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Maize in Rwanda: A Value Chain Analysis

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LIST OF ACRONYMS

- **CIP** – Crop Intensification Program
- **COMESA** - Common Market for Eastern and Southern Africa (COMESA).
- **EAC** - East African Community (EAC)
- **EDPRS** – Economic Development and Poverty Reduction Strategy
- **EICV** -Integrated Household Living Conditions Survey (EnquêteIntégralesur les Conditions de Vie des Ménages)
- **EWMI** – East West Management Institute
- **GoR** – Government of Rwanda
- **MINAGRI** – Ministry of Agriculture
- **MINICOM** – Ministry of Trade and Commerce
- **NISR** – National Institute of Statistics Rwanda
- **OPV** –Open Pollination Variety
- **PHHS** – Post Harvest Handling and Storage
- **RAB** – Rwandan Agricultural Board
- **SIPA** – School of International and Public Affairs
- **SSA** – Sub-Saharan Africa
- **WFP** – World Food Program
- **UNIDO** - United Nations Industrial Development Organization

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Executive Summary

The goal of the maize value chain analysis is two-fold. Firstly, to create visibility of the current 'end-to-end' maize value chain in Rwanda, and secondly to describe the constraints limiting the development of the industry and suggested recommendations to address these.

Key findings on the current status of the maize value chain include:

- **Production:** Maize production in Rwanda has increased by 129 percent from 175,000 tons in 2008 to 400,000 in 2011 due to crop intensification programs.
- **Usage:** In Rwanda, fresh maize, maize flour, and maize grits are used for food products, while maize bran is used as animal feed.
- **Data:** Consistent data is difficult to obtain, however it is estimated that consumption of maize flour has increased by 450 percent from 100,000 tons in 2004 to 550,000 tons in 2012.
- **Formal Trade:** Rwanda is a net importer of maize grain and general processed maize products, but is a net exporter of maize flour.
- **Informal Trade:** There is a significant informal trade in green maize between Rwanda and the DRC, however no official data exists to make a clear assessment of this activity.
- **Value Addition:** Most of the value addition to the value chain occurs at the agricultural level, followed by the processing stage.

Recommendations are summarized in table below and the five perhaps highest priority recommendations are as follows:

Recommendation A - Form MINICOM-MINAGRI integrated maize value chain working group to address enhance cross-Ministerial visibility of planning, investment and data collection.

Recommendation B - Co-operatives can provide smallholder farmers with better access to market information and more efficiently invest in equipment and smooth income risks. Continue to strengthen existing initiatives to foster maize co-operatives to reduce their post-harvest losses, increase yields and crop quality.

Recommendation C - Address credit availability for both working capital and investment in the context of broader financial sector reforms.

Recommendation D - Explore demand for additional value-added maize products (e.g. grits, bran, corn oil) to diversify and increase the value of the maize industry.

Recommendation E - Improve enforcement of certification requirement on processors and institutional buyers to incentivize farmers to produce higher quality maize grain and millers to process at a higher quality.

The total list of 16 constraints with associated recommendations is as follows (prioritized recommendations are labeled A-E):

#	Constraint	Actions Taken	Actions In Process	Recommendation (Future)
1	Limited cross-Ministerial visibility of the maize value chain.	Informal liaisons between the two ministries may exist.		A. Form MINICOM-MINAGRI integrated maize value chain working group to address the limited cross-Ministerial visibility of planning, investment and data collection.
2	High Post Harvest Losses (22 percent).	MINAGRI Post Harvest Taskforce w/ USAID exists.	MINAGRI Post Harvest Taskforce w/ USAID scheduled for termination	B. Continue to strengthen existing initiatives to foster maize co-operatives to reduce their post-harvest losses, increase yields and crop quality.
3	Individual farmers have limited market information.	Text Messaging program exists for farmers.		
4	Cooperatives have limited management and production capacity. No baseline data for quality exists.	Government support for cooperatives (incentives).	Baseline study of cooperatives in progress.	
5	Limited access to long-term credit for cooperatives, and limited use of short-term credit by farmers.	Access to SACCOs have increased (farmers).		C. Address credit availability for both working capital and investment in the context of broader financial sector reforms.
6	Limited irrigation facilities and the high cost of construction of large-scale facilities.	Large scale construction of 9 irrigation facilities started.		
7	Seeds and fertilizers subsidies are likely to be removed.	Phase-out plan prepared.		
9	Limited product diversification.	Mix Sosoma currently produces vitamin enriched maize flour.	Minimex's exploring enriched corn maize blends.	D. Explore demand for additional value-added maize products (e.g. grits, bran, corn oil, ethanol, mixed flours, corn

				starch).
10	Limited implementation of certification standards by millers.	RBS Standards Exist, processes in place for monitoring compliance.		E. Improve enforcement of certification requirement on processors and institutional buyers.
11	Production and consumption trade data inconsistencies exist.			Commission a review and analysis of all data gathered for consolidation and standardization.
12	Limited maize farm mechanization.	Ongoing efforts to increase mechanized process.		Conduct cost-benefit analysis of farm mechanization for value-add.
13	Limited agricultural insurance mechanisms.	IFC / WB / Earth Institute insurance project being explored.		Evaluate weather index insurance (IFC-WB, Earth Institute).
14	Limited information about the impact of maize development on the environment.	-		Study environmental impact of maize farming and consider shifting maize production growth to the Eastern province.
15	Infrastructure needs impact productivity		Action plans underway for improvements	Continue to address under existing programs.

Unit (1) describes the project methodology, discusses the history and development of maize in Rwanda, maps the value chain between agricultural production, post-harvest processing, transportation, milling and processing, packaging, trading, the retail market and exports.

Unit (2) is a detailed constraints analysis of processes and stakeholders in the maize value chain, with suggested recommendations.

1 Maize In Rwanda: Project Overview

1.1 Background

This maize value chain analysis was completed upon request from Rwanda's Ministry of Trade and Industry (MINICOM), the United Nations Industrial Development Organization (UNIDO) and the East West Management Institute (EWMI). The authors of this report are Master's students at Columbia University's School of International and Public Affairs (SIPA), and have a cumulative 24 years of work experience in management consulting, finance, international development, research and microfinance across five continents. This report will be used by UNIDO in its consultative capacity with Rwanda's Ministry of Trade and Industry (MINICOM) to identify opportunities and associated risks for the development of the Rwandan maize industry. This exercise aims to contribute to the development of the Rwandan economy and support the ongoing activities to improve food security.

In consultation with the Permanent Secretary of MINICOM, UNIDO and EWMI, maize was identified as a priority crop and selected for the research and development of a comprehensive value chain analysis. Key drivers for this include the following:

- ✓ Maize is a staple crop that ensures food security in many sub-Saharan African countries and has the potential to do the same in Rwanda.
- ✓ Maize production has increased significantly in the past six years.
- ✓ Analytical work on 'end-to-end' maize value chains in Rwanda, covering agriculture, post-harvest processing, transportation, milling, packaging, trading and retail is limited.

In Sub-Saharan Africa (SSA), maize is a key ingredient in ensuring food security. Compared to other cereals, maize is higher yielding, lower risk, easier to process, and more versatile, with the ability to grow across agro-ecological conditions. Maize is consumed as a starchy base in a variety of items and provides an important source of carbohydrates, proteins, iron, minerals, and vitamin B.¹ White maize has the highest demand in the region and is therefore priced higher and represents the vast majority of regional maize crops.²

SSA has historically not been a large producer of maize due to food aid from abroad, which has centered on maize and wheat. The World Food Program (WFP) has acknowledged the effects of this and has implemented local and regional procurement policies.³ This has been a key driver in the increase in maize production throughout the region.

In Rwanda, the economy has shown strong signs of recovery from the global recession

¹TechnoServe. Addressing Food Security in Rwanda by Transforming the Maize Sector. February 2010

²Ibid

³Interview. Mashayo, Emmanuela (WFP). Mar 27, 2013

with an estimated growth of 7.7 percent in 2012.⁴ This growth can largely be attributed to expansion in the services sector, increased productivity in the agriculture sector, and increased public and private investment.⁵

The Government of Rwanda's Economic Development and Poverty Reduction Strategy (EDPRS) and Vision 2020 Strategy clearly define its strategic objectives and identify interventions to achieve middle-income status by 2020. One of the key goals within the EDPRS strategy is to modernize subsistence agriculture through the Crop Intensification Program (CIP).⁶ The CIP was started in 2007 to address food security and strengthen the country's agricultural productivity. Seven priority crops were identified including maize, wheat, rice, Irish potato, beans and cassava. Under the program, a focus has been made on farm consolidation, farm inputs (seeds and fertilizers), mechanization, irrigation, and extension services on the use of inputs and improved cultivation practices.⁷ The results on productivity have been positive with the production of maize and wheat increasing six-fold and Irish potato and cassava tripling. The production of rice and beans has increased by 30 percent.⁸

1.2 Objectives

This maize value chain report for Rwanda aims to achieve the following objectives:

- ✓ *Create visibility* of the current status of the maize value chain in Rwanda, including a flow chart, an analysis of key stakeholders, production and consumption figures, trade statistics.
- ✓ *Drive problem solving* amongst key stakeholders at MINICOM, MINAGRI, the private sector and others.
- ✓ *Share high-level recommendations* with MINICOM and MINAGRI concerning the strengthening of the Rwandan maize value chain to promote food security and economic development.

1.3 Methodology

The team's research methodology makes use of three types of research tools, an analytical framework and has three outputs. Research tools include:

- ✓ *Desk research:* Research was completed on maize value chain best practices, as well as regional and global trends.

⁴ (Clover, Jenny. Rwanda Sees GDP growth hit if aid doesn't restart. Reuters. 02/11/2012. <<http://www.reuters.com/article/2012/11/02/us-rwanda-economy-idUSBRE8A10SL20121102>>)

⁵Bank Group Country Strategy Paper 2012-2016. African Development Bank. October 2011

⁶ World Bank. Rwanda Overview. September 2012
<<http://www.worldbank.org/en/country/rwanda/overview>>

⁷Kathiresan, Arumugam. Strategies for Sustainable Crop Intensification in Rwanda. MINAGRI. 2011)

⁸Ibid

- ✓ *In-country interviews*: Over 50 interviews were carried out with stakeholders across various stages of the maize value chain in Rwanda.
- ✓ *In-country focus groups*: Discussions were facilitated with groups of maize farmers in Rwanda.

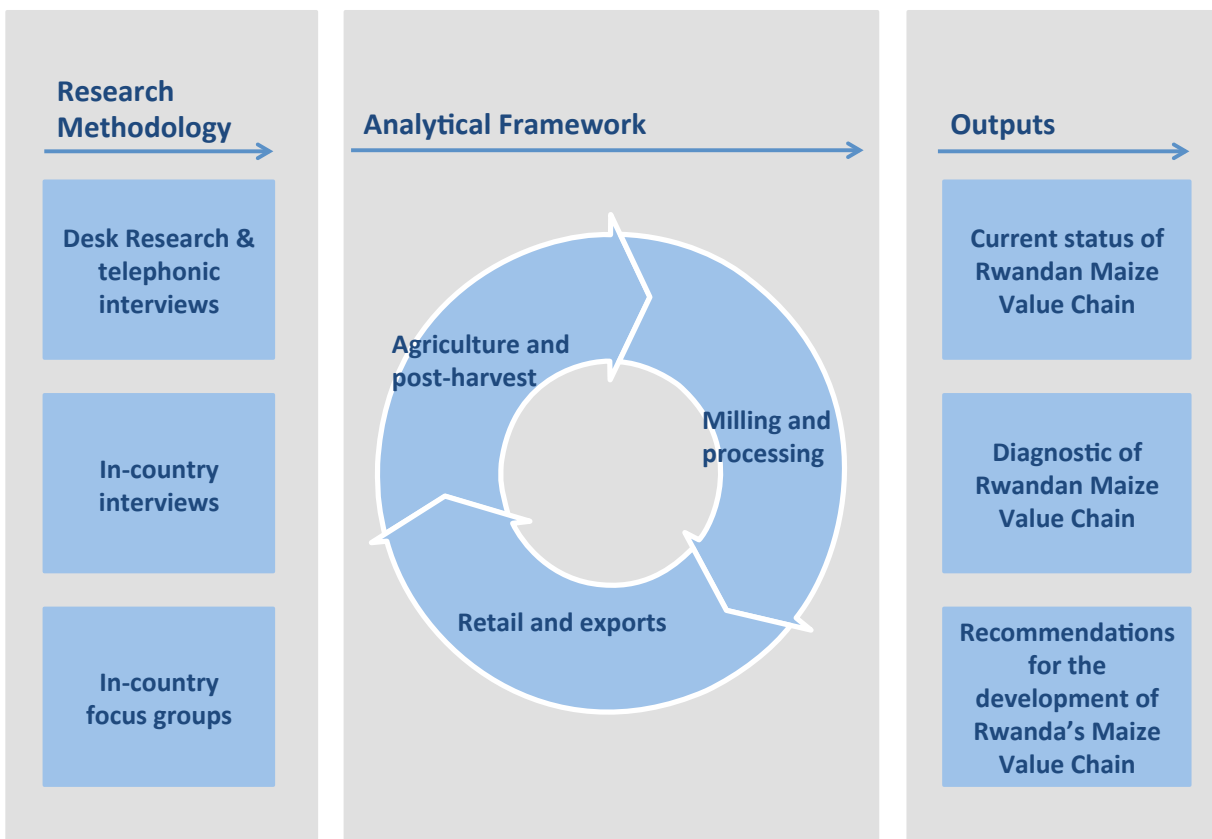
The analytical framework follows a unit (one kilogram) of dried maize through the value chain to determine opportunities for development throughout the following stages:

