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MOZAMBIQUE'S NATURAL RESOURCE BOOM

What Potential Impacts on Agriculture's Competitiveness?

FINAL REPORT

OCTOBER 2014

This publication was produced for review by the United States Agency for International Development. It was prepared by DAI and Nathan Associates.

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What Potential Impacts on Agriculture's Competitiveness?

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Program Title:	***Mozambique Support Program for Economic and Enterprise Development (SPEED)***
Sponsor:	***USAID/Mozambique***
Contract Number:	***EDH-I-00-06-00004-00/13***
Contractor:	***DAI and Nathan Associates***
Date of Publication:	***October 2014***

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Acknowledgements

This report was prepared for the *Confederação das Associações Económicas de Moçambique* (CTA) by USAID/Mozambique's Support Program for Economic and Enterprise Development (SPEED).

The authors wish to thank all representatives of the Mozambican government, private sector, research and education, and international organization communities who took the time to share information with us regarding agricultural value chains and competitiveness in Mozambique. A complete list of interviews held can be found in Annex A.

Acronyms

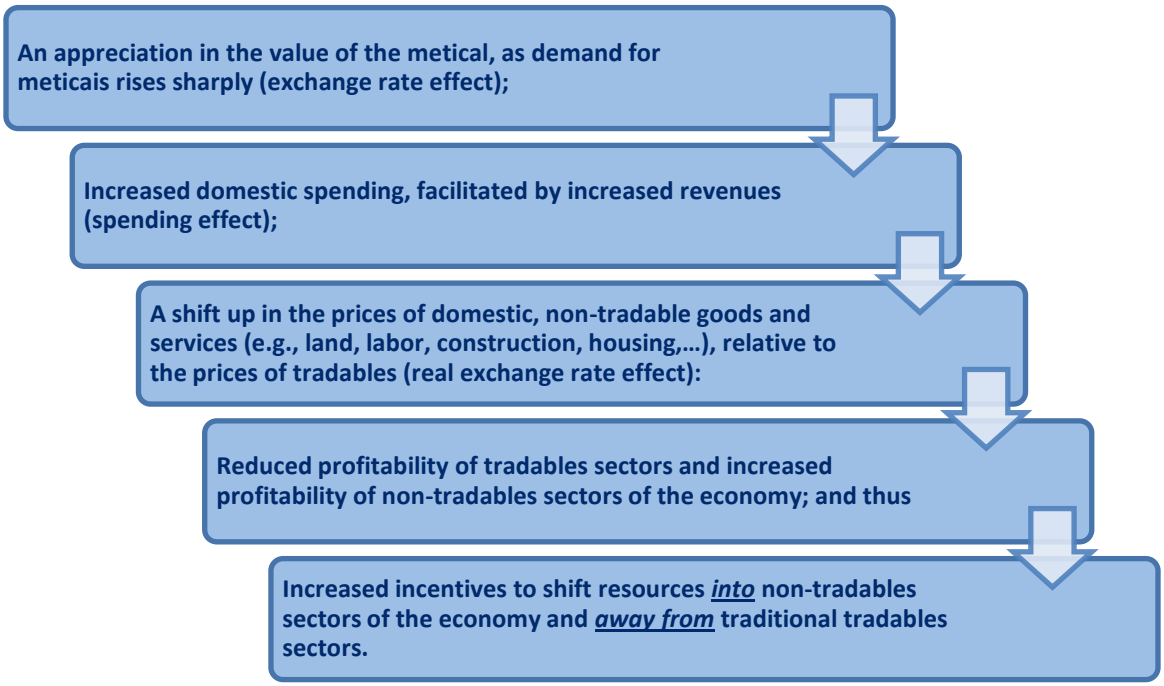
AIM	*Agência de Informação de Moçambique* (Mozambique News Agency)
CAADP	Comprehensive African Agriculture Development Program
CEPAGRI	Commercial Agriculture Promotion Center
CTA	*Confederação das Associações Económicas de Moçambique* (Confederation of Business Associations in Mozambique)
DUATs	*Direito de uso e aproveitamento da terra* (Rights of land use and exploitation)
FAO	Food and Agriculture Organization of the United Nations
HICEP	*Hidráulica do Chokwé Empresa Pública*
IAI	*Inquérito Agrícola Integrado* (Integrated Agricultural Survey)
IAM	*Instituto de Algodão de Moçambique* (Mozambican Cotton Institute)
IIAM	*Instituto de Investigação Agrária de Moçambique* (Mozambican Institute of Agrarian Research)
IMF	International Monetary Fund
INE	*Instituto Nacional de Estatística* (National Institute of Statistics)
IRRI	International Rice Research Institute
JFS	*Grupo João Ferreira dos Santos* (JFS Holding)
LNG	Liquefied natural gas
MT	Metical
NEP	Net economic profitability
PEDSA	Strategic Plan for Agricultural Development
RBL	*Empresa Pública do Regadio do Baixo Limpopo*
RSA DAFF	Republic of South Africa, Department of Agriculture, Forestry, and Fisheries
SADC	Southern Africa Development Community
SIMA	*Sistema de Informação de Mercados Agrícolas de Moçambique* (Agricultural Market Information System of Mozambique)
SPEED	Support Program for Economic and Enterprise Development
TIA	*Trabalho de Inquérito Agrícola* (Agricultural Survey)
USAID	United States Agency for International Development

Executive Summary

Mozambique has consistently figured among the top ten African countries, ranked by economic growth rates, for over a decade. Prospects indicate this will be sustained in the coming years, fueled by the natural resource boom. How can this opportunity be capitalized upon so as not to jeopardize the livelihoods of 80 percent of the population who rely on the agriculture economy? What could the boom mean for the smallholder farmer growing rice in Xai-Xai, cotton in Niassa, tomatoes in Moamba District, soybeans in Zambezia, or to the Mozambican and foreign agribusinesses and agro-partnerships engaged in plantation agriculture, such as bananas for export? What would a worst-case Dutch disease scenario look like, and how might its worst effects be mitigated?

Stimulated by the questions above, the Support Program for Economic and Enterprise Development (SPEED), a program of the U.S. Agency for International Development, and its partner, the Confederation of Business Associations in Mozambique (CTA), have launched a suite of studies that explore the potential impacts of the natural resource boom on currency appreciation, competitiveness, the Mozambican labor market, and its core, traditional, tradable economic sectors, namely, agriculture, tourism, and manufacturing.

Early work done by SPEED underscores the real potential for the expected sharp rise in exports of natural gas, added to rapidly growing exports from other extractive industries (coal, heavy sands, minerals), to lead, inter alia, to



Mozambique's resource base encompasses not only minerals and energy products, but also arable lands, river systems, and normally benevolent, but sometimes unpredictable, climate. Its agricultural potential, highly touted in strategies and action plans, has encouraged investors to contribute their capital, technology, production know-how, and export market linkages to expand, innovate, and improve agricultural horizons in Mozambique.

Whether Mozambique's farmers grow foods for domestic consumption in substitution for imports or produce commodities for sale across borders or across seas, the incentives they face are strongly affected by economic forces, some local and some that occur beyond Mozambique's borders. Three factors – (1) exchange rates of the metical with global currencies, (2) regional and international market prices, and (3) domestic costs of production – influence the incentives faced by Mozambican farmers and whether locally, regionally, or globally produced foods will be consumed in Mozambican households or sold in regional and global markets.

Five agricultural value chains – bananas, cotton, rice, soybeans, and tomatoes – are explored here, selected with input from agricultural private sector representatives as examples of what might happen in the case of strong appreciation of the metical in the wake of the natural resource boom. Two (bananas and cotton) are mostly grown for export, two (rice and tomatoes) are fundamental foods in Mozambicans' diets that are imported to meet the shortfall in domestic production, and the fifth – soybeans – is a rapidly growing crop that is grown, at present, as a feed input for poultry operations.

Value-chain summaries are presented for each of the five commodities, exploring production, processing, markets and trade, cost structure and drivers, and profitability analyses. These latter are conducted first in "financial" terms, that is, seen from the perspective of the producer, considering only the financial costs that she or he incurs in the growing and marketing of each crop, valued at the prices that she or he actually pays. Family labor, in the financial profitability analysis, is thus valued at zero. Profitability is also estimated in "economic" terms, i.e., valuing all factors of production and intermediate inputs at their opportunity costs and net of any taxes or subsidies that may be applicable. In the economic analysis, family labor is valued at prevailing market wages. The analysis also looks at sensitivity of results from a) 50 percent strengthening of the metical, from 30 MT/$ to 20 MT/$,[1] and b) a scenario that combines the metical appreciation with an improvement in farm-level yields. Results are summarized below.

Economic Cost-Benefit Ratios (Base Case, Exchange Rate, and Yield Simulations)

		Economic Profitability		
	Reference Market	Base Case (Yield)	@ 20 MT/$	@ 20 MT/$ with Yield Increase
Bananas	CIF Europe	0.40 (40 T/ha)	0.52	0.44 (52 T/ha)

[1] At 30 MT/$ one metical equals 0.033 USD. Appreciation to 20 MT/$ means that one metical equals 0.05 USD. The increase in value is thus 50 percent (0.05/0.03333 = 1.50). This is a "worst-case" scenario that proxies a range of possible Dutch disease-type impacts on the nominal exchange rate, government spending, levels of domestic prices of non-tradable goods and services, and thus the real exchange rate.

Cotton	FOB	0.67 (0.7 T/ha)	1.01	0.79 (1 T/ha)
Rice	Maputo	1.41 (4 T/ha)	1.74	0.98 (9 T/ha)
Soybeans	Entry, feed mill	0.71 (1.2 T/ha)	0.96	0.81 (1.5 T/ha)
Tomatoes	Maputo	0.43 (40 T/ha)	0.51	*Not needed*

Source: Study Team Analysis

As seen in the table above, the base case analysis suggests that bananas, cotton, soybeans, and tomatoes are economically profitable (economic cost-benefit ratios are less than 1.00) at current costs, yields, and world prices, whereas rice is not (cost-benefit ratio is 1.41). However, should the metical strengthen to 20 MT/$, cotton and soybeans look vulnerable (cost-benefit ratios very close to 1.00) and the negative economic profitability of rice is accentuated. The combination of a stronger metical with a 25-45 percent increase in yields restores economic profitability to cotton and soybeans; however, more than a doubling of yields (to 9 tons of paddy rice per hectare) is required in rice, all else equal, to compensate for the metical's simulated appreciation.

