the morning and turning the porridge sour.
- Bran, with a higher water absorption than endosperm, apparently gives a bloated feeling to the eater.
- Hammer mills can have around 70 percent recovery, although some industry experts estimate that recovery doesn't exceed 60 to 6 percent. There are estimates of around 20 percent recovery reduction as the millers adjust their mills to recover more bran for poultry feed (e.g. when the price of broilers or eggs is high) or to create darker flour so proportionally less bran is removed to obtain a higher recovery.
- The millers 'play' the market to achieve differing milling recovery yields depending on the market prices for milling by-products such as bran. This seems the norm hammer mills in Tanzania.

### Combination of milling approaches with plate mills / disc mills

Combining milling approaches involves higher investment costs than hammer mills but much lower investment cost than roller mills. After the whole maize grain is cleaned and conditioned it can be milled by means of a plate mill only and then sifted (without de-germination). A significant part of the bran and germ meal is then sifted off, resulting in a special-sifted meal — of lower quality than roller milled meal but of higher quality than hammer milled meal.

- Sifted maize mills usually have around 70 percent recovery.
- These mills can be set to discard the seed coat and produce purer white flour.

### Roller mills

The best quality maize meal is obtained by de-germinating the maize prior to milling with rollers rather than hammer mills or plate mills / disc mills. Recovery can be up to 85 percent with roller mills. The latter re found in the large capacity mills installed in Dar es Salaam by the limited number of larger agribusiness participants in the maize milling industry.

## A: CASE STUDY OF A SMALL SCALE MAIZE MILLER IN IRINGA TOWN

Iringa town has 10 maize processors each of a similar size processing up to 200 tonnes of maize per month, or annually 12 000 to 24 000 tonnes of grain, and producing around 8 400 to 1 700 tonnes of maize flour. This implies there are probably 10 competing supply chains, which if amalgamated in some way would be substantial. There is no Iringa maize milling association.

Findings from a long-established small-scale maize miller, C. J. Sembe Safi of Iringa town, illustrate the maize milling operations in a rural city in the Southern Highlands.

- Enterprise operations: The miller has operated a maize mill for 19 years, growing from a very small enterprise. He started the enterprise to obtain an income. He owns a maize farm and a poultry business raising broilers and producing eggs. The entrepreneur has purchased yellow maize from Songea for his poultry farm.
- Milling process and equipment: The miller operates what appeared to be a combination of milling approaches using a plate mill I disc mill followed by a hammer mill. His equipment is largely in line although housed in a series of cramped spaces in a residential part of Iringa City.
  - Equipment. The milling equipment was purchased from Small Industries Development Organization (SIDO) around six years ago, and the power units are Chinese electric motors. The milling equipment seems based on simple and old designs. There is no colour sorter or destoner, so that small stones — and indeed any other foreign particles — are simply pulverized or ground up to become part of the final flour product. The plant is not in line and operations don't flow smoothly.
  - Milling processes. The sequence of processes was:
    - All raw material is grain, so there is no dehusking involved;
    - The sieving is by hand;
    - The grain is washed using water (source and quality unknown) flowing top down over plastic buckets; this just removes some dirt and light particles;
    - An Engleberg huller (also termed an 'Engleberg mill') is used to remove bran and germ. The term used by the miller was the "Engleberg miller peels the grains" to separate the germ and the bran;
    - A winnowing machine blows the lighter by-products (bran and germ) by air;
    - Women are used to pick out black specs by hand from the remaining maize;
    - A hammer mill pulverizes the grain (and the stones, dirt and other contaminants if not earlier removed), and is the last mill in line. Some others term this a "village posho mill".
    - The end product is an extremely fine 'semolina' or maize flour.
    - Note: Sifted flour is the fine flour separated from coarse particles after grinding. Similar to most other millers, C. J. Sembe does not sift the flour, believing that unsifted flour is quite acceptable for cooking at a household level There was no mention of whether sifting might lead to the miller obtaining market segmentation or a higher unit price for sifted flour.
  - Staff employed. The miller employs up to 7 persons who might be termed 'permanent casual workers'.

- Milling enterprise issues and value added.
  - Maize volume processed: 100 — 200 tonnes / month, or around 1 200 to 2 400 tonnes per annum of grain. Assuming 70 percent stated recovery, this is around 850 — 1 700 tonnes of maize flour per annum (rounded).
  - Maize procurement: purchases maize locally, and had used the same buyer for the last 10 years when purchasing from Songea.
  - Maize grain prices: Iringa market — buys at around TSh 400/kg. Songea market — pays around TSh 300 — 335/kg, and freight at around TSh 70/kg, totalling around TSh 370 — 405 per kg delivered to Iringa (around US\$255 — 260/tonne).
  - Processing recovery: Stated to recover from 1 kg of maize: 70 percent flour and 30 percent bran. The miller readily uses the bran for his poultry business.
    - The miller particularly noted maize from Dodoma has much less bran compared from grain sourced from the Southern Highlands.
  - Costs of production: Ex warehouse sale prices are around TSh 480.0/kg (US\$307 per tonne), with milling costs before packing at around TSh 430/kg, with a combined packing and closeting cost of around TSh 50.00/kg.
  - Packing and labelling: Milled flour is packed into good-quality printed, woven polypropylene sacks with handles of 10 and 25 kg capacity. The suppliers name and full contact details and agents representing the supplier in Dar es Salaam were all clearly identified on the finished product packing.
  - Wholesale and direct retail selling price: Markets the finished product at around TSh 700/kg (US\$447 per tonne) to outlets in Iringa and Dar es Salaam.
  - Banking and finance: Works with three banks— NBC, CRDB and NMB.
  - Additional business: Mills on a casual basis the maize of women who are responsible for their households, with individual volumes of up to 20 kg.
  