- ✓ *Agriculture and post-harvest*
- ✓ *Processing*
- ✓ *Retail, wholesale and exports*

The outputs of the report include:

- ✓ *The current status of the Rwandan maize value chain*
- ✓ *Diagnostic analysis of constraints within the value chain*
- ✓ *Recommendations for the development of Rwanda's maize value chain*

Figure 1: Research Methodology



1.4 History and Development of Maize in Rwanda

Maize is sold and consumed in both fresh cobs and dried grain in Rwanda, however this report focuses primarily on dried maize and secondary products, primarily maize flour. Other secondary products include bran and grits. Due to the Crop Intensification Program (CIP), over 65 percent of Rwandan farmers now grow maize, both for household consumption and commercial sale to traders and millers.⁹ Rwanda is a net importer of maize grain and a net exporter of maize meal (it is a net importer of processed maize products including maize meal, animal feed, beer, and all of the other types). Since 2007, the CIP has increased production six-fold due to four areas of intervention:¹⁰

- ✓ *Distribution of Improved Inputs:* Within the CIP, imported seeds from neighboring countries are distributed free of charge to farmers to increase productivity. Imported fertilizers have also been distributed through private distributors. Vouchers are available for farmers to buy the fertilizer at a 50 percent discount.¹¹
- ✓ *Consolidation of land use:* This involves rearranging land parcels to consolidate the use of farm holdings. Farmers in a given area are encouraged to grow a particular crop that will improve productivity. This pillar has been implemented in roughly half of all farms in Rwanda.¹²
- ✓ *Proximity to extension services:* The Rwandan Agricultural Board (RAB) coordinates the provision of extension support from seed production to post-harvest and consumption.¹³
- ✓ *Post-Harvest Handling and Storage (PHHS):* This initiative focuses on identifying gaps in community harvest and storage facilities and providing training to farmers on PHHS.¹⁴

Despite this boost in production, domestic supplies of maize have been insufficient in terms of quality standards required by the major buyers.¹⁵ This is driven largely by high moisture content and impurities. As a result, much maize continues to be imported from neighboring countries.¹⁶

⁹MINAGRI, 2013

¹⁰United States Department of Agriculture

¹¹Kathiresan, Arumugam. Strategies for Sustainable Crop Intensification in Rwanda. MINAGRI. 2011

¹²Musabyimana, Innocent (RAB). March 2013

¹³Nsemgiyumva, Francois. March 2013

¹⁴Kathiresan, Arumugam. Strategies for Sustainable Crop Intensification in Rwanda. MINAGRI. 2011

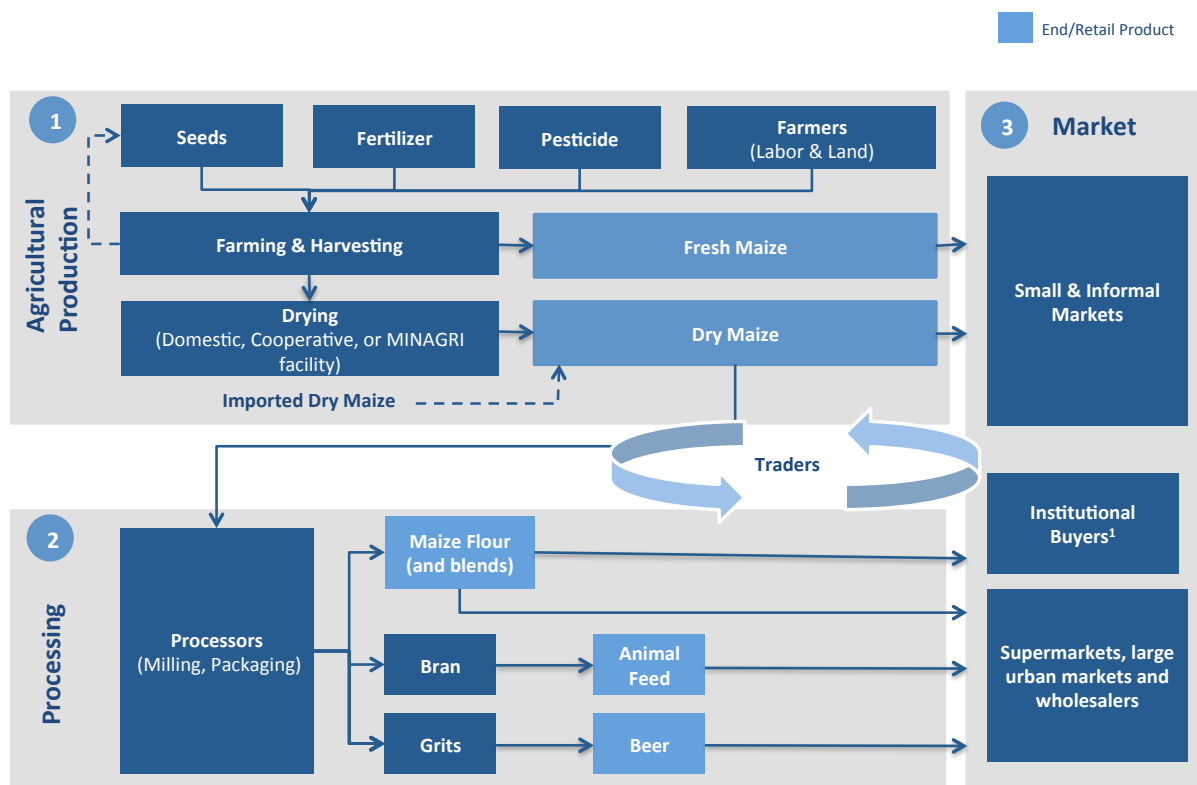
¹⁵ Rwanda Post-Harvest Handling and Storage. March 2013 <<http://www.rwandaphhs.com/?q=node/95>>

¹⁶Ibid

1.5 Maize Value Chain Map

The Maize Value Chain Map depicted in Figure 2 below can be broken down into three key stages: (a) Agricultural Production, (b) Processing, and (c) Market:

Figure 2: Maize Value Chain Map



¹ World Food Program, National Correctional Services, Ministry of Education, Strategic Food Reserve Task Force, Rwanda Grain & Cereal Corporation (RGCC), MINAGRI (seeds); ² The additional value of economic activity generated through value added services eg. Production, processing, retail
Source: Team, interviews

(1) Agricultural Production

Seeds: At the provincial level, local administrators estimate their necessary seed requirements and relay this information to the federal government. The government in turn purchases and distributes the seed at no cost to farmers (plans are underway to phase-out this subsidy). Seeds (hybrid and OPV) have historically been sourced from Zambia, Kenya, Tanzania, and South Africa however seed multiplication is now done by Rwandan cooperatives under the guidance and supervision of RAB.¹⁷ In 2012, MINAGRI was able to locally source the majority of

¹⁷Interview. Nsenguyuma, Francois. (MINAGRI). Jan 2013

seeds, however the remaining 25 percent was imported from Kenya, Zambia and Tanzania.¹⁸

Fertilizer: MINAGRI imports a range of fertilizers for use in farms across the country. MINAGRI identifies appropriate maize fertilizers based on annual research. Tenders are then put out to companies to import DAP (for the planting phase) and Urea (for the weeding phase).¹⁹ This fertilizer is provided to farmers for 50 percent of the cost. Plans are underway to phase-out this subsidy.

Pesticides: RAB relies on the private sector but also purchases a strategic stock of pesticides to control for the risk of outbreaks. Pesticides were not cited as a major input for maize production.²⁰

Farmers: About 50 percent of Rwandan farmers are organized into co-operative farms (under the CIP's land consolidation efforts) through support from MINAGRI and other stakeholders. The majority of maize farmers in Rwanda continue to rely on rainfall and low technology for maize production (only 10 to 12 percent of farms are mechanized). There are large-scale hillside and marshland irrigation projects underway through MINAGRI, the World Bank and DFID, however it is estimated that these have reached only approximately four percent of farmers. The target for irrigation access is 17 percent of farms by 2017.²¹

Farming and harvesting: The Government of Rwanda has implemented programs to increase access to mechanization through village mechanization centers, which offer selling of machinery, renting, maintenance, and training. The target for mechanization is 25 percent by 2017.²² These centers support farmers in implementing improved agricultural practices. At harvest time, farmers keep some maize, sell some fresh maize (often to the DRC) and much is kept for sale as dried maize. The selling of fresh maize allows farmers to gain access to their field earlier to plant a new crop.²³ However, since the government promotes dried maize, little data is available on the sale of fresh maize as farmers are hesitant to share this information.

Drying: Drying is done in a variety of ways from very informal methods at the farm level to formal drying facilities. It is estimated that 60 percent of farmers dry their crops at large-scale drying facilities provided by MINAGRI through cooperatives.²⁴ The remaining farmers dry maize in trees or other informal methods with or without a tarp (provided by USAID) for protection. The maize is then threshed

¹⁸Interview. Gervais, Ngerero (RAB). March 2013

¹⁹Interview. Murkozi, Charles (MINAGRI). Mar 2013

²⁰Ibid

²¹Interview. Nzeyiman, Innocent (MINAGRI). Mar 2013

²²Ibid

²³Interview. Smith, Bruce (USAID/MINAGRI). March 2013

²⁴Field Visit, Nasho. March 2013

either manually or with machines. The dried maize is then stored in bags with and without insecticide and sold to traders.²⁵

(2) Processing

Traders: Traders serve as middlemen both in the delivery of maize from farmers to millers as well as the delivery of flour from millers to the marketplace or institutional buyers. There are a range of larger traders in the Rwandan marketplace including ENAS, Morenzi, Tubura/One Acre Fund, and Nsekuye.²⁶ Some of these organizations also engage in further drying and packaging depending on buyer requirements. The remaining individual traders are smaller operators with one or two trucks.

Processors: Maize is processed by a range of milling companies who act as both processors and traders. Some purchase dried maize from domestic cooperatives and traders while others import from neighboring countries. Rwanda's largest miller, Minimex, was founded in 2002 and is the only miller to be certified by the Rwanda Bureau of Standards.²⁷ This certification supports their institutional sales. A second group of smaller millers produce the majority of maize annually and are organized into a cooperative called AMIRWA.²⁸ Outside of these larger millers, small-scale milling facilities exist at the local level to assist farmers with subsistence needs. Silos and grain bags for storage are provided by MINAGRI as well.²⁹

End Products: The milled maize is then produced into three key end-products:

1. *Maize flour* (and blends): Maize flour is the main product however there has been an increased demand for maize flour blends recently. These blends, which are enhanced with vitamins and minerals, have been developed by Sosoma.³⁰
2. *Bran.* The outer coat of the grain, bran, is a byproduct of the milling process, and is sold as animal feed and used as biomass for energy.³¹
3. *Grits:* Another byproduct in the milling process, grits, can be used in beer production. Minimex has a contract to sell this at the same price as maize flour to Heineken.³²

²⁵ Jean Marie (USAID). March 2013

²⁶ Rutayisire, Mark (ENAS). March 2013

²⁷ Mansell, Claude (MINIMEX). March 2013

²⁸ AMIRWA interview, March 2013

²⁹ AMIRWA interview, March 2013

³⁰ Thedee (Sosoma). March 2013

³¹ Nsemgiyumva, Francois (MINAGRI). Jan 2013

³² Jean Marie (USAID). March 2013

(3) Market

Institutional Buyers: The main institutional buyer of dried maize and maize flour is WFP. Additional buyers include schools, and prisons that don't require the high quality and certification of WFP.

Market: The three end products are sold to markets including supermarkets, large urban markets, wholesalers and through informal markets.³³

1.6 Stakeholder Analysis

There are a number of stakeholders throughout the value chain, however about 20 key players have been identified below. These stakeholders vary from governmental actors, to private companies and farmers at the village level.

Table 1: Key Stakeholders in the Maize Value Chain

STAKEHOLDER ANALYSIS			
Stakeholder	Description	Role in the Maize Value Chain	Key Constraints/ Challenges
GOVERNMENT / ORGANIZATIONAL LEVEL			
Ministry of Agriculture	Ministry overseeing agricultural development.	Provides training for farmers, subsidizes inputs, communicates price information, manages strategic grain reserve, and oversees irrigation and mechanization transformation	Changing farmer behavior, inter-agency communication
Ministry of Trade and Industry	Ministry overseeing industrial development and trade	Promotes exports of maize, provides loans to public-private millers.	Inter-agency communication.
Rwandan Development Board	Oversees Rwandan Development across several sectors	Conducts parallel agricultural programs to MINAGRI	
Rwandan Bureau of Standards	Regulatory body for industry.	Sets regulatory standards for maize millers	Limited capacity to carry-out certification

³³According to the USAID report, "Rwanda Cross-Border Agriculture Analysis", the huge informal trade exists between the neighboring countries, such as Rwanda, Uganda, Burundi, DR Congo, and Tanzania. The data in the report says that Rwanda's total informal exports for unprocessed maize between these countries are 4,681 MT, and for processed maize are 11,574 MT.