Earlier analysis by Salinger and Ennis (2014a) suggested that labor market segmentation is sufficiently strong to prevent upward pressure on wages in the rural sector. Thus, no simulations were undertaken of an increase in rural labor's economic price. However, high costs of logistics (transport, port charges) and inefficiencies in agro-processing (cotton, rice) are also concerns.

Analysis of this kind is useful to highlight the potential resilience or vulnerability of these five commodities to possible Dutch disease pressures. Particularly for rice, cotton, and soybeans, the analysis underscores the importance of raising yields in order to be able to withstand possible macroeconomic shocks. Improvements in cotton ginning and rice milling technologies to improve processing yields and thereby reduce costs would also improve competitiveness. Bananas and tomatoes, on the other hand, appear to be quite resilient to exchange rate shifts. However, they face their own competitive threats, from pests and disease and high export logistics costs (bananas) and significant import competition from more competitive South African producers (tomatoes), aided by a depreciating rand.

This work has also surfaced the importance of a number of policy questions that affect dimensions of competitiveness, although since they are not directly related to the natural resource boom they are not the explicit focus of this study. These include:

- How do **land markets** work today in Mozambique, especially in the face of rising interest from foreign investors and especially in Mozambique's highly prized, irrigated land areas; what land use rights institutions provide the right balance of user protections and incentives to invest in higher value-added agriculture?
- What is the productivity of labor in Mozambique, by sector, how does it compare with the **official minimum wage in agriculture** and market-determined rural wage rates? What impact does the official minimum wage for agriculture have on the availability of wage labor, employment, migration, and actual wages paid to rural workers?
- What more can be done to encourage the **use of improved inputs** by farmers? What role could agrocprocessors, such as rice mills and cotton ginning companies, play a more

active role to contract with farmers and act as an extension services and input dealer intermediary?

- While "land grab" stories have claimed plenty of international attention, a more serious look at, for example, the role of Chinese assistance in African agricultural development (Brautigam and Ekman 2012) paints a very different picture of government-led development seeking technical assistance from Chinese companies to raise technological ceilings of crop agriculture. How to assure **balanced reporting regarding the role of foreign investors** in Mozambican agriculture today?
- What is the **appropriate formula for setting local producer prices**? In Mozambique, most commodity prices are market-determined. However, in the case of cotton, producer prices are set using a formula that takes recent world cotton lint prices into account. Without incorporation of a futures price, and with producer prices fixed per growing season, ginning companies bear the risk of a commodity price drop during the season (as described by Tshirley et al. 2009 regarding West African cotton sectors in 2004).
- **Improved post harvest technologies** for harvesting, threshing, drying, and storage will improve the quality of stored grain and thus increase the likelihood that agro processing facilities will be able to use locally sourced, rather than imported, raw materials. More work is needed to understand to what extent these bottlenecks arise from policy, infrastructure, legal/business environment, and/or technology constraints.
- **Infrastructure** constraints are well-recognized, not only in Mozambique, but across Africa. It could be useful to develop a grid to aid decision makers in prioritizing infrastructure investments by highlighting those arable zones of the country with greatest potential for agriculture whose potential goes unfulfilled due to insufficient road density.
- Mozambique depends on **trade for food security**. In some cases, this is to bring needed foods in from global markets (rice) or from countries in the region (maize, some horticulture). In some cases, food security is enhanced by exports, allowing producers to earn income through sales of cash crops (bananas, cotton). In yet other cases, diversifying into new cash crops (soy) is dependent on vigilance against unfair trade practices to ensure that Mozambican food producers (poultry) are not faced with unfair competition from dumped food products. Efficient physical, human, and software infrastructure to facilitate trade is a crucial dimension of food security.
- **Exchange rates** are a crucial conversion factor that translates foreign into domestic costs/prices. There is little Mozambique can do when the currency of its most significant trading partner, South Africa, depreciates. However, the experiences of producers, processors, and traders with bilateral trade flows over the last two years provides an interesting lens through which to consider the effects of an appreciating metical. The economic impacts of shifting trade with South Africa to illustrate the potential, broader impacts of Dutch disease (Salinger and Ennis 2014b).

The report concludes with key takeaway messages about the importance of recognizing the potential threat to agricultural competitiveness of the natural resource boom, especially for traditional agricultural commodity producers, and of building a strategy to anticipate, manage, and respond to it. This will involve plans to manage natural resource-derived revenues directly, build productivity and invest in infrastructure that will enhance competitiveness and better resist

competitive threats, and monitor and publicly exhibit Dutch disease indicators in order to give the economy early warning of possibly building pressures.

The report lays out a conceptual framework for understanding natural resource booms and their potential economic impacts and definitions of agricultural sector competitiveness (Section 1), provides an overview of the role of agriculture in Mozambique (Section 2), introduces the approach used in this report (Section 3), presents findings of five value-chain assessments undertaken for this study (bananas, cotton, rice, soybeans, tomatoes) (Section 4), summarizes and offers thoughts on policy issues and key messages (Section 5). Annexes include a list of stakeholder interviews conducted for this work (Annex A) and of print and online references utilized (Annex B).

1. Natural Resource Booms and Economic Competitiveness

The present study is part of a series of investigations undertaken by USAID's SPEED program to help Mozambique's private sector and government policymakers anticipate the potential impacts of the country's natural resource boom on the Mozambican economy.

Work on this topic was initiated by SPEED under the direction of Dr. Tyler Biggs, who explored the effects of currency value fluctuations (2011) and, more specifically, the risks of a possible "natural resource curse" (2012) on the Mozambican economy. Such a curse has been documented in many countries around the globe, both so-called developed and emerging, in the wake of rapid extractive industry expansion (Humphreys et al. 2007; Collier 2010; Shaffer and Ziyadov 2012). SPEED followed on Dr. Biggs' work with an overview of the range of potential impacts of a resource boom on economic competitiveness (Webber 2013). A more detailed overview of the natural resource boom in Mozambique, the so-called "Dutch disease" that may emerge from such a boom, and other countries' experiences with Dutch disease is available in SPEED's report on potential impacts of the boom on labor markets in Mozambique (Salinger and Ennis 2014a).

Three value-chain studies are also being conducted of traditional, "tradables" sectors. These are sectors of the economy that produce goods either for export or to substitute for imports and whose international prices are set *not* by Mozambican producers but rather in global markets. The three value chains include agriculture (presented here), tourism (study launched in June 2014), and manufacturing (forthcoming, October 2014).[2] These are not value-chain studies per se. Rather, they take as their starting point the natural resource boom in Mozambique and then explore the range of potential economic impacts of the macroeconomic and relative price responses on the value-chains as they exist today and as they might evolve in response to the boom.

The challenge, in a nutshell, is the following scenario, referred to broadly as Dutch disease because it was first observed in the Netherlands when natural gas exports sharply expanded:

- ***Exchange rate effects.*** Sharply rising inflows of foreign exchange from expanding natural resource exports will likely increase demand for the domestic currency. This can lead to strengthening of its market value, relative to foreign currencies.

  As the market value of the currency appreciates, world prices are converted into domestic prices of goods, services, and imported inputs at a stronger exchange rate. This exchange rate effect will reduce the domestic price of outputs and tradable inputs. For example, the current exchange rate of the metical to the U.S. dollar is around 30 MT/$. If the metical

[2] Each of these reports will be posted to SPEED's website, when available; see www.speed-program.com.

were to strengthen by as much as 50%, to 20 MT/$,[3] a world price of USD 500, when converted into meticais equivalent, would "fall" from MT 15,000 to MT 10,000. Thus the domestic prices of imported products and inputs, as well as exports, will decline.

- ***Relative price impacts.*** With currency appreciation and increased revenues, both public and private, may translate into increased domestic spending. The effects of such increased spending – whether by government to build more roads or schools, hire more health care workers or teachers, or spend on many other priorities, or by the private sector to build more factories, offices, housing, or hire more workers – will likely be increased price pressure on so-called "non-tradables" sectors, i.e., on wages, real estate, construction, transportation, etc. As domestic prices rise, relative to price shifts in partner countries, the *real effective exchange rate* will also appreciate.

  As the relative prices of tradables to non-tradables falls, demand and supply shifts within each sector may be induced. In many countries experiencing Dutch disease, the expanding extractives industries and non-tradables sectors crowd out the traditional tradables sectors. Angola and Nigeria are just two examples of economies whose agricultural and industrial sectors have shrunk as oil exports have expanded.

The immediate exchange rate and relative price effects may set in motion a set of economic consequences, summarized below. The validity of these hypotheses is being probed through interviews with a variety of key stakeholders in each of the potential impact studies.

- ***Labor market impacts.*** Skilled labor may move into the extractives and non-tradables sectors (construction, infrastructure, real estate, etc.) and out of traditional, tradables sectors. With the lower prices of imported inputs, producers may substitute imported inputs for domestic factors (e.g., may increase use of imported equipment in place of more expensive skilled labor). As (some) wages rise, especially those of scare, skilled workers, and (some) employment shifts, some labor market impacts may be anticipated. For example, agriculture, tourism, and/or manufacturing enterprises may lay off or may not be able to hire a full complement of workers in the face of skilled labor wage pressures. On the other hand, lack of appropriate skills will likely constrain the ability of rural labor to migrate in search of employment in the extractives sector. However, increased spending on labor-intensive, low-skill projects such as infrastructure development may provide off-farm employment opportunities for labor, with possible repercussions for labor supply in agriculture.
- ***Non-tradables sectors impacts.*** As growth in the non-tradables sectors – construction, infrastructure, real estate, etc. – expands, downstream impacts may be felt in agriculture, tourism, and manufacturing. There could be positive impacts, for example, as growth of

[3] Although the literature is full of Dutch disease experiences, empirical observations of market or real exchange rate appreciation per se are less common, although instances of real exchange rate appreciation of 30-40% have been recorded. Ebrahim-zadeh notes a real appreciation of nearly 40% in Colombia, due to soaring coffee prices in the mid 1970s (2003). Oil revenues in the central African CFA zone led to appreciations of around 30% (Treviño 2011).

infrastructure development could improve market linkages for agricultural or manufacturing producers.