- Occupational health, safety and quality assurance.
  - Official registration: The enterprise is registered with the Tanzania Bureau of Standards.
  - Occupational health and safety: There were no protective covers for fast moving v-belts, motor shafts, and the operating equipment produced a lot of noise. There was no dust extraction or dust and eye masks for operators, no effective management of water on the floor or near electrical points. Equipment had no clearly marked or easy- to-use cut-off switches, and in parts the milling area was poorly illuminated.
  - Laboratory facilities. The miller has no laboratory and quality control is manual, visual and by experience.

C. J. Sembe Safi is willing to learn, share and would benefit by technical and enterprise development support, and is positively inclined to participate in trade association development.

## **(B) CASE STUDIES OF TWO NATIONAL SCALE MAIZE FLOUR MILLERS IN DAR ES SALAAM CITY**

Findings are based on discussions with two large, well-established agribusinesses that have size and scale. Their largest milling activity is producing wheat flour, which is sourced worldwide, and the companies are well versed in the international grain trade, with key criteria being availability and price (although some sources are prized for the grain quality it is a lesser criteria). Both organizations are used to trading in a range of countries in east and central Africa and can be termed 'regional multinationals'.

- Enterprise compliance: The enterprises have a corporate legal structure, with full business registration, and pay VAT and tax at the corporate level. They are registered and comply with the Tanzania Bureau of Standards, and the Food Standards of the Tanzania Food and Drugs Authority.
- Grain procurement: Maize purchasing is in Tanzania only (i.e. compared to wheat). Combinations of approaches are followed, with one firm using established field agents, and another has its own staff that mainly buy direct from growers. The largest single supply source is the Kibigwa maize market near Dodoma, with other important sourcing locations including Iringa, Mbeya, Rukwa, Songea and Tanga. Although the National Food Reserve Agency are assessed to be well managed, some potential purchases have been rejected, as the grain was contaminated with mould, indicating that there are challenges in terms of storage, moisture control and aeration.
- Milling equipment: The maize milling equipment is sourced from a range of specialized manufacturers outside Tanzania and includes standard equipment in line to clean grain prior to milling. Items mentioned were aspirators, separators, destoners, dust extractors and roller mills. Both companies are considering investing in colour sorters with the stated best equipment coming from Buhier, Switzerland or Satake, Japan.
  - There have been investments of over US\$1 million in maize milling equipment lines to produce semolina ('sembe' in Kiswahili). Additional costs include buildings to house the equipment, engineering linkages and infrastructure.
  - Using roller mills, recovery ranges from 70 to 72 percent with one miller; the other achieves 75 to 80 percent flour extraction of high quality.
  - Bran is easily sold to animal feed companies, which, while mainly small in size do have regular demand.
- Enterprise operations: There are production costs and profitability challenges for the larger processors. For example:
  - There used to be five large maize flour mills in Tanzania. Three are now closed and two operate only part time. One of the operational mills runs only three months of every year; the other operates below capacity (e.g. at 70 tonnes per day rather than 100 tonnes per day).
  - Together, the two mills process around 50,000 to 100,000 tonnes per annum.
  - Comparing the capacity and recovery of large, sophisticated mills with rural mills: one mill (with a capacity of around 100 tonnes a day) can mill the same amount of maize at

a higher quality than the Iringa mill can mill in one month. Running the larger mill on three shifts nearly triples the output.

- Product diversification.
  - Sweeteners and glucose: There may be future interest in these products, although specialized equipment and approaches will be required. Generally, however, African origin products are labelled with quality assurance issues.
- Quality assurance: Purchasing standards are based on those issued by the Tanzania Bureau of Standards.
  - Procurement in the field: Field purchasing sometimes involves moisture meters, although the entire scope of field purchasing standards, internal quality control measures and manuals with supporting equipment and staff training can be strengthened. This observation is also relevant to the small millers.
  - Laboratory facilities. All operational maize millers have generally well equipped laboratories for quality control that are operated and managed by trained competent staff. The millers would benefit with international exposure such as attending industry conferences and study tours.
- Occupational health and safety.
  - Although the enterprises are well established, they would benefit from refresher programmes and compliance with occupation health and safety issues. For example, the constant noise and dust seem hazards that could be reduced; the dangers from the constant stream of vehicles and people (loading and unloading products) could be reduced by automated handling.