Rwandan Grain and Cereal Corporation	Public-private partnership for maize storage.	Purchases maize kernels from farmers to stabilize prices. Will manage strategic maize reserve in future.	Low purchasing capacity
Rwandan Business Development Fund	Small and Medium Business Credit Provider.	Works with financial institutions to guarantee loans for small and medium businesses.	
Rwandan Cooperative Authority	Certifies farmer, miller, and trader cooperatives	Certifies farmer, miller, and trader cooperatives	Insufficient staff to regulate cooperatives.
Bilateral Aid Organizations	USAID, DFID	USAID assists MINAGRI in technical training and development strategies. Promotes better post-harvest storage and farmer marketing through "Sell More for More" program.	
Farmers			
Farmer Cooperatives	Cooperatives of farmers consolidating land for joint crop production. May or may not have government assistance	Producers of maize. Vary by maturity and market linkage. Produce kernels for seed and milling.	Poor post-harvest storage, erosion.
Individual Farmers	Farmers on non-consolidated land	Producers of maize for milling and seed. Receive less training from government, may or may not use fertilizer.	Poor post-harvest storage, erosion, transportation problems, poor market linkage.
Millers & Traders			
AMIRWA	Cooperative of several small-scale millers located throughout Rwanda	Largest milling association in Rwanda (400,000 metric tons milled per year). Mill with simple machines, buy kernels from traders and local farmers. Mill maize into flour and residue.	Difficulty reliably acquiring maize for milling. Lack of operating capital. High rent in Kigali.
Minimex	Miller	Largest single milling plant in Rwanda (48,000 metric tons milled per year). Possesses most advanced milling facilities, mills maize into flour, grits, and bran. Sells to institutional buyers--WFP, prisons--and consumers. Operates storage facility in Eastern Rwanda.	Lack of working capital. Not milling at full capacity. Difficulty finding mature farming cooperatives.
Sosoma	Multiproduct miller	Relatively low milling capacity (1,825 metric tons per year). Mix maize with other products to produce mixed flours. Purchase from farmer cooperatives	Lack of supply from farmer cooperatives

Traders³⁴			
Small Traders	Trader	Provide transportation to/from regional trading centers and farmers. These individual traders work with trucks, bikes, and by foot.	High fuel costs and road quality.
Morenzi	Medium-size trader	Outsources milling to Minimex. Sells to WFP, GoR, and traders. Has fleet of six trucks for transportation. Outsources milling to Minimex.	Poor quality maize due to poor post-harvest storage.
Nsukye	Medium-size trader	Medium size miller. Possesses a few trucks for transportation. Sells to MINAGRI, WFP, and exports to Uganda, Burundi, and DRC.	Poor quality maize due to poor post-harvest storage.
ENAS	Medium-size trader	Collects maize from farmers and smaller traders and delivers to millers. Possesses largest maize warehouse in Rwanda. Offers some training to farmers.	Difficulty acquiring quality maize kernels, especially from Uganda. Difficulty up-scaling storage facility.
FINANCE			
Commercial Banks	Access Bank, Banque Populaire, Ecobank, and others.	427 branches providing loans to farmer cooperatives and millers. Typical 18% interest rate.	Assessing creditworthiness
Microfinance Institutions	Equity Bank, Urwego Opportunity Bank, Vision Finance Company	Provides loans to farmer cooperatives and some instruction. There are 22 MFIs publicly reporting which serve 40.2 million clients. ³⁵	
Community-level savings and credit groups.	Savings and Credit Co-operatives (SACCOS) and informal savings groups.	1 million Rwandans served through a strengthened network of SACCOS. Provides savings and loan services to individual farmers at local level. Widespread through country. Over 100,000 are served through informal savings groups. ³⁶	
Institutional Buyers			
World Food Program Rwandan Government	UN Food Distributor Schools and prisons	Buys maize flour from MINIMEX and other millers. Purchases dried maize and maize meal	

³⁴ Other traders include Tubura (formerly of One Acre Fund), and SOPAR.

³⁵ MIX Market. Microfinance in Rwanda: Country Profile. <

<http://www.mixmarket.org/mfi/country/Rwanda>> (Savings Groups Information Exchange, 2013)

³⁶ Savings Groups Information Exchange. <<http://savingsgroups.com/projects/search/country/206>>

1.7 Maize Value Addition Distribution Map

Each segment of the value chain adds *value* to the original agricultural output. All of the following data was collected during field research in March 2013, and reflects prices at that time.

(1) **Agricultural Production:** Farmers input cost was 23 RWF/kg, which includes the cost of fertilizer and seeds. The average sale price of dried maize was 200 RWF per kg, giving the typical farmer an average of *177 RWF/kg of profit*, which is also 'value addition' to the economy.

(2) **Trading:** Small traders purchase dried maize for an average of 200 RWF/kg and have the additional cost of petrol, labor and trucks to collect the dried maize and transport it to millers for processing. This costs an average of 10 RWF/kg, so the total cost to traders is 210 RWF/kg. Traders sell dried maize to millers for about 220 RWF/kg, giving the traders an average of *10 RWF/kg of profit*, a further 'value addition' to the economy.

(3) **Processors:** Millers and processors purchase the dried maize from small traders for 220 RWF/kg but then have additional fixed and variable costs including labor, overhears, machinery, energy and packaging material. This costs an average of 10 RWF/kg, so the total cost to processors is 230 RWF/kg. Millers and processors sell maize flour (and other products like bran and grits) for an average of 260 RWF/kg, giving the processors an average of *30 RWF/kg of profit*.

Figure 3: Maize Profit Distribution Map³⁷

Value addition distribution per kilogram of maize – Typical Case

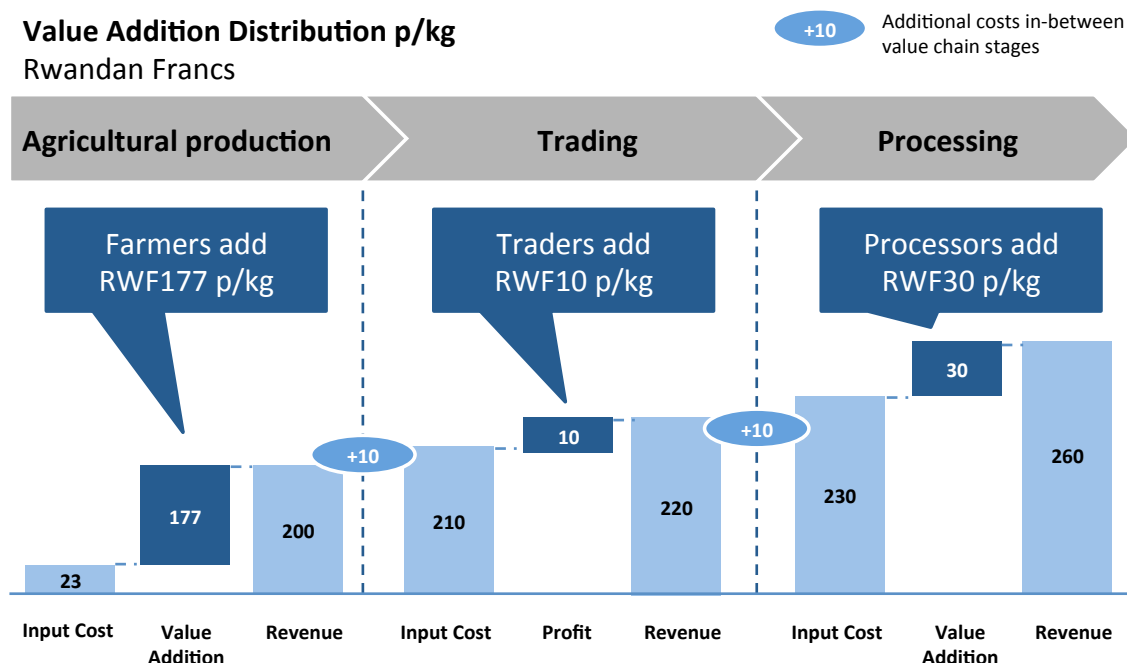


Table 2: Maize VCA Value Add Per Kg Of Dried Maize And Improved Storage

Farmer/Miller	Value Addition per kg of dried maize	Additional profit from improved storage
Farming Cooperative (sample)	182 RWF	12 RWF
Individual Farmer (typical case)	177 RWF	13 RWF
MINIMEX (milling)	70 RWF	0 RWF
Amirwa	30 RWF	0 RWF

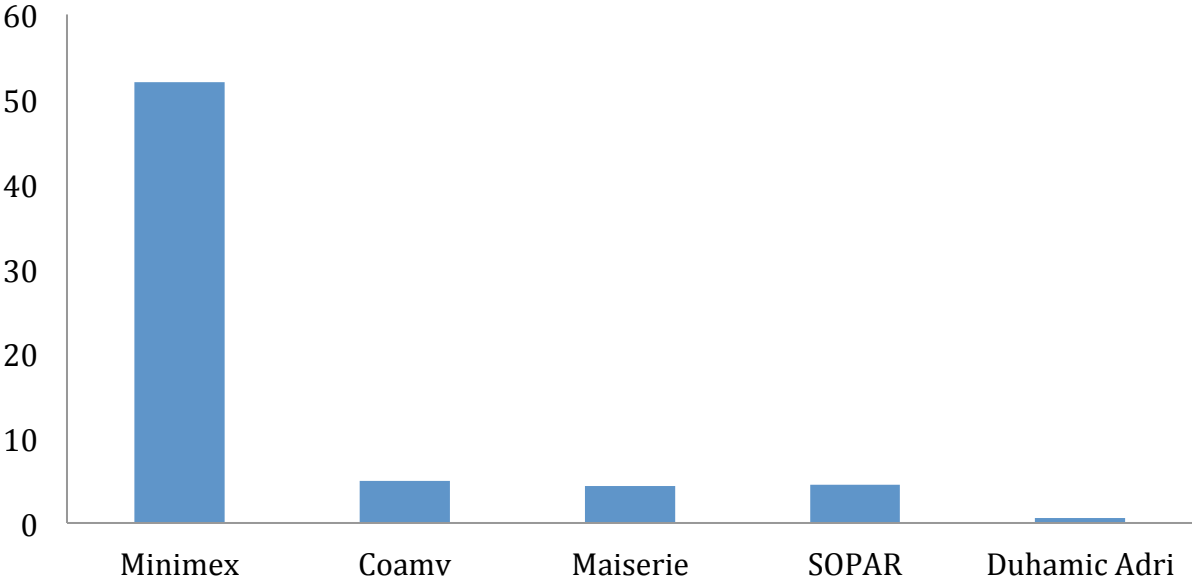
Different farmer types add varying amounts of value to each kilogram of maize. Co-

³⁷Input costs do not match revenue from previous step due to additional inputs: for example gasoline for traders or electricity for millers.

operative farmers add the most value with an average of 182 RWF/kg. The farmers we visited had access to excellent irrigation facilities; good drying stations, used DAP fertilizer, and had relatively low levels of post-harvest losses. In contrast, most individual farmers do not use fertilizer, had no access to irrigation, and experienced post-harvest losses around 24 percent.³⁸ Post-harvest losses were often cited as a major loss to farmer’s incomes. A 5 percent decrease was simulated in post-harvest losses for both farmers and found a 12 RWF value addition for the cooperative farmer and a 13RWF value addition for the individual farmer per kilogram.

Minimex adds 70 RWF of value to each kg of dried maize. AMIRWA, the largest maize miller co-operative adds 30 RWF per kg. This is largely due to the fact that Minimex produces certified high quality flour and produces and sells more expensive maize products such as maize grits, while AMIRWA produces only flour. Minimex is currently not operating at full capacity and there is a great opportunity to improve the value addition of Rwandan maize by increasing production at Minimex. However, as Minimex has currently exhausted the domestic demand for grits, it will need to find international buyers or alter the mix of maize products it produces. The current mixture of maize products is reflected in Minimex’s value addition above.³⁹ All of the data above was obtained through interviews at the time of our field visits in January and March 2013.