- ***Market impacts.*** As incentives shift in favor of domestic markets, agriculture, tourism, and manufacturing may undertake shifts in terms of targeted markets for their goods. For example, the tourism industry might shift away from international luxury tourism into tourism aimed at local business men and women or manufacturing might turn away from exports and seek to deliver a different product mix into a less exchange rate-sensitive segment of the domestic market.
- ***Consumption impacts.*** As domestic prices of imported goods fall, impacts may be felt in terms of total calories consumed, composition of the food consumption basket, or nutritional outcomes. For example, lower meticais prices of imported foods – while competing with domestic food producers – could help poor households afford more food, more diverse foods, and/or more nutritious foods. These impacts may, in turn, improve overall food security.
- ***Innovation impacts.*** As profitability margins are squeezed, innovation responses may be induced in each sector. For example: In the case of the labor market, "innovation" may mean upskilling of the workforce through training, especially in vocational trades; in agriculture "innovation" may mean investments in new techniques (and higher productivity), new products, new brands, new markets developed; in tourism "innovation" may mean development of new tourism streams, packages, products; in manufacturing "innovation" may mean investment in new forms of value-added processing to capture more value-added locally and thus improve productivity (e.g., export furniture, not wood).
- ***Gender impacts.*** As the above impacts unfold, men and women may be affected differently, either at the level of labor markets or within each of the sectors. For example, with regard to labor markets women may be affected by men migrating away from home in search of new jobs. This may decrease the availability of household labor, thereby increasing the burden of household work for women. On the other hand, it may also improve empowerment of women, if they in fact benefit from increased control and decision-making. Women may also face increased demand for sex workers in/around mining areas, and thus increased health risks. Since the majority of farmers in Mozambique are women, they may be negatively affected by declining profitability of smallholder agriculture. Men may benefit from increased job opportunities in the mining sector, but then they may face increased risks of hardship labor in construction, mining, etc., with possible adverse working conditions.
- ***Institutional impacts.*** As natural resource export revenues into Mozambique increase, pressures may be felt on Mozambican economic and political institutions for more transparent economic management (business environment). For example, as awareness mounts of natural resource-related resource inflows, Mozambicans may demand broader inclusion to benefit from the resource boom. Lack of responsiveness to these increased demands may increase social tensions.
- ***Induced demand impact.*** As incentives shift to favor extractives and non-tradables sectors, public and private investment needs may be identified that could mitigate the

impacts of shrinking profitability. For example, investment in roads to promote market linkages or training to improve skills can raise productivity and thus raise returns per hectare or labor-day. Thus, despite likely profitability pressure in terms of unit costs and net revenues per unit, raising overall productivity would help to raise total net revenues to offset the per-unit profitability squeeze.

- ***"Boom" perception impact.*** As the natural resource boom magnifies and Mozambique's strong growth is felt more widely, this might change the way Mozambique is viewed from outside the country. Such changing external perceptions might, in turn, affect global demand for Mozambican goods and services. For example, widening perceptions of Mozambique as a dynamic, growing, inclusive economy could attract new attention from international tourism consumers for different ways of engaging in Mozambique, e.g., nature tourism, historical tourism, village-level tourism,… On the other hand, if the natural resource boom is mismanaged, widening perceptions of Mozambique as an increasingly fractious, corrupt economy, may dissuade investors, tourists, and other consumers of Mozambican goods and services.

The ways in which these effects may take root will likely vary in each sector. Thus the purpose of SPEED's natural resource boom potential impact studies is to probe weaknesses, challenges, and opportunities that the boom might induce on the part of value-chain producers, processors, traders, wholesalers, service providers, etc. Each of the studies will be a unique, stand-alone product. At the end of the study cycle, they will be presented as an integrated set of studies.

Although this study does not present detailed value-chain analyses for the five sectors under consideration, the elements of market dynamics, full value-addition, business environment, value-chain relationships, and new opportunities for value-addition are each taken into account here.

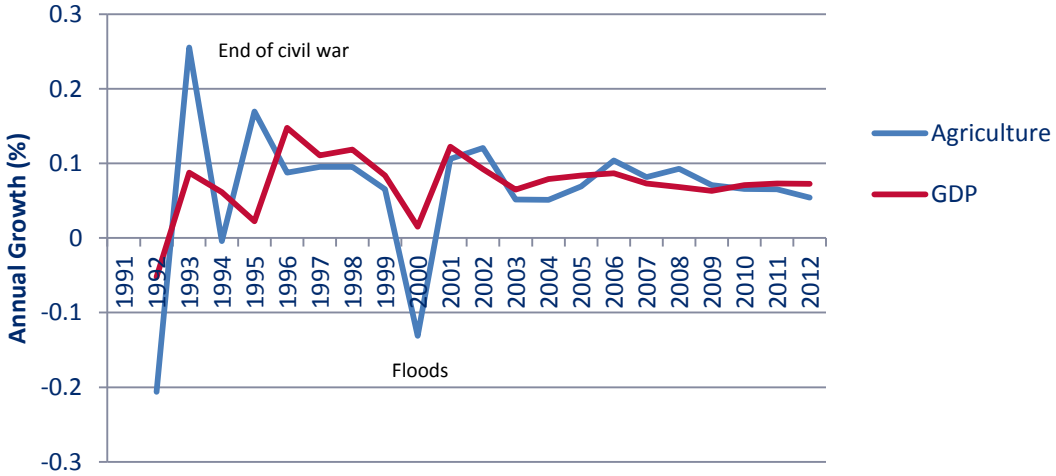
In the following sections of this report, we explore the role of agriculture in the Mozambican economy (Section 2), the methodology used for this study (Section 3), potential impacts of the natural resource boom on five agricultural value chains (Section 4), and offer some concluding thoughts and recommendations (Section 5).

2. Overview of Mozambique's Agricultural Sector

Agriculture's contribution to the Mozambican economy has been extensively analyzed elsewhere.[4] Agriculture remains an important contributor to the country's economy and to the livelihoods of four-fifths of Mozambicans, and an important potential contributor to future economic growth, if wise management of impacts of natural resource boom is in place.

Since the early 1990s agricultural sector growth has progressed in tandem with the country's economy recovery and growth. After a strong upturn following 16 years of civil war, agricultural output grew by an average of 8 percent per year, compared with growth of Mozambique's Gross Domestic Product (GDP), which has averaged an annual rate of growth for the same period of 9 percent (Figure 1).

Figure 1: Agricultural Performance, 1992-2012



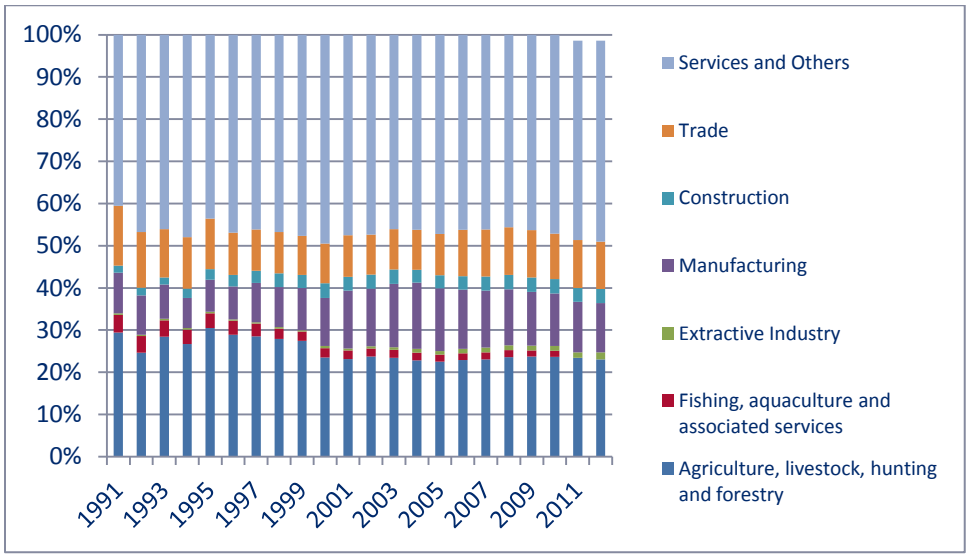
Source: National Institute of Statistics (INE)

While Mozambique's recent growth story is largely due to the emergence of so-called "megaprojects" (large investments to generate electricity and process imported alumina into aluminum) and the newly emerging and fast-growing extractive industries (coal, natural gas, and other minerals), it is of paramount importance that Mozambique's future growth story not be limited to these industries, if the benefits of growth are to be broadly shared.

[4] See, for example, the Strategic Plan for Agricultural Development (PEDSA) prepared by the Ministry of Agriculture (2010), as well as the agro-livestock census of 2009-2010 (INE 2011), a multistakeholder action plan for agriculture (Monitor Group 2012) and a report exploring the use of improved inputs in Mozambican agriculture (Cunguara et al. 2013).

Over the last twenty years, agriculture's share of GDP has averaged 25 percent (Figure 2). Until 2011, the contribution to GDP of the extractive industry was less than 2 percent; with the recent discoveries of gas, oil, and coal the Mozambican economic landscape will change and the share of extractive industries in the economy will rise. The IMF estimates that the share of coal and liquefied natural gas (LNG) sectors will rise to about 20 percent of GDP by 2023 (IMF 2013). The challenge for national policy makers is to implement policies that provide the right incentives for a competitive agriculture in the context of a strong, resource-driven economy.