The finished milled maize flour products are sold in wholesale packaging of 25 or 50 kg bags summarized in the below, and in retail paper bags of 2 and 5 kg.

**Table 15: Milled maize flour wholesale prices from larger millers Dar es Salaam**

TSh/25Kg	TSh/50Kg	Sacks/tonne	TSh/tonne	Forex. TSh/US\$	US\$/tonne
	41 000	20	820 000	1 565	524
20 000		40	800 000	1 565	511

*Source: Larger maize flour milling companies in Dar es Salaam serving Tanzania and regional countries, 29 August 2012*



## Annex 8. Financial services

The two leading lenders to agribusiness in Tanzania are NMB Bank (formerly the National Microfinance Bank), the single largest lender to agribusiness, and CRDB Bank (formerly the Cooperative Rural Development Bank), which is the largest bank by assets in Tanzania. The findings presented in this annex are based on corporate perspective discussions, as well as discussions with the branch managers of NMB and CRDB (the two largest banks in Mbeya City).

- Corporate lending approaches: All Tanzania banks set their lending policies centrally, and while these are implemented via their sometimes very extensive branch structures, they also have teams focused on large corporate clients.
  - There is a disconnect from the domestic banking system, with some very large firms securing cheaper financing outside Tanzania.
- Client categories: Banks lend little or nothing directly to small growers. The preferred approach is to work via savings and credit cooperatives, co-operative Savings and Credit Associations (SACCO and SACCA), as well as directly with established enterprises.
  - Lending to small growers is only via a group such as a SACCO or SACCA.
  - After the global financial crisis, some groups became less trustful and more fragmented.
- Objectives are to work with groups including:
  - Larger and well-established growers;
  - Agrodealers (franchising seems a relatively new approach and has good potential);
  - Established cooperatives and associations such as a SACCO and SACCA, as their members are small growers who as individuals often don't meet collateral requirements (e.g. they have no land title, no ID, are often commodity price takers, and 'growers by default' without viable on or off farm options); and
  - Established agribusinesses.
- Loan sizes. Examples include:
  - Micro lending, which can be very successful.
  - Small loans: TSh 0.1 to 7.5 million (US\$63 to 480).
  - Large loans: TSh 7.5 million to 1 billion (US\$480 to 640,000). Some branches work with SACCO on this level.
  - Other loans. Loans above TSh 1 billion, and interest rates become negotiable at this borrowing level.
- Loan purposes. Working capital for six to twelve months, and interest rates of around 20 percent, negotiable. Interest rates to 13 percent are also possible.
- Collateral. Loans can be made up to 65 percent of the accepted requirement, with collateral.
  - Property is the most common form of collateral.
  - Grain is not considered collateral, although some banks do accept commodities in storage with warehouse receipts.

- The latter system is potentially challenging when a warehouse is not secure or well managed and particularly in the case of maize storage. Warehouse receipts are used in coffee, paddy, cashew nuts and tobacco.
- Southern Highlands. One banking industry member has 21 bank branches, with 11 branches in the Mbeya Region, and uses mobile banking vans with good effect. The largest agribusiness financier has around 200 branches throughout Tanzania including the southern highlands.
- Governance and oversight. All bank branches are structured with limits of responsibilities, are regularly monitored for performance and are audited by head office teams.
- Lending issues. One criteria is the cost of lending compared to income generated (i.e. a 'banking cost benefit'), and with the socioeconomic and logistics situation in Tanzania considerations include:
  - The average distance to a bank branch for most rural people is 60 km. Lending is not usually promoted beyond five to ten kilometres from a branch, as it is just not cost effective. Mobile banks do fulfil some of the gaps in regularly servicing clients, and clients use mobile phones via M-Pesa and Air Tel, agencies and ATMs.
  - Private extension — is an on-going and massive effort although it takes time and is expensive. One bank goes to the extent of training local officers on appreciating warehouses and warehouse receipts. The banking sector accepts that (i) the public extension system is extremely weak in agribusiness, and is concerned there are very few organizations actually working with growers; (ii) most development programmes have their own limitations and are rarely sustained beyond their funding cycles, and (iii) considers the future is in private extension.
- Agribusiness lending. One bank has lent to the production sector (agricultural growers) for the last five years. However, it is currently trying to reduce this portfolio, stating that the bank "associates agriculture with rainfed farming, which equates to risk<sup>11</sup>. There are, nevertheless, indications of maturing off-farm enterprises and more interest in post-harvest finance. Lending to date has included loans to:
  - Processors of maize, rice, edible oil and coffee.
  - Mlowo Village Mbeya: discussions on establishing an agribusiness park.
  - The banks sometimes need to avoid large umbrella cooperative entities, as the grower interests are not always respected.
  - The banking sector encourages franchising and branding, such as establishing full agroservice centres.
- Bank criteria for rural lending and servicing outgrower clients. The following criteria at least have to be fulfilled:
  - Buyers must be financially stable;
  - Growers must provide some suitable form of collateral;
  - Contract growing is mandatory.

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