Figure 4: Processing capacity of Rwanda’s largest millers (‘000 tons per year)



Source: MINAGRI, 2009

³⁸Nasho visit, March 2009

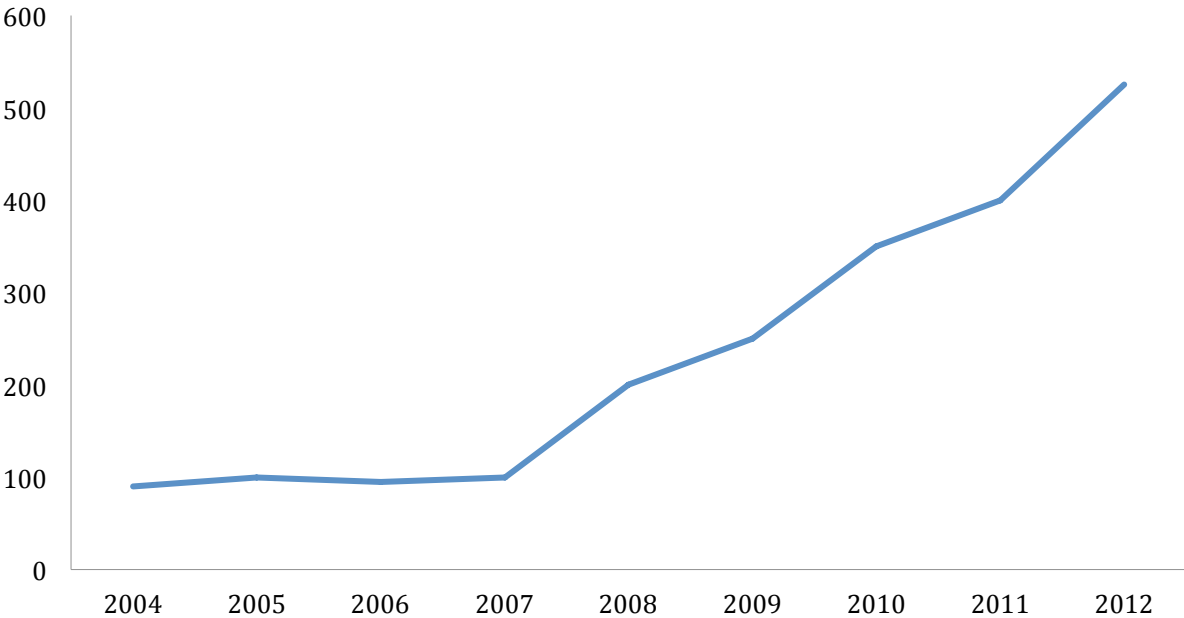
³⁹AMIRWAand Minimex interviews. March & January 2013.

1.8 Rwandan production and consumption

Production

Total maize production has increased dramatically since the introduction of the Crop Intensification Program (CIP), from 175,000 MT⁴⁰ in 2008 to 400,000 MT fresh maize produced in 2011⁴¹; with 2012 estimated at a record of 575,000 MT.⁴² The chart below clearly shows the impact of the CIP in 2007, after which production increased dramatically. Production had been historically low due to the relatively recent introduction of maize and the gradual change in eating patterns towards maize (and away from other crops like beans, potatoes, cassava, and bananas). It is important to note that although minimal, there is a data inconsistency in Rwanda’s maize production across entities. For instance, the United States Department of Agriculture estimates production around 525,000 MT per year, whereas USAID estimates around 575,000 MT based on MINAGRI’s data.⁴³

Figure 5: Rwandan maize flour production (‘000 MT per year)



Source: United States Department of Agriculture

Maize is grown throughout Rwanda, although there are some areas more suited to production. The CIP identified the Eastern Province for its’ flatter topography as the best

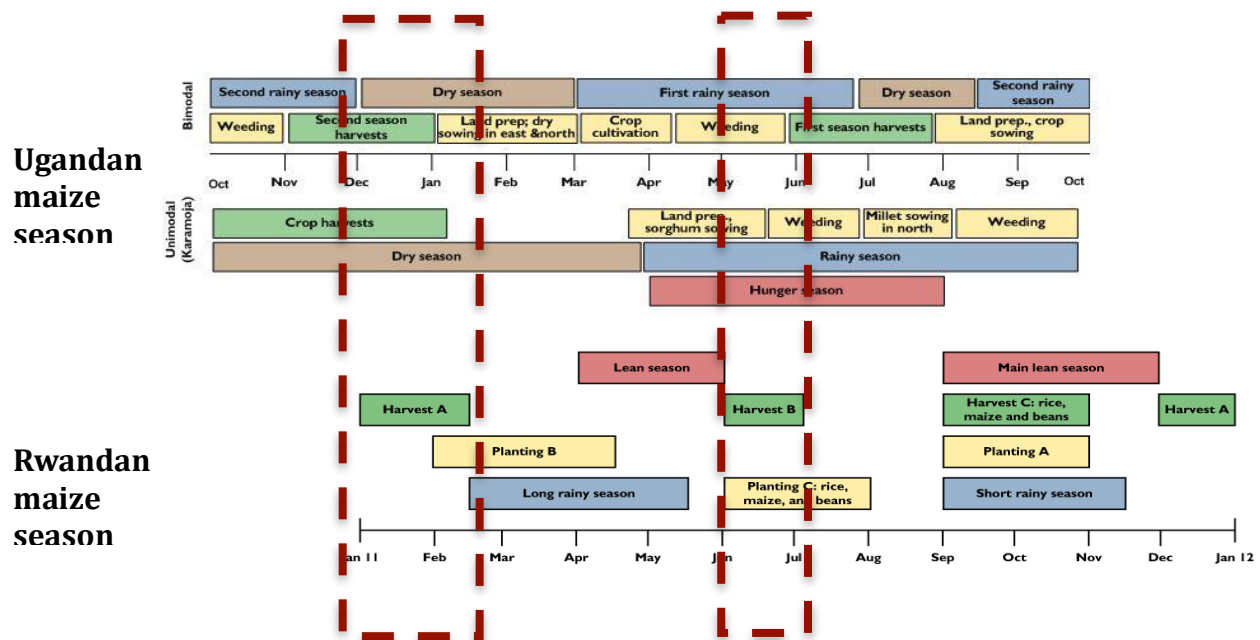
⁴⁰ Metric Tons
⁴¹Rwanda Post-Harvest Handling and Storage. March 2013 <<http://www.rwandaphhs.com/?q=node/95>>
⁴²Nsemgiyumva, Francois. MINAGRI. January 2013.
⁴³ Rwanda Cross-Border Agricultural Trade Analysis, USAID February 2013. Due to the fact that the consumption data from USAID is not a time-series data and only covers the year 2012, this report uses the production/consumption data from the U.S. Department of Agriculture.

location for large-scale development.⁴⁴

Maize is produced in three seasons in Rwanda.⁴⁵The first season runs from September to February when most of the maize is grown (75 percent). The second is from March to June when less maize is grown (20-25 percent) as fields are often interchanged for other legumes. The last season, July to September, is the driest season and the season when little maize (5-10 percent) is produced.

Due to these seasonal production variations, Rwandan maize is competitive with Uganda during particular periods of the year – specifically the months of January, February, May, June and July (see Figure 18).⁴⁶

Figure 6: Opportunities for Competition – Ugandan and Rwandan Harvest Seasons



Source: FEWS NET and USAID, 2010

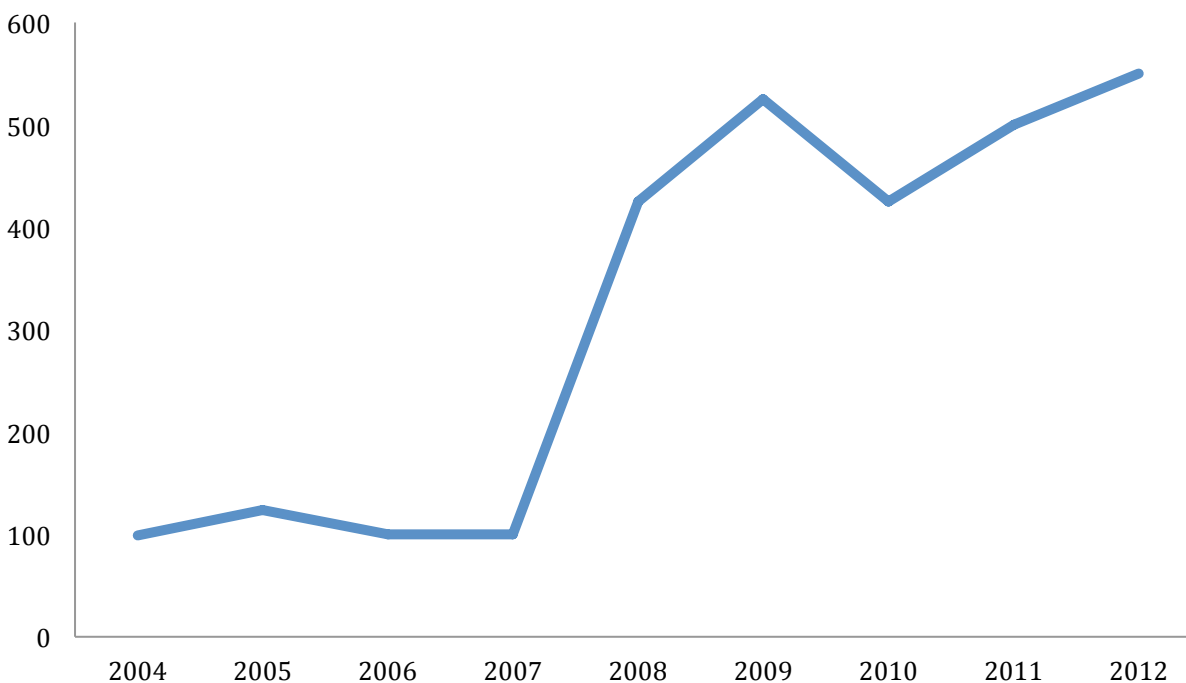
Consumption

With the growing maize demand in the country and persistent food insecurity concerns, maize is an important crop in that it has the ability to address not only food security, but income for individual farmers. Maize consumption has consistently grown according to the United States Department of Agriculture, with total maize consumption in Rwanda increasing from 100,000 MT per year in 2004 to 550,000 MT in 2012⁴⁷.

⁴⁶ Going Local. Agri-Profocus, Janna van Der Laan, January 2011

⁴⁷United States Department of Agriculture. 2013.

Figure 7: Rwandan maize four consumption ('000 MT per year)



Source: United States Department of Agriculture

1.9 Regional Maize production and consumption

Regional Production

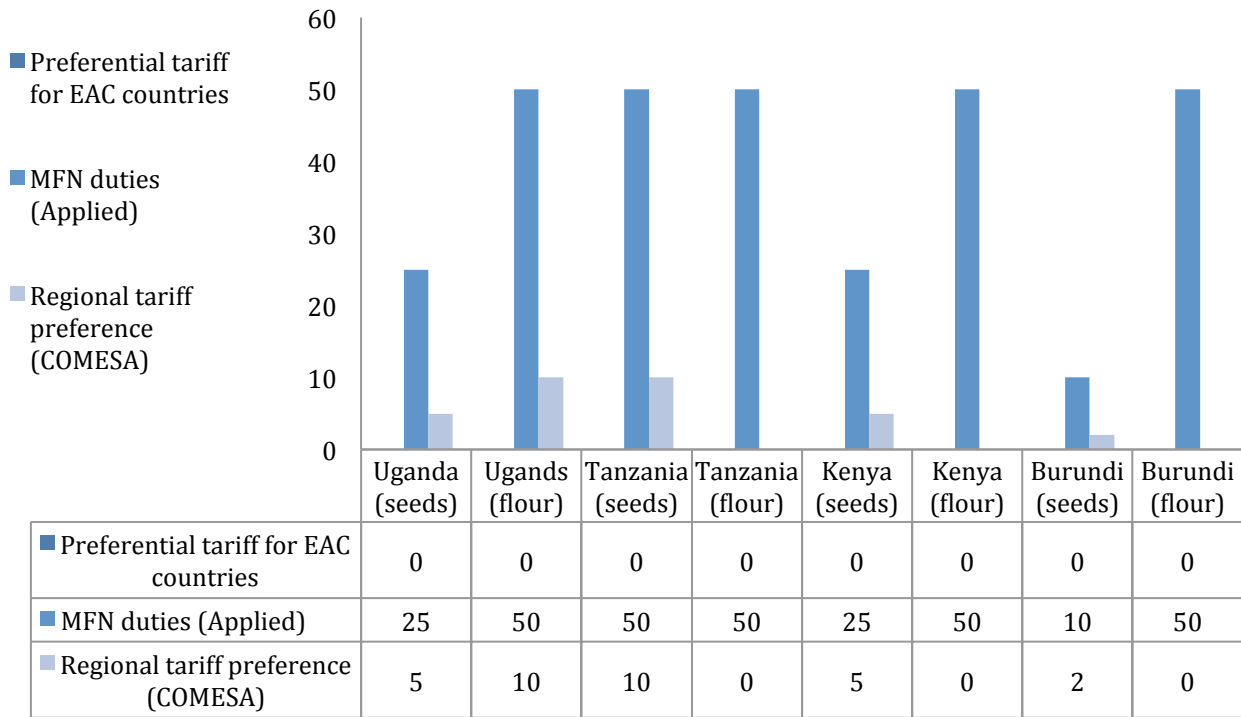
Rwanda is a relatively small maize producer in the East African region⁴⁸. It shares borders with four countries (Uganda, Tanzania, Burundi, and Democratic Republic of Congo) and is integrated in the regional East African Community. Two trade agreements dominate East Africa's regional trade system. The first is the East African Community (EAC) and the second is the Common Market for Eastern and Southern Africa (COMESA).

Food can flow relatively freely across the borders within the Eastern African Customs Union, which was established in 2005, although there are still some non-tariff trade barriers. Free flow of goods also applies to intra-regional trade although more exceptions apply, including a list of sensitive goods such as maize, wheat, and milk that are excluded from the tax exemption.⁴⁹

⁴⁸Lalui, Armin, External Trade Department, MINICOM. March 2013.