Figure 2: GDP Composition by Sector, 1991-2012 (%)



Source: National Institute of Statistics (INE)

As Table 1 and Figure 3 below illustrate, agricultural exports are an important contributor to the country's exports. Despite expansion of megaprojects' exports, agricultural exports have maintained their share of total merchandise exports over the last seven years.[5] New agricultural exports, such as bananas, sesame, chili peppers, and other non-traditional agricultural exports, are emerging and developing fast. This development is in the context of growth rates of the country's exports by nearly 60 percent between 2008 and 2013.

Mozambique's major export trade partners have been changing over the last decade, with exports to Asian markets representing 23 percent of total exports in 2013, compared with 5 percent in 2005. This is in contrast with declining export shares to Europe, from 65 to 38 percent in 2005 and 2013, respectively. Exports to the Africa region experienced relatively modest growth, from 22 to 25 percent in the same period.[6]

[5] Note the rising share of the "other" exports category, suggesting that further disaggregation into discrete categories by INE would be useful.

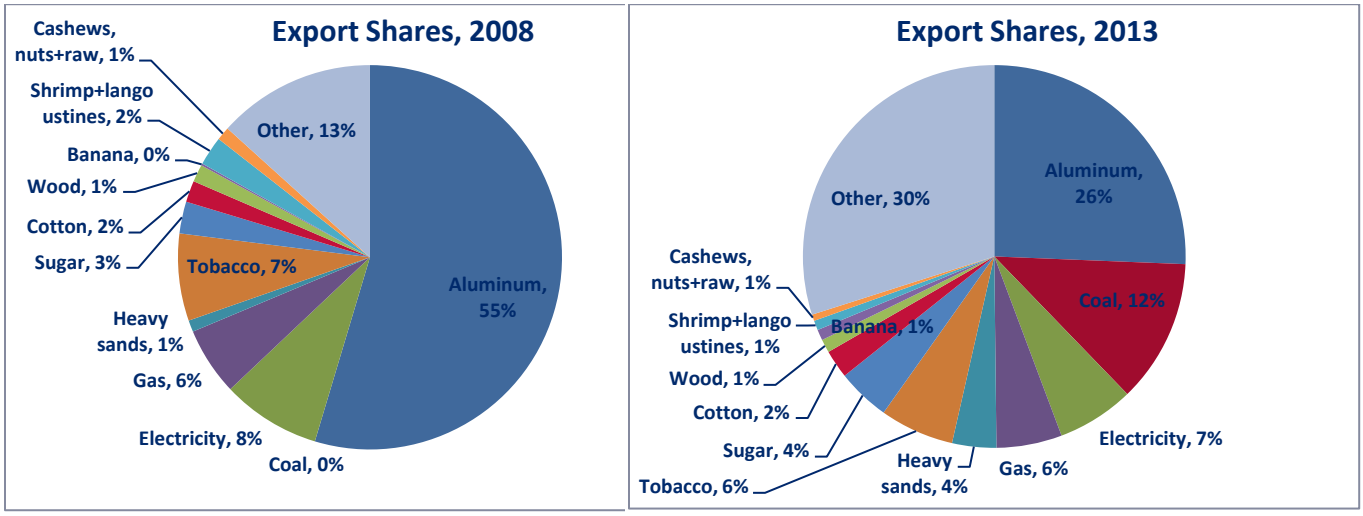
[6] *Banco de Moçambique* (2009 and 2013).

Table 1: Mozambique's Major Exports (US$ millions)

	2008	2009	2010	2011	2012	2013
Aluminum	1451.8	867.7	1159.6	1357.1	1091.7	1063.2
Coal	0.0	0.0	0.0	21.2	435.2	502.9
Electricity	221.2	274.4	276.5	299.5	233.4	270.1
Gas	152.0	123.3	133.8	162.1	175.1	229.6
Heavy sands	26.0	45.3	98.1	175.4	238.1	154.6
Gold	5.8	6.6	0.7	0.2	0.2	0.4
Tobacco	195.0	180.6	152.6	179.5	238.2	259.9
Sugar	71.3	58.3	87.5	87.9	154.4	185.7
Cotton	48.0	26.5	29.1	38.7	49.2	99.3
Wood	38.9	38.1	65.6	125.6	176.8	46.6
Banana	4.5	4.5	12.2	169.7	27.0	37.7
Shrimp, langoustines	65.1	57.1	46.1	42.8	30.1	33.9
Cashews (raw & nuts)	30.2	28.5	25.7	82.0	19.3	22.5
Miscellaneous	60.4	14.0	30.9	65.2	44.6	69.9
Other	287.3	426.8	227.0	311.4	942.2	1170.2
TOTAL, FOB	***2657.5***	***2151.7***	***2345.4***	***3118.3***	***3855.5***	***4146.5***
OF WHICH, IN PERCENTAGES						
Agricultural	17%	18%	18%	23%	18%	17%
Bananas, as % Agricultural	1%	1%	3%	23%	4%	5%
Cotton, as % Agricultural	11%	7%	7%	5%	7%	14%
Energy, minerals	70%	61%	71%	65%	56%	54%
Miscellaneous, other	13%	20%	11%	12%	26%	30%

Source: Banco de Mocambique. Balanca de Pagamentos 2013

Figure 3: Mozambique Exports, 2008 and 2013



Source: Banco de Mocambique. Balanca de Pagamentos 2013

These shifts are also reflected in agricultural exports. For example, in 2012/13 almost 80 percent of cotton lint exports were sold into Asian markets (Malaysia, China, and Indonesia), while in 2004 Portugal, South Africa, Indonesia, and Bangladesh were equally important lint markets. South Africa is the country of destination today for Mozambican bananas, accounting for more than 75 percent of total banana exports; other markets include Botswana, Swaziland, East Europe, Saudi Arabia, and United Arab Emirates.[7] Mozambique also imports milled rice mainly from Asian suppliers, such as Thailand, Pakistan, Vietnam, and India.

Mozambican agriculture occupies a very small space in global value chains. Local agricultural activity occurs at the primary level (farm-level production), with some subsectors (e.g., tobacco, sugar, cotton, seafood, and some timber) providing added value from agro-processing. Mozambique mostly exports unprocessed or primary processing level agriculture products (such as cotton lint, cashew nuts).

The predominance of low input-low yield systems, coupled with poor infrastructure limiting access to markets, contributes to the current limited state of agro-industry in Mozambique. According to the 2010 Agricultural Census, more than 95 percent of Mozambique's production takes place on smallholder farms, of which three-quarters occupy an average area ranging from 0.5 to 3 hectares. Mozambique's 2007 Green Revolution Strategy focused support on the transformation from subsistence into commercial agriculture (PEDSA, p. 1), such as emerging or advanced farmers who grow cotton and soy. The Commercial Agriculture Promotion Center (CEPAGRI) was established in 2009 with a a primary role in policy formulation and setting priorities towards the development of the agricultural and agro-industrial commercial sector, including promoting its implementation.

On average, the use of improved agricultural inputs, such as fertilizers and pesticides, is very low in Mozambique. Only 3 percent of small and medium farms use such inorganic fertilizers and 6 percent pesticides (especially those growing industrial crops such as tobacco and cotton), whereas the use of improved seeds by maize farmers is estimated at 9 percent (from Mozambique's Integrated Agriculture Survey 2012, cited in Mouzinho et al. 2014). The use of animal traction and mechanization is also negligible. For example, 34 percent of farmers in Tete use inorganic fertilizers and 30% of farmers in Manhiça use improved maize seeds. While the Tete story is directly related to tobacco cultivation, it appears that indirect benefits are applicable to other commodities: 40 percent of farmers using fertilizers also apply them to their maize and sweet potatoes.

These technological challenges, coupled with inadequate agricultural practices, render very low agriculture productivity, critical to attain a competitive agricultural sector. For example, cereals yields in Mozambique are estimated to be one-quarter to one-third of the levels enjoyed in neighboring Zambia and Malawi (700 kg per hectare in Mozambique versus 2.1-2.7 tons per

[7] Republic of South Africa, Department of Agriculture, 2012 and calculations based on UN COMTRADE statistics until January, 2013.

hectare nearby) (Mouzinho et al. 2014). Such national averages, however, mask some interesting variation by province.

3. Value Chains: Structure, Cost Drivers, and Potential Impacts of Dutch Disease

As discussed in Section 1, the profitability of agricultural commodity value chains is determined by a range of variables, e.g., costs, field- and processing-level productivity, efficiency of logistics, value addition, product quality, etc. In the analyses here, costs of production, processing, and marketing are compared with prices to assess profitability and highlight points along the value chains were particular constraints or challenges are posed. Discussions of value chain production and marketing characteristics, cost drivers, and profitability analyses are below.

The value chains targeted by this study were selected with the CTA agriculture working group, based on a combination of factors. This sample includes both export crops (bananas, cotton) and import-substitution crops (rice, tomatoes, soybeans), all but one of which are part of Mozambicans' diets, directly or indirectly. Soybeans have recently been introduced into Mozambique as an input into integrated poultry farming operations in Mozambique. Selected agricultural production statistics for those crops are below.

Table 2: Agricultural Production Statistics, Selected Crops, 2012

Food Crops			Cash Crops		
	'000 tons	$ '000		'000 tons	$ '000
Cassava	10,051	1,050	Bananas	470	132
Beans	282	138	Cotton lint	88	126
Pulses	235	123	Sugar cane	3,394	111
Maize	1,177	92	Tomatoes	250	92
Paddy rice	280	73	Tobacco	54	87
Sweet potatoes	900	68	Sesame seed	117	78
			Cashew nut	65	57
			Soybeans	18*	N/A

Notes: Beans and pulses would normally be combined, but are presented separately by FAOSTAT.
** 2010 estimate from Opperman and Varia (2011) for the Southern Africa Trade Hub*

Source: Food & Agriculture Organization, FAOSTAT, accessed August 20, 2014

Value chains were also chosen according to the current performance of the value chain and its future potential in the country's economy and its impact on food security, aligned with the government strategy and the millennium challenge goals (Monitor Group 2012). All are grown by smallholders either for self-consumption or cash income, although emerging or commercial farms are also involved in the production of bananas, cotton, and soybeans as cash crops

Mozambique's natural resource boom's biggest potential threat to traditional sectors of the economy will be through impacts on the value of the currency, the metical, and thus on prices of

tradables (both products and tradable inputs) as well as on the prices of non-tradables, such as labor, land, and goods and services produced and consumed in the local market without parallel from the international market. As hypothesized earlier, a strengthened metical may make it hard for food crops to be produced profitably.