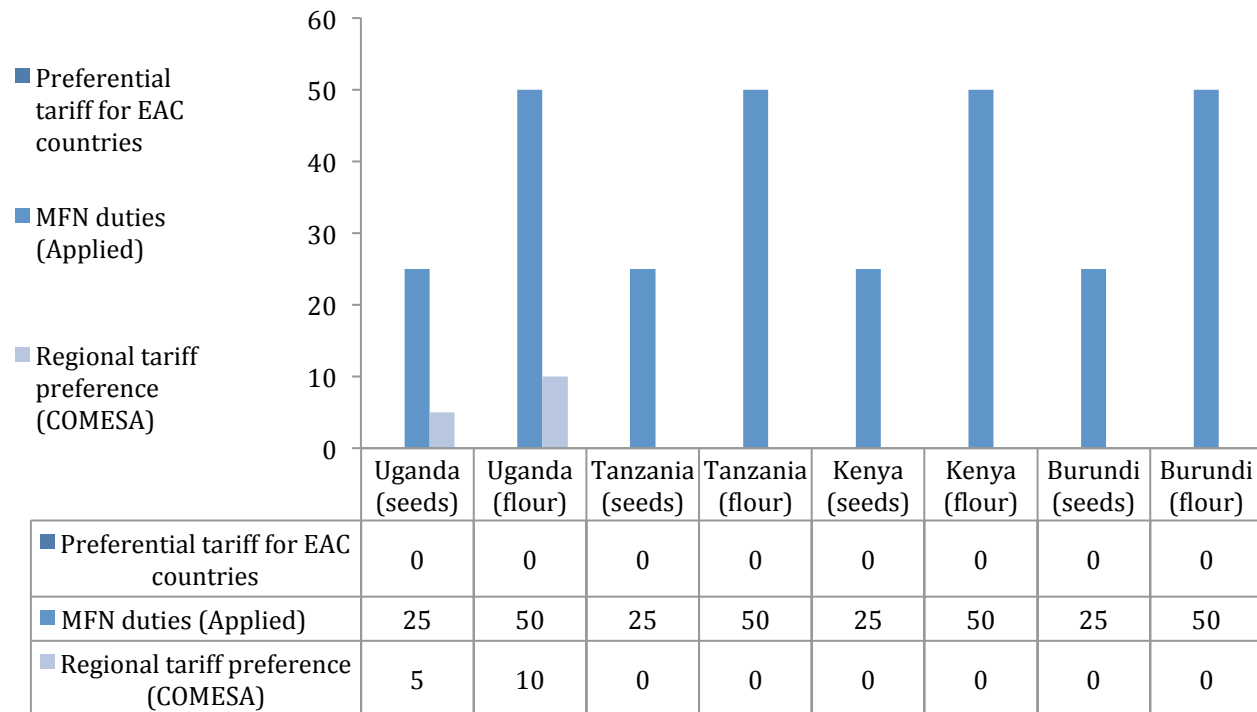
⁴⁹ Comprehensive Food Security and Vulnerability Analysis and Nutrition Survey, World Food Programme. December 2012.

Figure 8: Rwandan tariffs on EAC maize imports (% of value)



Source: ITC Trade Map, 2012

Figure 9: EAC country tariffs on Rwandan maize exports (% of value)



Source: ITC Trade Map, 2012

There is no maize tariff between EAC member states. However, all states impose Most-Favored Nation (MFN) duties of either 25 percent or 50 percent, along with COMESA regional tariffs around 5 to 10 percent on maize seeds and flour (for some)⁵⁰. In East Africa, Tanzania is the largest maize producer (average production: 4.7 million MT/year), followed by Kenya (2.7 million MT/year), Uganda (2.4 million MT/year), Rwanda (0.2 million MT/year), and then Burundi (0.1 million MT/year)⁵¹. To satisfy regional demand, maize has become one of the most traded commodities into and across East Africa. For example, the monetary value of the maize traded within the EAC has steadily increased from USD 13 million (2009) to USD 21 million (2011).⁵²

Regional Trade

The nature of the regional maize trade has varied depending on the direction of trade and the trading partner. There is significant informal cross-border trade about which there is limited data. As far as formal trade is concerned, the major external source of maize is Uganda (88 percent of all imports), followed by Tanzania (9 percent, mainly as grain) and Kenya. The main destinations of Rwanda's exported maize are the DRC (69 percent of all exports, mainly maize meal) and Burundi.⁵³

The stakeholders of regional trade in maize and maize meal include small informal traders who carry no more than 100 kg of maize meal per day across the border to commercial importers who purchase as much as 20,000 MT.⁵⁴ Both maize and maize meal is occasionally exported from Rwanda to Burundi and Uganda through formal and informal channels. The cross-border trade reflects the lack of barriers to trade at these crossing points, so that the trade is highly dependent on local demand and supply⁵⁵.

The majority of formally traded maize meal in Uganda and Tanzania is produced using roller-milling techniques. This produces two grades of maize meal (generally designated No.1, No.1.5 or No.2). The finest grade has an extraction percentage of just 60 percent, while the second grade is higher at 70 percent. By contrast, less than 20 percent of the maize meal produced in Rwanda is of this quality. Instead it is mainly produced by hammer mills, which can extract 90 percent or more of the grain as flour, albeit of lower quality.⁵⁶

The cost of producing meal through a hammer mill is at least 22 percent less than producing using a second grade roller meal⁵⁷. The result is that commercially imported maize meal from Uganda and Tanzania is less competitive in the Rwandan market, which is dominated by hammer mill production.

⁵⁰ ITC Trade Map, 2012.

⁵¹ EAC Study on the Review of the Common External Tariff Rates on Sensitive Items in the Partners States, MINICOM. March 2013.

⁵² Lalui, Armin, External Trade Department, MINICOM. March 2013.

⁵³ Rwanda Cross-Border Agricultural Trade Analysis, USAID. February 2013.

⁵⁴ Ujeneza, Noel, IFDC. March 2013.

⁵⁵ Rwanda Cross-Border Agricultural Trade Analysis, USAID. February 2013.

⁵⁶ Rwanda Cross-Border Agricultural Trade Analysis, USAID. February 2013.

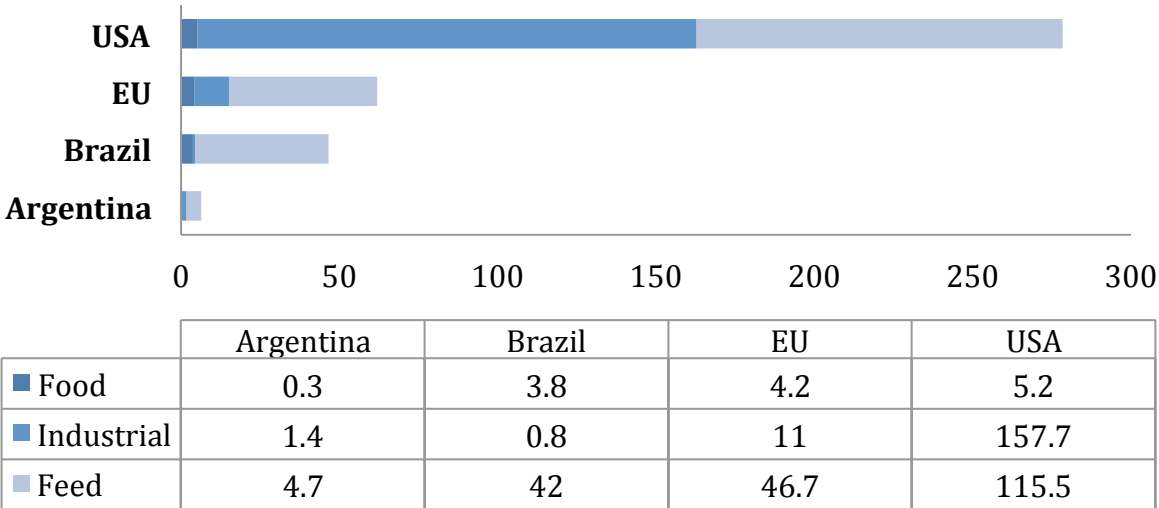
⁵⁷ Rwanda Cross-Border Agricultural Trade Analysis, USAID. February 2013.

1.10 Global Maize Production and Consumption

Maize is traded as a staple crop for food, for animal feed and for industrial use. Most of the increase in world maize production during the past decade can be attributed to rapid production expansion in Asia. Asian maize production grew by nearly 35 percent during the past decade, accounting for almost 30 percent of the global increase.⁵⁸ Both area and yield increases contributed to this high level of growth, with China making the most significant advances. It has contributed to as much as 60 percent of the total gains in Asian maize production over the past decade.⁵⁹

The chart below shows the differences in the use of maize (food, industrial, and feed) by large-scale producers in different regions. In 2011/12, a majority of the countries used the biggest portion of maize for animal feed, but the United States used the largest part of maize for industrial purposes.⁶⁰ Among the major maize producers, developing countries such as Argentina and Brazil tend to use maize mainly for animal feed and food. In these regions, a larger percentage of land area is dedicated to planting white maize, which is used for food consumption.⁶¹ However, developed countries such as the USA and EU states, generally use more maize for industrial purposes than developing countries.

Figure 10: Uses of Maize in Selected Countries in 2011/12 (million MT)



Source: Grain Market Report, International Grains Council, March 2013

Annual world production of maize in 2013 is forecasted around 860 million MT.⁶²The United States alone produces over 40 percent of the world’s supply, followed by China and

⁵⁸Abbasian, FAO 2010

⁵⁹Abbasian, FAO 2010

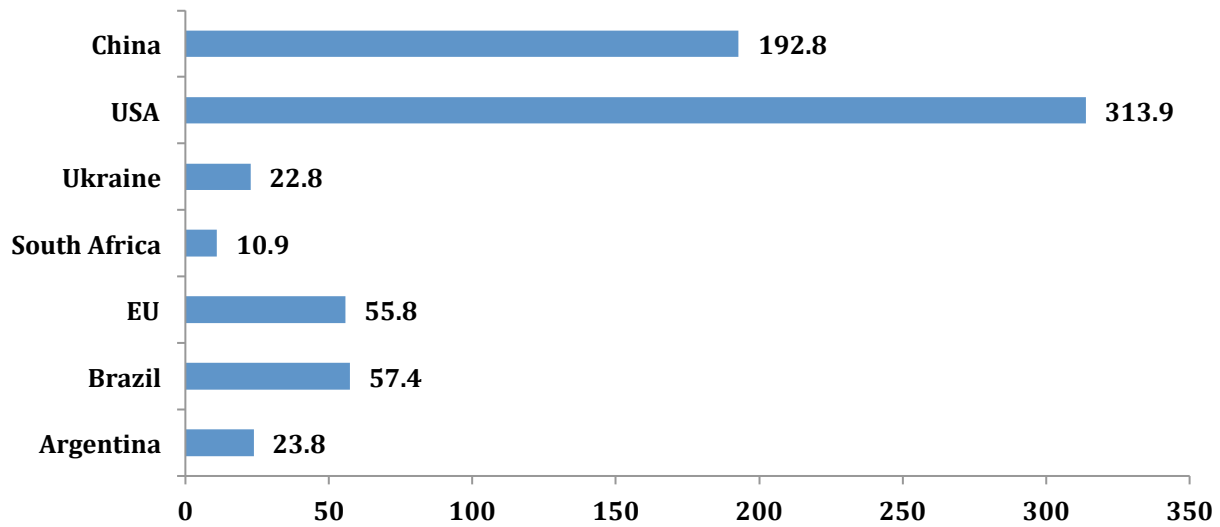
⁶⁰ International Grains Council, March 2013

⁶¹Addressing Food Security in Rwanda by Transforming the Maize Sector, Technoserve. Feb. 2010

⁶²World Grain Report.International Grains Council, March 2013

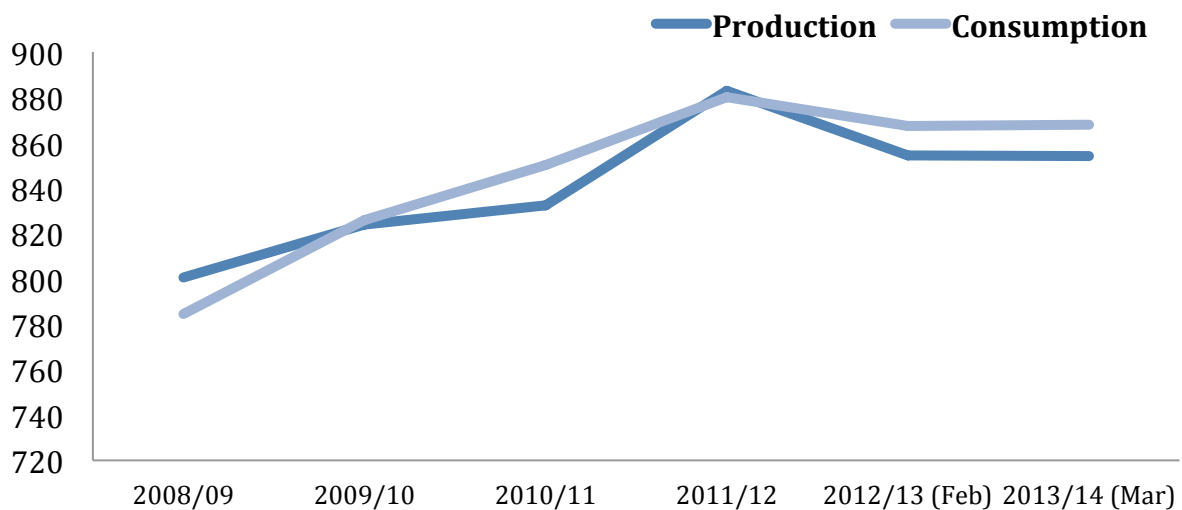
about 65 percent to 75 percent of total worldwide maize production is yellow maize, which is primarily used for animal feed, but in the developing world, maize is still a significant part of the human diet.⁶³

Figure 11: Largest maize producers (2011-2012) (million MT)



Source: Grain Market Report, International Grains Council, March 2013

Figure 12: Total world maize production and consumption (million MT)



Source: Grain Market Report, International Grains Council, March 2013

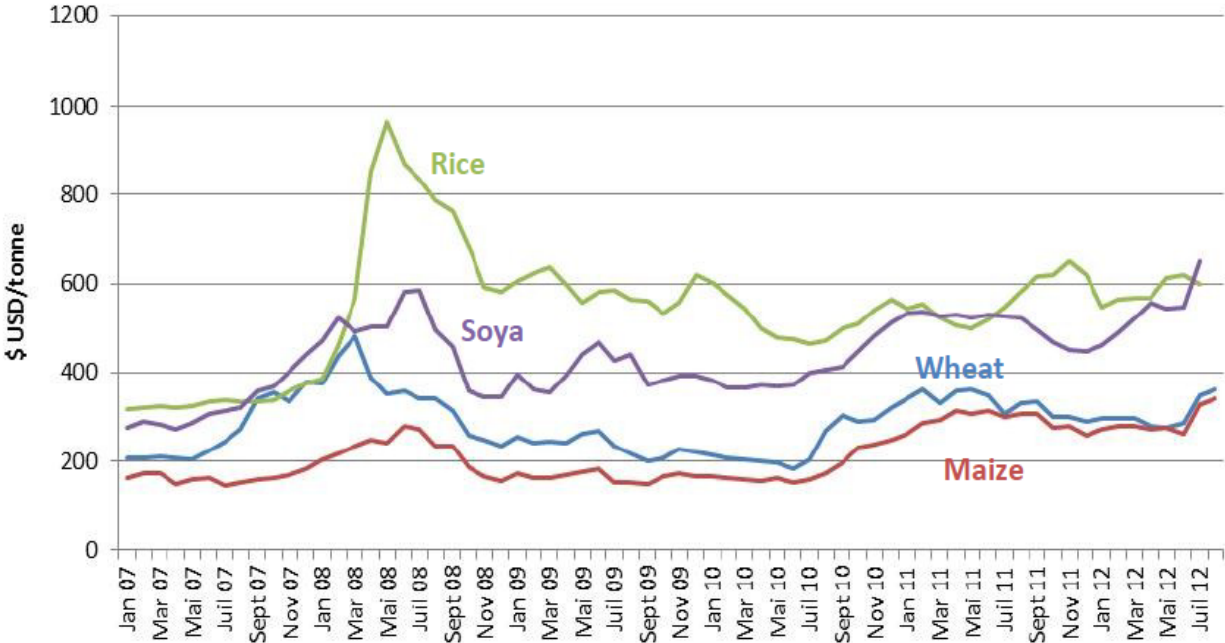
⁶³Addressing Food Security in Rwanda by Transforming the Maize Sector, Technoserve. Feb. 2010

The demand for maize in developing countries in 2020 is estimated to exceed the demand for both wheat and rice.⁶⁴ On average, per capita consumption of maize in urban areas is lower than in rural areas, primarily due to the higher diversity of food substitutes like rice and bread, but the maize farms in Western and Central Africa increased from 3.2 million hectares in 1961 to 8.9 million hectares in 2005, leading to a production increase from 2.4 million MT to 10.6 million MT, and this dramatic increase was almost exclusively driven by area expansion, not productivity increases – in fact, the average yield of maize production has remained very low in sub-Saharan Africa (approximately 1.3 MT per hectare) compared to those in developed countries (e.g., 8.6 MT per hectare in the U.S., 7.8 in Egypt, 5.0 in China).⁶⁵

1.11 Local, Regional and International Maize Market Prices

The international price of maize has increased by 100 percent in past five years. In December 2008, the price was near USD \$163 per MT, but in December 2012, it was USD \$329 per MT. A rapid increase of international prices occurred between June 2010 and March 2011.⁶⁶

Figure 13: Trends in International Prices (USD per MT)



Source: International maize price fluctuations, WFP, Aug. 2012

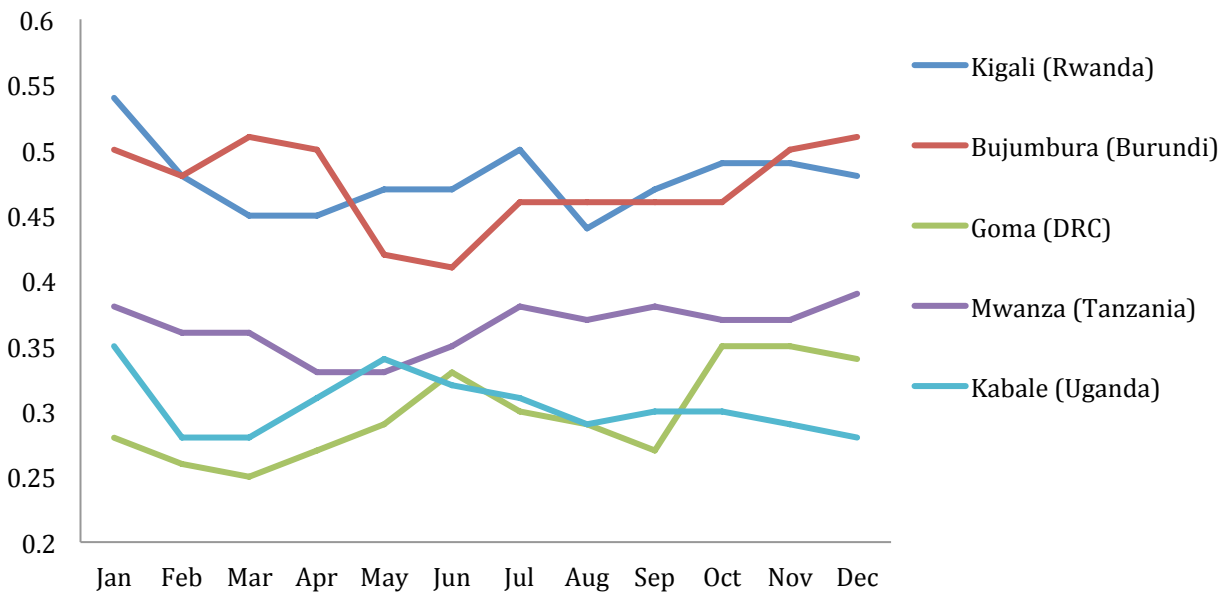
⁶⁴Cereal Knowledge Bank, International Rice Research Institute

⁶⁵Addressing Food Security in Rwanda by Transforming the Maize Sector, Technoserve. Feb. 2010

⁶⁶Maize price data based on U.S. Department of Agriculture, maize monthly price, IndexMundi

In the East African Community, imports of maize from Uganda and Tanzania are driven by lower wholesale prices, reflecting lower production costs. Although transport costs are substantial from the market in Mwanza (Tanzania) to Kigali (USD \$65 per MT), these costs are generally less than the product price differential.⁶⁷ Imports from Tanzania therefore remain feasible for most of the year. For Kabale (Uganda), however, prices are not only lower than those of Mwanza, but transport costs are lower still. Imports of maize from Kabale therefore remain viable through the year.⁶⁸

Figure 14: Average monthly maize flour price per city (2010-2012) (USD per kg)



Sources: FAO, InfoTrade Uganda; Rwanda eSoko; WFP

Average retail prices of maize flour in Rwanda, between 2010-2012 are higher than neighboring countries. The reasons for this are not clear and may include the fact that the exchange rate of Rwanda is relatively overvalued compared to the other countries.⁶⁹

Localized trade is subject to exchange rate fluctuations, which can favor the movement of maize in one direction or the other. Cross-border trade of this nature is common in Burundi and Uganda where areas adjacent to Rwanda are highly populated and share similar agro-ecological zones.⁷⁰

⁶⁷Rwanda Cross-Border Agricultural Trade Analysis, USAID. February 2013.

⁶⁸Rwanda Cross-Border Agricultural Trade Analysis, USAID. February 2013.

⁶⁹Lalui, Armin, External Trade Department, MINICOM. March 2013.

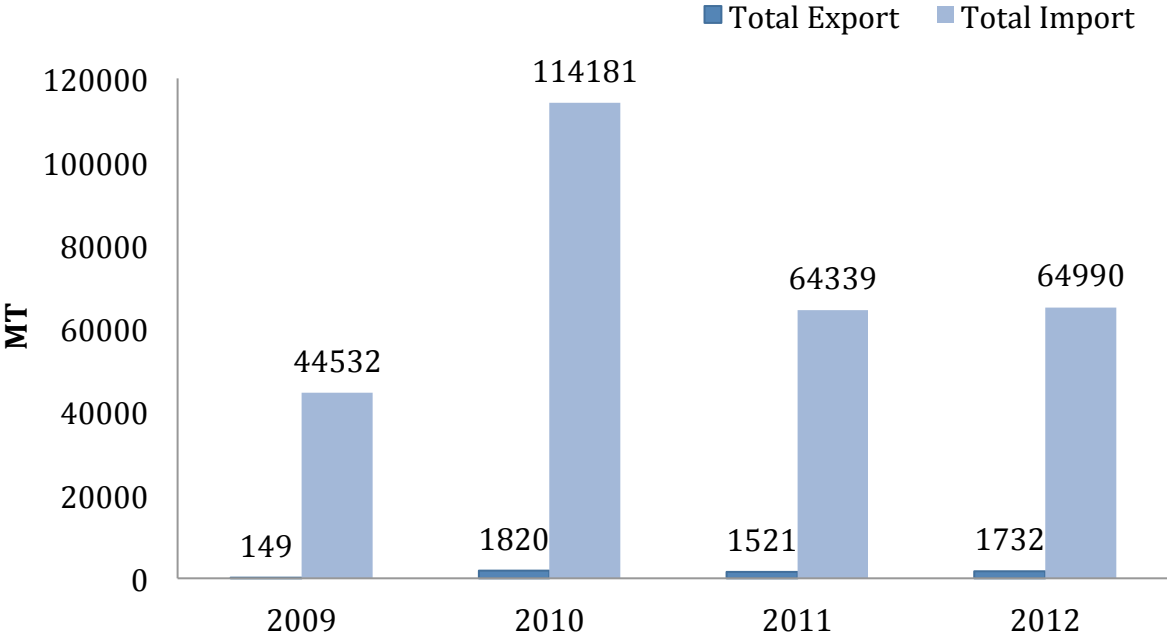
⁷⁰Lalui, Armin, External Trade Department, MINICOM. March 2013.

1.12 Maize Exports and Imports in Rwanda

Both imports and exports of maize grain have grown steadily since 2009, with Rwanda remaining a **net importer of maize grain** and a **net exporter of maize meal** (it is a net importer of total processed maize products including maize meal, animal feed, beer, and others). Most of the imports are grains, which are then processed and milled in Rwanda.⁷¹ Most countries in Africa are importers of maize. In recent decades, to satisfy growing consumption demand, SSA has become increasingly reliant on grain imports, which now account for at least 20 percent of the region’s supplies. Since the liberalization of trade in the 1980s and 1990s, the affordability of these grain imports have become sensitive to world prices. World prices have increased in recent years due to competition and reduced supply. This dependency, plus the region’s inability to reliably produce and distribute food, has exacerbated the food insecurity situation for half of the region’s population⁷².

There is an undeveloped market for quality maize seed in neighboring countries, especially in Uganda and Tanzania (the top two exporters of maize to Rwanda). Rwanda imports a substantial and consistent amount of maize grain and meal from Uganda and, to a lesser extent, Tanzania.