DATA COLLECTION AND ANALYSIS

An investigation checklist was developed to guide the team's understanding of the following variables:input markets: use of land, machinery and non-mechanical tools, improved inputs, labor; costs of production per hectare: financial prices of factors and inputs, taxes or subsidies that affect those prices; product markets: market options for sale of products, prices received, competitors; role of foreign investors in the value chains; ex-farm processing: value-chain structure, costs of processing; and key legal and regulatory framework challenges and overall business environment.

Cost structures were analyzed using simple, partial equilibrium worksheets in order to assess financial (or private) and economic (or social) profitability, at relevant points in each value chain. Analyses are crop-specific and do not take into account farming systems, complementarities or conflicts between or among various crops in terms of growing seasons, labor requirements, intercropping potential, etc. All costs are estimated on a per-hectare basis, whether actually produced on 0.5 or 4 hectares by the farmer.

Financial profitability is estimated from the farmer's perspective, reflecting actual costs incurred. Family labor, in such a scenario, is not costed, but net returns per day of family labor can be estimated. The cost of other inputs, such as land, may also be omitted in the financial analysis, if no financial outlay for land is incurred. The price used to value production is the price received by the farmer upon sale of the commodity. Prices paid by the farmer may also incorporate taxes (making the financial price higher) or subsidies (reducing the financial price to farmers).

The economic analysis assigns estimates of opportunity costs to both land and labor inputs. Where relevant, taxes and/or subsidies that may raise or lower prices actually paid by the farmer are eliminated. The economic analysis also values output using international parity prices, adjusted to Mozambican wholesale (for import-substitution crops) or the Mozambican border (FOB, for export crops) levels by adding or subtracting appropriate margins.

Economic and financial profitability ratios have been estimated. A cost-benefit ratio less than 1.0 indicates that returns to the crop's production exceed costs, i.e., the value chain is profitable, whereas a ratio greater than 1.0 indicates that costs exceed returns, i.e., the value chain is not profitable. Sensitivity analyses test alternative exchange rate and innovation (yield) scenarios.

REFERENCE MARKETS

All five value chains of interest are tradable commodities. We thus use international reference prices to benchmark the economic values of production, as explained below, converted into meticais at the prevailing market exchange rate with the U.S. dollar (30 MT/$).

Domestic prices in Mozambique may differ from international prices. A commodity may be a virtual non-tradable (for example, cassava); even domestic maize may be a virtual non-tradable.

Prices within Mozambique of basic food grains may not be well integrated, given the size and poor status of transport and storage infrastructure. Quality differences that make domestic production distinct from the properly dried, consistent grain that can be imported from outside. Thus, prices in port cities may be significantly different than prices up-country (even for a traded commodity such as maize). Recent analysis of maize prices across Tanzania, for example, found that domestic factors, such as weather, seasonality, and – in particular – export bans, affect price levels and variability to a far greater extent than world prices (World Bank 2014a), reflecting limited storage and transport infrastructure (similar to conditions in Mozambique).

Nevertheless, regional and international market prices represent the economic benchmark of value of agricultural commodity production. In some cases, adjustments may need to be made to the international reference price to account for domestic varieties or qualities produced. For example, cotton lint from Mozambique may sell at a discount relative to the international reference price because of shorter staple length or higher degrees of impurities per bale. Or, Mozambique's imported milled rice may contain a higher rate of broken grains, thereby requiring downward adjustment of the international reference price. And so forth.

Table 3: World Reference Prices, Expected 2014 and 2020

Commodity	Parity	Reference Market	Unit	Expected, 2014	Expected, 2020
Bananas	FOB	South Africa	$/kg	*N/a*	*N/a*
		Europe	$/kg	0.95	0.93
Cotton	FOB	Asia	$/kg	2.00	2.17
Rice	CIF	Thailand, 5%	$/metric ton	410	392
		Thailand, 25%	$/metric ton	390	
		Vietnam, 5%	$/metric ton		
Soybeans	CIF	Europe	$/metric ton	550	522
Tomatoes	CIF	South Africa	MT/kg		

Source: World Bank Commodity Prices, South Africa Wholesale Prices

Our analysis took as its references the following markets; adjustments were made to prices to bring them to Mozambique shores and convert them into meticais.[8] The initial analysis presented here uses expected 2014 prices.

BANANAS

Bananas have traditionally been part of the basket of staple foods grown and consumed in Mozambique, particularly in the Central region. Bananas, traditionally bananas were produced by smallholder farmers, account for nearly half of all fruits consumed in Mozambique, according to the FAO's 2011 food balance sheet.

[8] All but the tomato price are sourced from the World Bank's commodity market prospects webpage.

Mozambique enjoys very good conditions to grow bananas on a commercial basis, currently produced in Maputo, Manica, and Nampula provinces. Commercial plantation output is targeted for export in Maputo and Nampula; plantations in Manica have great potential, but the quality of bananas needs improvements and critical mass to qualify for export to the biggest markets. Despite optimal growing conditions, bananas are also experiencing challenges that hinder competitiveness in international markets, including the Asian fruit fly infestation, the threat of Panama disease, and logistics costs to reach the international markets.

The commercial cultivation of bananas was launched in Mozambique over the last decade, attracting South African and Mozambican investments in the form of joint ventures or partnerships in medium and large companies. This transformation has established bananas as a high-value, cash crop. Across the country, fifteen medium to large commercial plantations are in operation, the two largest being Matanuska (in Nampula) and Bananalandia (in Maputo), along with a conglomerate of companies operating in the South, including Beluzi Bananas, Lda (an organic banana operation), Rio Verde, and AAA Enterprises.

Investors in Mozambique's banana industry have been expressing their interest to expand production areas. However, investments have been put on hold, due in part to concerns over high logistics costs (scanners, dry port and other inefficiencies)[9] that hamper the competitiveness of Mozambican bananas in international markets. Plant pathology challenges also hinder further development of banana production. Evidence of Panama disease (Fusarium wilt) has been reported on the farm of Matanuska, the same disease that threatens global production of Cavendish bananas (Gondolini 2014; Koeppel 2014).[10] In Manica, exports are limited both by the small scale of production and the fruit fly, whose appearance has caused a ban on Manica bananas in Maputo and South Africa markets. Donors and local governments have been investing and are implementing several programs to strengthen the banana value chain (Dalberg 2013). One example is the fruit fly lab that was inaugurated in the last semester in Manica province

The graphs below illustrate the distribution of banana production areas and production volumes across the country. While areas are fairly evenly distributed among Matanuska, the Southern plantations, and smallholders, smallholders are still estimated to supply over 40% of total production, although their production lacks quality for exports and suffers fruit fly issues that prevent production from being sold in Southern Mozambique. Smallholder production is thus

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[9] For further information, see Murithi et al. (2012).

[10] According to May and June 2014 reports on www.freshfruitportal.com, an international task force, including the University of Stellenbosch, the Southern African Development Community, the International Institute for Tropical Agriculture, USAID, and the Bill and Melinda Gates Foundation, are drafting a "continental action plan." See "Mozambique Panama Disease talks to yield containment report," May 30, 2014, http://www.freshfruitportal.com/2014/05/30/mozambique-panama-disease-talks-to-yield-containment-report/?country=mozambique, and "African taskforce reveals plans for Panama Disease TR4 fight," June 18, 2014, http://www.freshfruitportal.com/2014/06/18/african-taskforce-reveals-plans-for-panama-disease-tr4-fight/?country=mozambique. The Food and Agriculture Organization of the United Nations (FAO) also oversees the World Banana Forum, with a special section on Fusarium wilt (http://www.fao.org/economic/worldbananaforum/wbf-aboutus/en/).

confined to domestic consumption. By far the largest share of production comes from plantations in Southern Mozambique, producing for export to South Africa.

Figure 4: Distribution of Banana Areas (% ha)

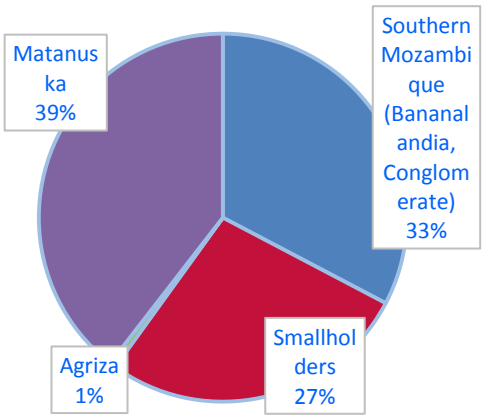
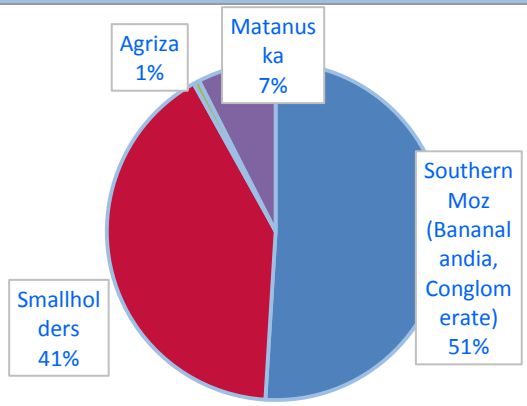


Figure 5: Distribution of Banana Production (% tons)



Source: TechnoServe (2013)