Figure 15: Official Cross-border Trade of Unprocessed Maize in Rwanda (MT)

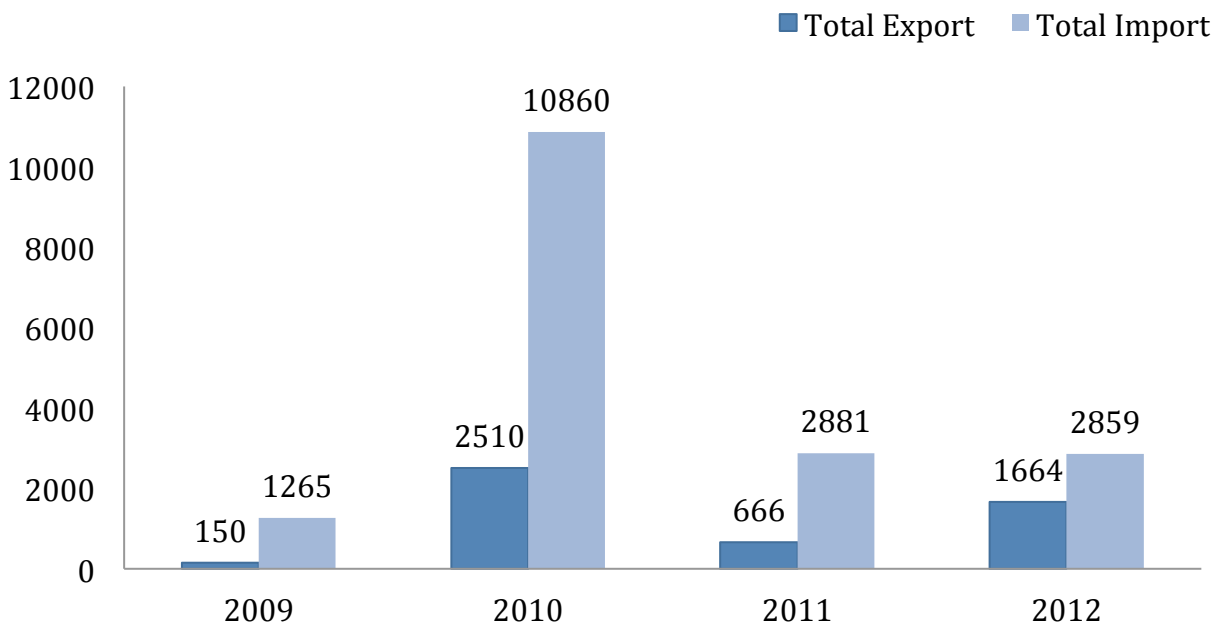


Source: Rwanda Cross-Border Agricultural Trade Analysis, 2013, USAID

⁷¹Nsemgiyumva, Francois, MINAGRI. January 2013.

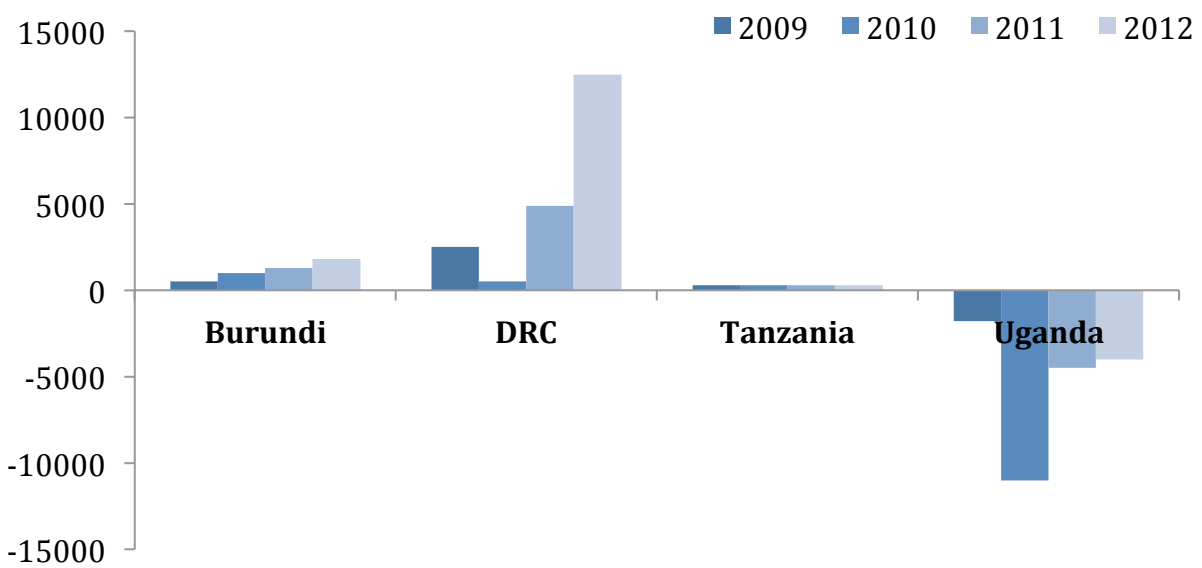
⁷²Addressing Food Security in Rwanda by Transforming the Maize Sector, Technoserve. Feb. 2010

Figure 16: Official Cross-border Trade of Processed maize in Rwanda (MT)



Source: Rwanda Cross-Border Agricultural Trade Analysis, 2013, USAID

Figure 17: Cross-border maize flour trade (2009-2012) (MT)



Source: Rwanda Cross-Border Agricultural Trade Analysis, 2013, USAID

The WFP's Purchase for Progress (P4P) Program, established in 2008, has supported domestic production to decrease imports from the US and other countries. WFP has acted as a catalyst for supporting domestic maize farmers and intervenes from the post-harvest process onwards. In 2012 they purchased 1,200 MT of maize for distribution in Rwanda only.⁷³ WFP also runs the Forward Purchase Facility (FPF), where maize is purchased regionally at a low price and sold to other countries for emergency preparedness. Rwanda is a supplier in this effort and contributed to the total 9,600 MT purchased by WFP. WFP Rwanda is a regional office for this program in partnership with MINAGRI⁷⁴.

Unofficial Trade

In general, the eastern portion of the DRC is currently Rwanda's largest regional export market, comprising more than two million consumers who are not well-supplied by their own domestic agricultural sector. The DRC has a high degree of urban concentration in the areas near Rwanda's border, and therefore represents the largest cross-border export market for Rwandan products. Having grown at an average rate of 50 percent since 2002, the DRC now consumes 70 percent of formal exports and 80 percent of informal exports from Rwanda.⁷⁵ MINICOM estimates that the market potential of the region is \$1.1 billion in North Kivu and \$1.2 billion in South Kivu, with \$387 million within Goma and Bukavu alone. Goma, in North Kivu, has an approximate population of 800,000 people and Bukavu, in South Kivu, 1 million.⁷⁶

Similarly, porous borders between Rwanda and Uganda and Burundi indicate short-term seasonal price fluctuations within the region. Informal traders in the border regions carry maize and travel as far as 30km on foot or by bicycle to purchase and sell⁷⁷. This can be a lucrative business, but it is based on seasonal price differences between the local markets in Rwanda and its neighboring countries, and is therefore intermittent.⁷⁸ Unfortunately, there is no official data or studies on the amount of this unofficial trade along the border. Almost all maize and maize meal entering Rwanda has been formally imported, with less than estimated 0.5 percent entering through informal channels. Conversely it is estimated that 54 percent of all exports have been through informal channels. Where informal trade is concerned, the DRC has the highest, with around 61 percent of all trade occurring informally.⁷⁹

⁷³Sheeran, Josette, WFP Rwanda, March 2013.

⁷⁴Sheeran, Josette, WFP Rwanda, March 2013.

⁷⁵Rwanda Cross Border Agricultural Trade Analysis, USAID/EAT. 2013.

⁷⁶ Addressing Food Security in Rwanda by Transforming the Maize Sector, Technoserve. February 2010

⁷⁷Lalui, Armin, External Trade Department, MINICOM. March 2013

⁷⁸Rwanda Cross Border Agricultural Trade Analysis, USAID/EAT. 2013.

⁷⁹Rwanda Cross Border Agricultural Trade Analysis, USAID/EAT. 2013.

2 Analysis of the Maize Value Chain

In an analysis of constraints to the development of the maize in Rwanda, the team has identified a number of challenges and opportunities. The following table summarizes all constraints, activities in progress and future recommendations identified, however key priorities (recommendations A-E) are discussed in detail below.

Table 3: Maize Value Chain Constraints and Recommendation Summary

#	Constraint	Actions Taken	Actions In Process	Recommendation (Future)
1	Limited cross-Ministerial visibility of the maize value chain.	Informal liaisons between the two ministries may exist.		A. Form MINICOM-MINAGRI integrated maize value chain working group to address the limited cross-Ministerial visibility of planning, investment and data collection.
2	High Post Harvest Losses (22 percent).	MINAGRI Post Harvest Taskforce w/ USAID exists.	MINAGRI Post Harvest Taskforce w/ USAID scheduled for termination	B. Continue to strengthen existing initiatives to foster maize co-operatives to reduce their post-harvest losses, increase yields and crop quality.
3	Individual farmers have limited market information.	Text Messaging program exists for farmers.		
4	Cooperatives have limited management and production capacity. No baseline data for quality exists.	Government support for cooperatives (incentives).	Baseline study of cooperatives in progress.	Determine implications of the termination of USAID program to MINAGRI capacity.
5	Limited access to long-term credit for cooperatives, and limited use of short-term credit by farmers.	Access to SACCOs have increased (farmers).		C. Address credit availability for both working capital and investment in the context of broader financial sector reforms.
6	Limited irrigation facilities and the high cost of construction of large-scale facilities.	Large scale construction of 9 irrigation facilities started.		
7	Seeds and fertilizers	Phase-out plan		

	subsidies are likely to be removed.	prepared.		
9	Limited product diversification.	Mix Sosoma currently produces vitamin enriched maize flour.	Minimex's exploring enriched corn maize blends.	D. Explore demand for additional value-added maize products (e.g. grits, bran, corn oil, ethanol, mixed flours, corn starch).
10	Limited implementation of certification standards by millers.	RBS Standards exist, processes in place for monitoring compliance.		E. Improve enforcement of certification requirement on processors and institutional buyers.
11	Production and consumption trade data inconsistencies exist.			Commission a review and analysis of all data gathered for consolidation and standardization.
12	Limited maize farm mechanization.	Ongoing efforts to increase mechanized process.		Conduct cost-benefit analysis of farm mechanization for value-add.
13	Limited agricultural insurance mechanisms.	IFC / WB / Earth Institute insurance project being explored.		Evaluate weather index insurance (IFC-WB, Earth Institute).
14	Limited information about the impact of maize development on the environment.	-		Study environmental impact of maize farming and consider shifting maize production growth to the Eastern province.
15	Infrastructure needs impact productivity		Action plans underway for improvements	Continue to address under existing programs.

2.1 Key Constraints

1. **Limited cross-ministerial visibility of the comprehensive maize value chain:**
Historically, MINAGRI has overseen the development of maize agricultural production while MINICOM oversaw the development of trade and industry. Within the maize value chain, MINICOM has been concerned with milling, processing, retail, wholesale and export components. Limited visibility exists regarding planning, strategies, actions, and budgets between the two Ministries due to poor communication. Full visibility of the value chain at a program level is needed in order to plan, prioritize, execute, monitor and evaluate the development of the comprehensive 'end-to-end' maize value chain.

A. Recommendation: Form MINICOM/MINAGRI integrated agricultural value chain working group. Appoint high-performing staff from both ministries to form a working group that will integrate knowledge-sharing, planning, execution, and escalate and communicate challenges on either end of the value chain. Empower the team with the appropriate resources and decision-making power.

2. Post-harvest losses, limited market information, and management and production capacity challenges:

- **High post-harvest losses:** Poor post-harvest drying and storage facilities account for a loss of about 22 percent of the total maize produced.⁸⁰ USAID and MINAGRI have conducted post-harvest storage programs that have greatly reduced losses in participating cooperatives, yet the problem remains for a majority of Rwandan farmers.
 - *Labor:* Skilled manual labor is needed at various stages of production including the shelling and cleaning stages to ensure minimal losses and that maize bags do not contain impurities.
 - *Drying Facilities:* While some farmers within co-operatives such as COVAMIS may have access to drying centers in their communities, others do not.⁸¹ At the drying centers, co-op members are able to store their crop for about three months in protected shelters. For those outside the co-ops, drying takes place at home under tarps and in trees. This makes the maize highly susceptible to consumption by birds and rodents, being blown by wind, and damage from rain. This often results in grains with high moisture content making the maize susceptible to mold and discoloration.⁸²
 - *Storage bags:* Finally, USAID estimates that 90 percent of Rwandan farmers store their crop in ordinary bags. Since these bags are not airtight and do not include pesticide, they also result in a high moisture content and have the potential to rot.
- **Individual Farmers (outside of cooperatives) have limited market information:** Cooperatives who sell directly to millers have good price information and market linkages, however farmers outside of these groups do not appear to be taking advantage of price information provided by MINAGRI.⁸³ Farmers are currently receiving larger returns on maize than traditional

⁸⁰Interview with Bruce Smith, Post-Harvest Storage Task Force.

⁸¹Nasho Field Visit. March 2013.

⁸²Ibid.

⁸³Ibid.

crops.⁸⁴ Ideally, farmer cooperatives would gain enough information on price and production information to select the most valuable crop themselves. This information is out of reach as many farmers are delinked from markets and lack familiarity with certain crops to determine potential opportunities.⁸⁵ A text-message system exists that allows farmers to see what prices their products reach at market, however its reach is limited and has proven cumbersome for some farmers to navigate.⁸⁶

- ***Cooperatives have limited management and production capacity.*** Cooperatives are a relatively new concept in Rwanda. Cooperatives coordinate farmers and facilitate technical assistance efforts, which make it easier for farmers to secure linkages with millers.⁸⁷ At the same time, market-oriented cooperatives guide farmers away from subsistence agriculture and encourage them to provide higher quality maize. Much work has been done in developing the 348 maize cooperatives currently legally registered.⁸⁸ However, cooperatives are of varying quality and not all are effective.
 - *Capacity:* Many have limited management (contracting, investment) and production (post-handling, technical assistance to farmers) capacity. This can result in a lack of contract fulfillment.⁸⁹ Many also remain unregistered as a legal entity to carry-through on contracts.⁹⁰
 - *Product Quality:* Maize cooperatives need to be carefully vetted to address other stakeholder's concerns regarding quality. Notably, millers have expressed difficulty interacting with cooperatives that fail to deliver adequate quantities of kernels or that have disconnects between representatives and members.⁹¹

An independent study is underway by the Rwandan Cooperative Authority (RCA) to categorize all cooperatives according to performance.⁹² This study will constitute a baseline to be regularly updated in the future.

B. Recommendation: *Continue existing initiatives to strengthen co-operatives to improve post-harvest handling, increase yields and crop quality; and determine impact of termination of USAID program.* The organization of farmers into cooperatives has been effective in overcoming a number of constraints and should

⁸⁴ Ibid.

⁸⁵ Interview with Armin Lalui, MINICOM.

⁸⁶ MINAGRI. March 2013.

⁸⁷ Mugabo, Damien. RCA. March 2013.

⁸⁸ Mugabo, Damien. RCA. March 2013.

⁸⁹ Ibid.

⁹⁰ Mansell, Claude. Minimax. March 2013.

⁹¹ Nasho Field Visit. March 2013.

⁹² Mugabo, Damien. RCA. March 2013.

continue. The current study underway will provide important information on where to drive further cooperative capacity building. Post-harvest storage has been a priority for USAID and MINAGRI, however, USAID's *Sell More for More* post-harvest program will be completed in 2013 and therefore it will be important to determine implications of the termination of USAID program to MINAGRI capacity.

- *Training:* Strengthening cooperatives through training and access financing to invest in shared mechanization and post-harvest storage facilities are particularly important.
- *Grain Bags:* Research needs to be done to identify less expensive options for air-tight grain bags with pesticide.⁹³
- *Price Information:* Price information should be readily accessible for maize farmers both on an individual basis and through the cooperative. Further analysis needs to be done on other successful text-message market information programs in order to increase the reach and uptake of these services to all farmers. In the short-run, cooperatives could be linked with traders and millers to secure stronger ties to maize markets. Additionally, this information could be physically posted in central locations at cooperatives as opposed to requiring a complicated navigation of a text message system.
- *Diversification:* While mono-cropping is encouraged by MINAGRI, cooperatives should also be encouraged to experiment with other crops in very small plots of land. The returns on these crops should be broadcasted to other farmers within the cooperative so that farmers acquire familiarity with new crops and a sense of what returns they can bring. Over time, cooperatives will be mature enough to select high-value crops on their own.

3. Limited access to long-term credit for cooperatives, and limited use of short-term credit by farmers. Removal of seeds and fertilizer subsidies

- *Millers – working capital:* While credit is available to finance equipment, Minimex, the largest individual maize producer in Rwanda, is unable to produce at full capacity due to limited access to working capital to purchase inputs. In 2012, Minimex operated at 30 percent capacity and expects to reach 40 percent capacity in 2013.⁹⁴ They lacked the capital required to bring in the maximum quantity of maize for storage during the high seasons. AMIRWA reported that its biggest constraint is access to operating capital and inputs. This limitation on credit may also limit the opportunity for expansion with smaller millers seeking to diversify their product mix through the purchase of costly equipment.

⁹³Bruce Smith, MINAGRI. March 2013.

⁹⁴Mansell, Claude (MINIMEX). March 2013

- *Farmers – low utilization of credit:* Among farmers, Saving and Credit Cooperatives (SACCO's) have greatly improved access to finance in Rwanda.⁹⁵ SACCO's offer credit to individual farmers and are present in almost every district of Rwanda. Interest rates from interviewees averaged around 18 percent for individual farmers.⁹⁶ However, while access to credit has expanded, many Rwandan farmers are not taking advantage of it. Some observers attribute this to a lack of understanding as to the opportunities of credit.⁹⁷ Farmers shifting from subsistence farming to a commercial outlook has taken time. However, reluctance to take credit may be perfectly rational response of farmersto uncertainty. The constraints on the demands for credit by farmers need to be better understood but reducing uncertainty will clearly help. Farmers interviewed indicated a hesitance to accessing credit due to fears of over indebtedness. Finally, interviews in Nasho district revealed that many farmers *do* take out loans to pay for fertilizer (50 percent of which is subsidized by the government). These loans often remain unpaid. The reason for this lack of repayment is unclear but may be driven by a lack of understanding of financial products.
- *Cooperatives –Long-term credit:* Interviews suggested that some cooperatives make use of credit to buy maize from their members, but less so to improve storage facilities or improve infrastructure. This indicates a lack of use of longer-term credit for more significant investments. This may be because while SACCOs have reached out into the rural areas of Rwanda (91 percent of adults live within a 5 km radius of a SACCO)⁹⁸, formal financial institutions, more able to meet the longer-term and larger credit needs of cooperatives, have not reached this population yet (60% of adults live within a 5km radius of a bank).⁹⁹ In addition, cooperatives are relatively nascent in Rwanda and taking on credit requires a level of sophistication in terms of management capacity.
- *Seed and fertilizer subsidy phase-out:* MINAGRI is planning a phase-out of input subsidies for farmers. The phase-out of seed and fertilizer subsidies underway poses a risk for farmers' ability to pay for these critical inputs.

C. Recommendation: Address credit availability for both working capital and investment in the context of broader financial sector reforms in Rwanda, ease removal of seed subsidy. Access to finance needs to be improved at the individual farmer level, at the cooperative level (assuming high quality cooperatives that can handle credit), and at the miller level. Analysis must be done to understand the level of reach of formal banks and the reasons that cooperatives are not accessing finance. Closing this gap would enable cooperatives to make long-term investments

⁹⁵Finmark Trust, Finscope, 2012, pg. 3

⁹⁶ Nasho field visit.

⁹⁷Ibid, pg. 4

⁹⁸Ibid, pg 21

⁹⁹Ibid, pg 21

in their members and in post-harvest handling. It will be important to investigate options to increase access to affordable financing mechanisms to enable maize millers to upgrade their technology and equipment and purchase maize in bulk for processing. This credit issue becomes particularly important given the planned transition away from subsidies to private seed and fertilizer distribution. An analysis of regional prices for seeds and fertilizers must be made in order to determine if the best prices are being achieved in Rwanda. The flow of high quality seeds to maize producers must not be interrupted, and subsidies for seeds and fertilizer should be gradually phased out to minimize disruptions.

4. Limited Product Diversification: Aside from Minimex, most Rwandan millers produce principally flour and bran. Minimex obtains much higher levels of value addition by producing grits which it sells to beer breweries. Greater product diversification would allow millers to produce more valuable products and more profitably use every part of a maize kernel.

D. Recommendation: Explore demand for other maize products in Rwanda: A regional market analysis of demand for other maize products must be done to identify potential products for expansion. These may include, but is not limited to: fortified flours, maize oil, cornstarch, mixed flours, and ethanol. Proposing specific products for diversification is beyond the scope of this study, but the opportunity should be further explored.

5. Limited implementation of certification standards: Though maize is a product that is certified by the Rwanda Bureau of Standards (RBS), its reach is limited. Currently, Minimex is the only certified maize meal producer and the WFP is the only buyer that requires certified maize meal. This combined lack of certified millers and lack of market demand for certified product results in highly variable quality of maize meal. This carries its way throughout the value chain with traders then not being driven by quality in their purchases and farmers also lacking a focus on quality.

E. Recommendation: Improve enforcement of certification requirements on processors and institutional buyers. While maize standards exist, there is an opportunity to improve the quality of dried maize produced by farmers and subsequently, the maize products produced by millers. To achieve this, enforcement of current RBS standards to address storage, food safety, pest control grievances, and other quality issues are necessary especially for smaller millers. Additionally, incentives for higher quality products by millers may be beneficial in improving quality all the way through the value chain.

2.2 Secondary Constraints

Limited maize farm mechanization: Mechanization saves labor for farm owners, but does not strictly add value to their product and will result in lower employment for farmhands. 90 percent of Rwandan farmers do not use mechanized tilling and planting equipment and transportation vehicles to move goods to drying facilities and markets. Interviews with farmers in Nasho region who had access to machinery such as planting machines indicated that while these machines are expensive to rent, they increase farmer profits and are widely used where available. They were preferred to using manual labor for financial reasons as well as quality. Sixteen village mechanization service centers offer rental and maintenance facilities for farm machinery, but it is estimated that there is a need to invest USD \$60 million to achieve the MINAGRI goal of reaching 45 percent of farmers by 2017.¹⁰⁰

Recommendation: Conduct cost-benefit analysis of mechanization: A full cost-benefit analysis of different levels of mechanization for maize farming is recommended. Mechanization benefits are offset by the fact that it can reduce employment on a net basis. A balance between these two effects is required.

Limited agricultural insurance mechanisms: Most Rwandan farmers still practice subsistence farming, growing several different crops in the same field. This is an effective insurance strategy against crop failure, but it does not link farmers with markets and does not allow farmers to capitalize on producing more valuable crops. The CIP has therefore advocated for land consolidation resulting in joint production of a single crop through farmer cooperatives. However, the lack of insurance opportunities may drive cooperative members to some level of multi-cropping of their fields in the future which may decrease overall production.

Recommendation: Evaluate weather index insurance (IFC-WB, Earth Institute): Mono-cropping opens farmers to greater risks than multi-cropping. Recently created weather-based insurance schemes could provide a possible model for insurance for Rwandan farmers.

Limited information about the impact of maize development on the environment: There remains little in the way of data and studies to show the impact of the increased agricultural production on the environment. The FAO estimates that 40 percent of Rwanda's land faces significant soil erosion threat due to steep inclines and 37 percent require soil retention measures.¹⁰¹ MINAGRI has sought to alleviate this concern by moving maize production to flatter areas in the East. Rwandan soil is often acidic and due to intensive utilization can be depleted without organic fertilizer use.¹⁰²

¹⁰⁰ Interview, MINAGRI Mechanization Task Force.

¹⁰¹ Rwandan Environmental Management Authority Report, Ch 3 p 10

¹⁰² Enviro Report, Ch 1 p12

Recommendation: *Study environmental impact of maize farming and consider increasing share of maize production in the Eastern province:* Due to soil erosion, it may be beneficial to further promote maize production on flatter terrain, particularly in the East. MINAGRI should also attempt to measure the impact of soil erosion on production to assess this and other environmental threats.

Infrastructure needs impact productivity: Rwanda's cost of doing business remains high due to the high transport and energy costs and poor national and regional connectivity. As a consequence, the private sector has yet to play its expected role as a growth driver.¹⁰³ Many millers and traders interviewed, cited the unstable electricity supply (particularly outside of Kigali), and poor physical and financial infrastructure as key issues impacting their bottom lines. There are growing efforts from the government to upgrade these different infrastructure sectors, however stakeholders agree that it is a still long way ahead.¹⁰⁴

Recommendation: *Continue transportation and electricity development.* The government of Rwanda has highlighted transportation costs and unreliable electricity as key challenges to industrial development. These challenges are high on the government's list of priorities and should remain so.

¹⁰³<http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Rwanda%20-%20CSP%202012-2016.pdf>

Appendix

Profit Distribution Detail (Prices, RWF)

Farmers	Coop	Worst Case
Yield per hectare (KG)	4000	500
Fertilizer price (/kg)	600	600
Fertilizer use (/hect)	100	0
Seed Price (/kg)	450	450
Seed Use (/hect)	25	25
Wage/day	0	0
Planting Machine	70000	0
Irrigation Capital Cost	7000000000	0
Post harvest losses	15.00%	24.00%
Costs per kg		
Fertilizer	15	0
Seeds	2.8125	22.5
Planting Costs	0	0
Post Harvest Losses	0	0
Irrigation Capital Cost	0	0
Total Cost (kg)	17.8125	22.5
Revenue	200	200
Profit	182.1875	177.5
Traders		
Kg per day	80000	
Price of Truck	21000000	
Years of Use	6	
Costs per kg		
Fuel	10	
Truck Capital Cost	0.168269231	
Kernels	200	
Total	210	
Revenue	220	
Profit	10	

Millers	AMIRWA	MINIMEX
% Processed to Flour	66.60%	50.00%
% Residue	33.33%	0.00%
% Processed to Bran	0.00%	30.00%
% Processed to Grits	0.00%	20.00%
Capacity per month	150000	3583333
Utilization	100.00%	60.00%
Kernels Milled / month	150000	2149999.8
Fixed Cost/ month	525833.33	80000000.00
Price of Flour/kg	360.00	400.00
Price of Bran/kg	100.00	100.00
Price of Grits/kg	400.00	400.00
Price of Residue/kg	60.00	60.00
Costs per kg		
Kernels	220.00	220.00
Packaging	10.00	9.30
Electricity, Water	0.01	10.23
Fixed Costs	0.00	0.00
Total Cost/kg	230.01	239.53
Revenue from flour	239.76	200.00
Revenue from Bran	0	30
Revenue from Grits	0	80
Revenue from Residue	19.998	0
Total Revenue/kg	259.758	310
Total Profit/kg	29.75	70.47

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