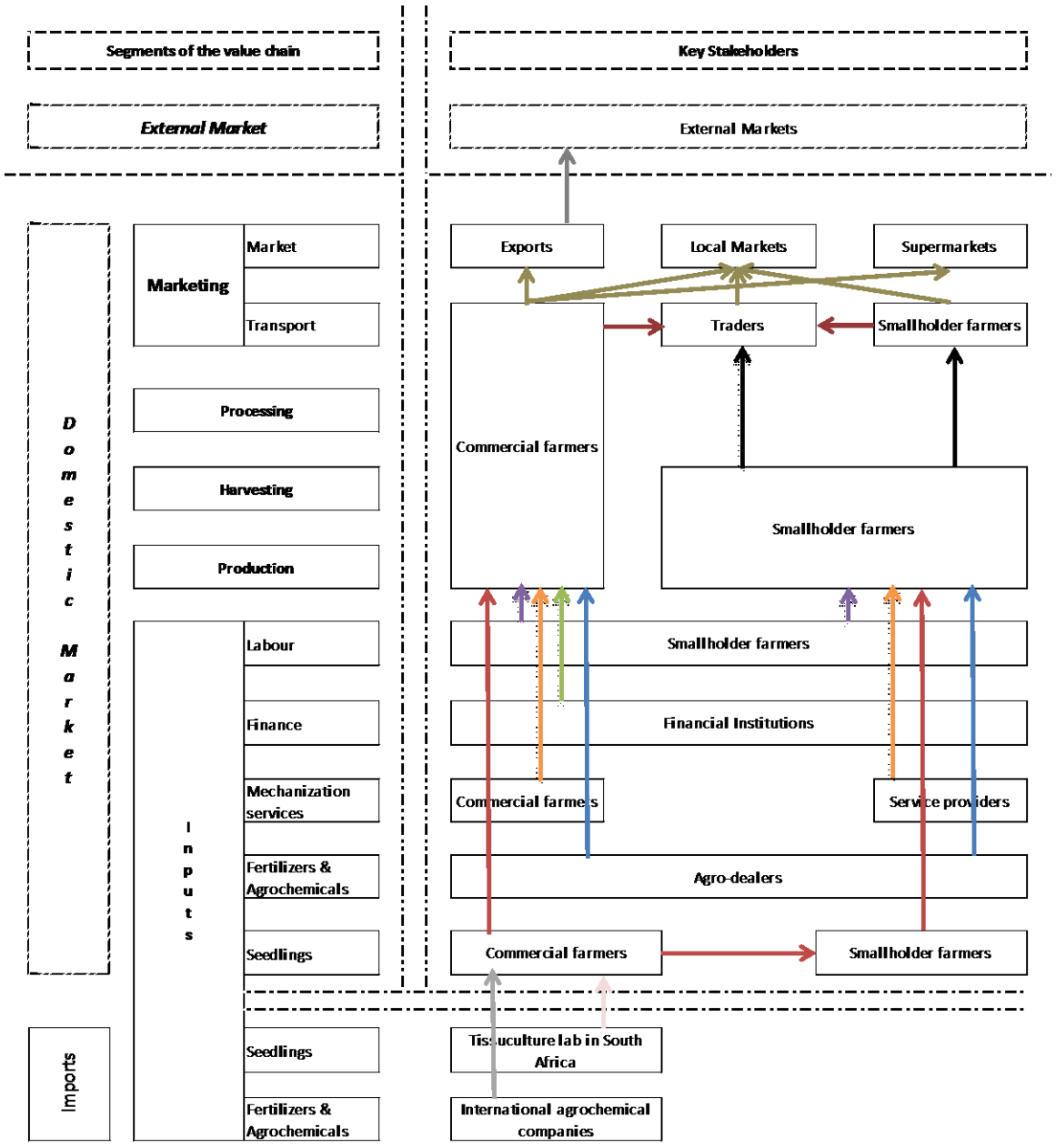
Production

Mozambique produces bananas in three main systems: (1) large-scale plantations, over 1,000 ha, using high tech irrigation systems, high input and high skilled management, and producing a high quality of bananas; (2) medium-scale plantations, areas approximately 100 ha and not exceeding 500 ha, use of irrigation systems, use of inputs, in some cases use of outgrower schemes (Manica) and good quality product; and (3) smallholder production, very small areas located around the house, with very low/no management, no use of modern inputs or irrigation, no attention to specific varieties, producing bananas of low yields and relatively poor quality.

Large- and medium-scale banana plantations were initiated with planting material supplied by Del Roi Laboratories in South Africa and moved to own-production of seedlings for expansion of production areas. Varieties used and proved commercially competitive are Williams, Grand-Nain, and Dwarf Cavendish. Other purchased inputs for banana production are supplied by local firms or directly sourced in South Africa and other international input markets.

Banana yields at the medium and large plantations range from 36-40 tons/ha initially, increasing to 52 tons/ha with maturity. Commercial banana production is highly labor-intensive, relying mostly on seasonal labor. Mechanization is used for land preparation and phytosanitary treatments. Management challenges include both managing the hired labor force and maintaining amicable relations with neighboring populations, to mitigate potential losses due to farm invasions and thefts. The banana value chain is outlined in Figure 6 and further described below.

Figure 6: Banana Value Chain Flowchart



Source: *Study Team Analysis*

Processing

Banana harvesting is done manually, with fresh fruit bunches placed in a conveyor system that moves unprocessed bananas from the plantation to the packing houses. At the packing houses, the bunches are processed into fingers, sorted by quality, weighed and washed in a water tank, wrapped with an inner polyethylene cover, packed in 18-kilogram, perforated boxes and then into 40- foot refrigerated containers, taken directly to a truck, and transported to the port (in the Center) or the border and on to South Africa (in the South), by local hired trucks.

Banana Markets and Trade

Approximately 85 percent of domestic production is consumed locally and the remaining 15 percent is exported by the commercial banana subsector. In the domestic market, especially in Maputo City, bananas are sold mainly through wholesalers' depots, established by Bananalândia. Retailers are supplied by the depots and sell in the local markets. Push carts are also a common form of bringing bananas to the final consumer.

Global banana exports in 2012 were about 16.5 million tons, of which nearly four-fifths was supplied by Latin America and the Caribbean region, 5% by African suppliers (especially Côte d'Ivoire and Cameroon), and the rest by Asia (especially from the Philippines, with 2.7 million tons) (FAO 2014). Over 85,000 metric tons of bananas (0.5% global market share) are exported from Mozambique to East Europe, Middle East, South Africa (with small re-exports on to Botswana and Swaziland), Zimbabwe, and Zambia (see below for volume trends and rough destination breakdowns). In Manica smallholder banana production was established before 1975 for domestic consumption and to supply Zimbabwe and Zambia. Banana production in Southern Mozambique, particularly in the Incomati River Valley, Marracuene, and Manhiça is targeted for the South African market.

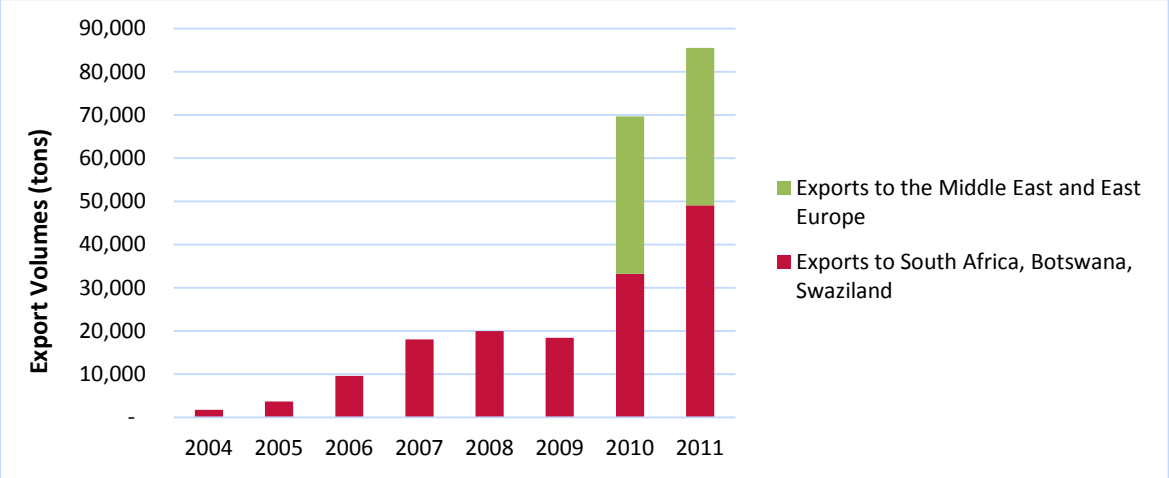
Statistics for Mozambican exports of banana are not readily available. The study team acquired information from different sources and interviews with value-chain stakeholders. The graph below was compiled with information from interview, showing exports of Mozambican banana, where major contribution comes from the companies in the Southern Mozambique and Matanuska in Nampula.

Mozambique used to *import* bananas from South Africa during the 1980s/90s (Republic of South Africa 2011). More recently, however, Mozambique has become a major and consistent *exporter* of bananas to South Africa. Mozambique's climate offers opportunities to supply bananas into South Africa, especially during the cold season when South African production is minimal.[11] In 2010 South Africa imported 36,685 MT of bananas from SADC countries, of which over 90 percent (33,217 tons) from Mozambique, far exceeding the 9 percent supplied by Zimbabwe.

[11] One 2012 South African news report tells of South African farmers "jumping ship" to grow bananas in Mozambique: "South African banana farmers are under threat of competition from their peers in Mozambique as the neighboring country can produce the commodity more cheaply." See N. Davids *Times* article, May 15, 2012, http://www.timeslive.co.za/local/2012/05/15/sa-banana-farmers-jump-ship. Panama disease has also plagued South African banana production in the past (Viljoen 2002).

Regional trade of bananas benefits from the SADC preferential tariff of zero duty in both Mozambique and South Africa. Middle East and Eastern Europe markets are serviced from Northern Mozambique. Annual exports to these regions are estimated at 36,452 tons/year.

Figure 7: Banana Exports from Mozambique, 2004-2011



Notes: Matanuska and Jacaranda export from Northern Mozambique to the Middle East and East Europe, while plantations from Namaacha and Boane in Maputo export to South Africa. Exports from the North were estimated based on the following: Jacaranda exports 2000 boxes/18Kgs per week and Matanuska exports 665 tons/week. Some re-exports from SA to neighboring countries occur.

Source: Stakeholders interviews 2014, SA Department of Agriculture 2011

Cost Structure and Drivers

This analysis of profitability of the banana value chain is based on a business plan for a banana plantation in Central Mozambique, provided by AgDevCo.[12] Costs are estimated for two segments, namely farm-level (production, harvesting, and packing, 73 percent of total cost) and post-plantation (transport, marketing, and trade logistics, 27 percent of total cost). Tradable inputs (fertilizers, pesticides, and packaging materials) are sourced from outside Mozambique. Fixed costs include qualified labor for management and technical support, as well as security, operating costs, and contingencies. In this value chain, since all labor is hired by the plantation, the adjustments from financial to economic cost are small: 600 MT are added to cover the cost of a hectare of land, and small adjustments are made for fuel subsidies included in the cost of mechanized operations. Marketing costs carry the bananas through to port and on to an assumed final destination in Europe.[13]

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[12] A U.K.-registered "social impact investor and agribusiness project developer."

[13] An alternative model that carries Mozambican bananas to a wholesale market in South Africa would also be useful for comparison, but accurate transport and logistics costs could not be obtained. The reference prices in the two markets are significantly different. Whereas the 2014 CIF price in Europe is $0.95 per kilogram (World Bank commodity prices), the wholesale price in Johannesburg in June 2014 was 3.92 Rand per kilogram ($0.37 per kilogram), according to Joburgmarket.co.za.

Assuming yields of 40 tons per hectare and valuing bananas at the 2014 CIF price in Europe ($0.95 per kilogram, per World Bank (2014b)), the value chain is profitable under current circumstances, in both the financial and economic scenarios, with a cost-benefit ratio of 0.40. In the longer run, the World Bank expects the nominal world price to remain steady (declining, therefore, in real terms).

The downstream, post-plantation segment of costs is driven by transport to port, trade facilitation, and shipping costs. Transport, marketing, and trade costs could be reduced by investing in logistics infrastructures and management efficiency. These downstream costs comprise nearly 30 percent of total value-chain cost, confirming reports that highlight the role of high logistics costs, which render uncompetitive many exports from Nacala and Beira ports, especially for agricultural value chains (Murithi et al. 2012).

Table 4: Cost & Profitability Estimates: Plantation Bananas

Cost Summary		Unit	Financial	Economic
Farm-level	Land, labor, water	MT/ha	89,670	90,470
	Tradable inputs	MT/ha	42,120	42,120
	Subtotal	MT/ha	131,790	132,590
Packaging	Labor	MT/ha	74,250	74,250
	Inputs	MT/ha	74,250	74,250
	Subtotal	MT/ha	148,500	148,500
Fixed	Management	MT/ha	51,300	51,300
Subtotal		MT/ha	331,590	332,390
	/ Yield (40 Tons/ha)	MT/ton	8,290	8,310
Transport, port, shipping		MT/ton	3,046	3,046
TOTAL	**CIF**	**MT/ton**	**11,336**	**11,356**

Profitability Analysis			Financial	Economic
EX-PLANTATION LEVEL, CIF SOUTH AFRICA[14]				
Gross revenue		MT/ton		
Costs		MT/ton		
Net revenue		MT/ton		
Cost-benefit ratio				
EX-PLANTATION LEVEL, CIF EUROPE				

[14] Could not be completed.

Profitability Analysis			Financial	Economic
Gross revenue		MT/ton	28,500	28,500
Costs		MT/ton	11,336	11,356
Net revenue		MT/ton	17,164	17,144
Cost-benefit ratio			0.40	0.40

Sources: *AgDevCo, Study Team Analysis*

Potential Impacts of Dutch Disease

Sharply rising inflows of foreign exchange from natural resource export sales can lead to strengthening of the value of the local currency, relative to foreign currencies. The immediate "exchange rate effect" is appreciation of the currency, which may set in motion a set of economic consequences. How might this impact the banana value chain? Table 5 shows shifts in profitability in line with likely impacts of Dutch disease.

Exchange rate effect: If we assume metical appreciation from the current USD exchange rate of 30 MT/$ to 20 MT/$, this would result in the lowering of both the reference price of bananas and the costs of imported fertilizers and pesticides. As tradable inputs become relatively cheaper, it improves profitability. Unit economic profitability declines from 17,144 MT per ton to 9,026 MT per ton, but still remains strongly positive.

Innovation effects: If yields are improved at the farm level, from the current 40 to at least 52 tons per hectare, the effect of this productivity increase would be to counteract the impact of the stronger metical. In a "full-innovation + logistics improvement" scenario that combines higher yields and expanded production areas, thereby increasing the critical mass of volumes available for export, and increased pressure on port authorities to improve logistics efficiency, the banana value chain is likely to become even more competitive.

Table 5: Impacts of Exchange Rate & Yield Changes on Banana Profitability

Profitability Analysis			Financial	Economic
EXCHANGE RATE = 20 MT/$				
Gross revenue		MT/ton	19,000	19,000
Costs		MT/ton	9,158	9,974
Net revenue		MT/ton	9,842	9,026
Cost-benefit ratio			0.48	0.52
EXCHANGE RATE = 20 MT/$ & YIELD = 52 T/HA				
Gross revenue		MT/ton	19,000	19,000
Costs		MT/ton	7,563	8,375
Net revenue		MT/ton	11,437	10,625
Cost-benefit ratio			0.40	0.44

Source: *Study Team Analysis*

COTTON

Cotton is Mozambique's third most important agricultural source of foreign exchange earnings (in 2013 cotton lint exports represented 14% of total agricultural exports and 2% of total exports) and an important source of cash income for many families in rural Mozambique. Even with the sizable megaprojects-related exports, cotton is amongst the top ten exports of Mozambique, in 2013 cotton export earnings reached nearly US$ 100 million.

Mozambique's seed cotton and lint production in 2012 was its highest level since 2004, 173,000 tons and 66,000 tons, respectively (IAM 2014). With just over 6 percent of farms producing seed cotton in 2012, according to the Integrated Agricultural Survey, the greatest concentrations of farmers involved in the value chain are found in the north and center, especially Cabo Delgado (20.5 percent) and Nampula and Sofala (10.5 percent of farmers, each) provinces.

Comparative data for 2013/14 presented by USDA suggest that Mozambique's total production of 44,000 MT puts it in the middle of the list of African producers, led by Burkina Faso (261,000 MT), Mali (205,000 MT), and Côte d'Ivoire (163,000 MT). In the aggregate, African producers account for about 6% of global lint production in 2013/14. Comparative yields from leading producers in Africa and globally are presented in Table 6, suggesting that Mozambique's current levels of productivity (discussed further below) compare quite favorably.

Table 6: Comparative Seed Cotton Yields

Africa	Yield, 2012/13 (Kg/ha)	Other	Yield, 2012/13 (Kg/ha)
Burkina Faso	471	China	1422
Mali	386	India	549
Côte d'Ivoire	460	United States	921
Cameroon	495	Pakistan	689
Benin	403	Brazil	1484
Egypt	729	Uzbekistan	703
Zimbabwe	284	Australia	2006

Source: USDA (2014a)

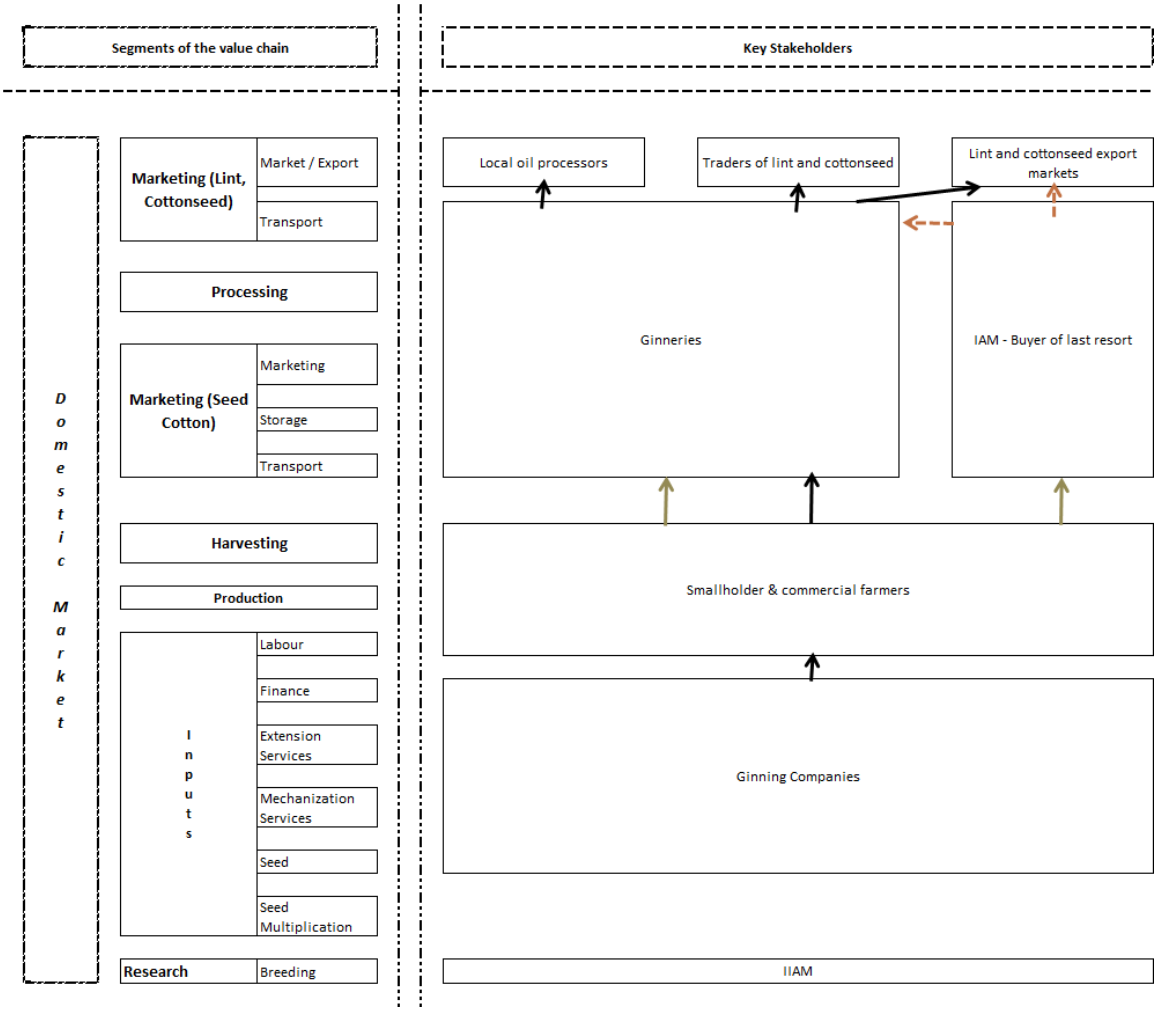
Mozambique's cotton value chain is summarized in Figure 8. Seed cotton is a labor-intensive crop, often requiring access to both family and hired labor. The main production areas are in the north; Nampula, Cabo Delgado, Tete, Niassa, and Zambezia provinces account for 84 percent of total production (IAM 2014 and INE 2013). Seed cotton is grown as a rainfed crop in Mozambique, produced by about 250 thousand farmers, mostly by smallholders cultivating on average 0.5 ha with seed cotton yields of 600-700 kg per hectare.[15]

Mozambique's cotton sector is organized according to a system of concessions granted by government to private ginning companies, based on a contract agreement between the latter and

[15] This represents a significant improvement over yields of 120-180 kg per hectare presented in FAO (2012).

the state, represented by the Mozambique Cotton Institute (IAM). The contract stipulates concessionaires' clear rights and obligations and sole marketing responsibility (they have monopsony buying power) over a given concession area. Ginning companies are responsible for promoting seed cotton production under contract farming arrangements with individual smallholders, providing inputs and agricultural services to producers, purchasing seed cotton harvested by producers, ginning, and exporting cotton lint and cottonseed.

Figure 8: Cotton Value Chain Flowchart



Source: *Study Team Analysis*

IAM was established in 1991 to support and supervise activities related to the production, marketing, processing, and export of cotton. IAM works closely with ginning companies and public research institutions to promote an efficient and competitive cotton industry. It also plays the role of buyer of last resort, if farmers are unable to sell to the ginning concessionaire in their district. For its various services, IAM assesses a 2.5% fee on exports.

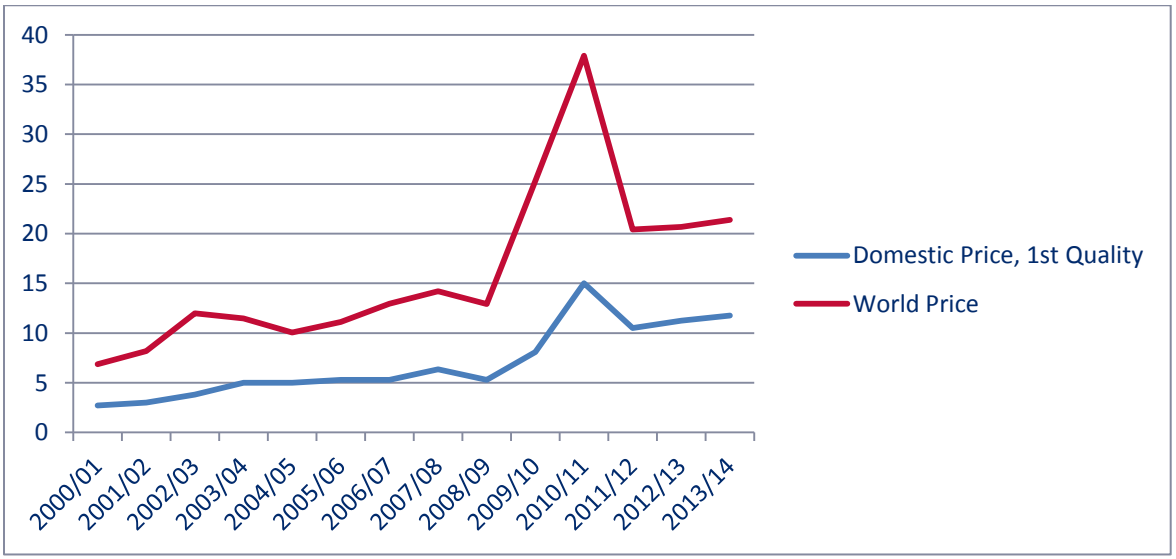
Two seed cotton producer prices are set annually by the government, negotiated among IAM, the Cotton Association representing ginners, and producers in each cotton production cycle. An *indicative price* is set before sowing begins (in October/ November), and an *official minimum price* is fixed just before the harvest begins (in April/May). The formula (below) for setting the

minimum producer price takes into account the world price,[16] the estimated cost of insurance and freight between Mozambique and importers, a quality differential (depending on whether first or second quality lint is exported), transaction fees, the exchange rate, the ginning ratio (% lint extracted per unit of seed cotton), net value of seed after deducting 12% of total seed ginned to be returned to farmers for next year's planting, and the negotiated share to producers on export income, ranging from 50-55 percent (FAO 2012). Ginning companies may offer prices that exceed these minima.

Minimum Producer Price = { [(World Price – (Insurance, Freight, Quality Differential, Transaction Fees)) * Exchange Rate] * Ginning Ratio + Net Seed Value} * Negotiated Producer Share

Mozambique's minimum producer price for first-quality seed cotton has tracked international prices over time, as seen in Figure 9. Since 2011/2, the domestic price received by producers is about half of the world price equivalent.[17]

Figure 9: Domestic & World Cotton Prices, Seed Cotton Equivalent (MT/kg)



Note: The world price shown here is a seed cotton equivalent price, equal to the average world CIF lint price from the second year of each campaign, adjusted from CIF to FOB by an assumed 5% price reduction, multiplied by the average MT/$ exchange rate (World Development Indicators), and converted into seed cotton equivalent using an assumed, constant ginning ratio of 38%.

Source: Domestic prices, 1st quality from IAM website; World lint prices from World Bank historical commodity price series

Like all agriculture, cotton production is subject to weather and market risks (World Bank 2010). However, since the domestic price is directly linked to the international cotton price, and since an

[16] Average price over the previous six months, according to one ginning representative.

[17] In August 2014 Mozambique's news agency reported that seed cotton had been confiscated from Mozambicans attempting to sell into Zimbabwe from Manhiça province (AIM 2014). The 2014 producer price in Zimbabwe is between 40 and 50 cents (US) per kilogram, depending on grade (Zimbabwe Mail 2014), compared with 11.75 MT (39 US cents) for top quality in Mozambique.

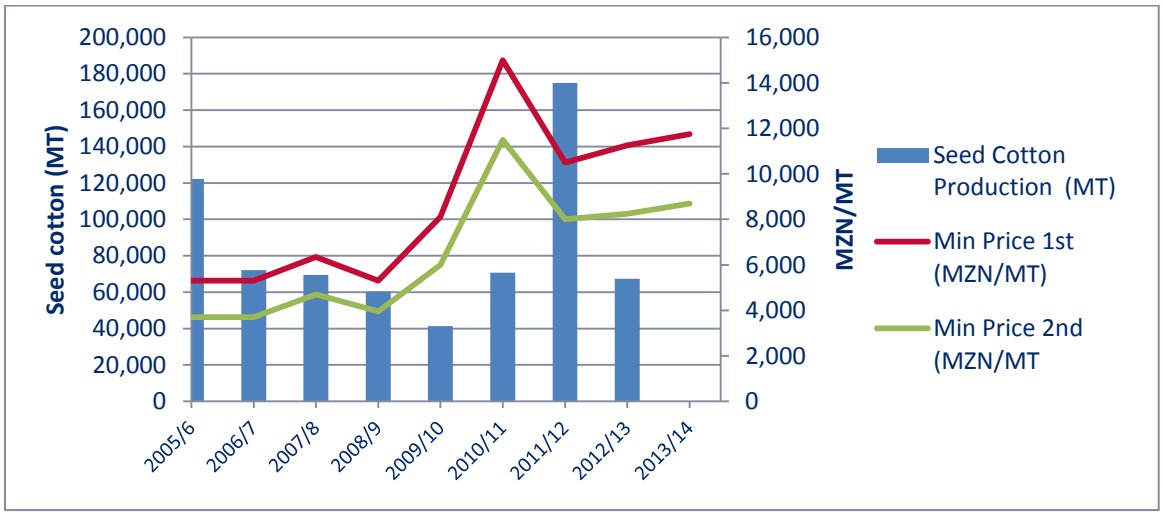
indicative price is set seven months before the commercial season begins (presumably to give farmers adequate information to weigh whether to plant cotton; a final price is announced in April just as harvesting and purchasing gets underway), the ginning companies face significant price and exchange rate risks, depending on how international prices and currency markets trend in the months of the commercial campaign following the April announcement of the official price.

Production

The production characteristics described here are related to a typical smallholder farmer with minimum use of inputs, no use of hired labor, getting low yield and operating under contract farming with ginning companies. Ginning companies supply seeds, chemicals, and extension services, purchase the harvest, and pay farmers.

The minimal use of improved inputs and the lack of varietal development for the seed supplied seem to be determinant factors for seed cotton yields (Grupo João Ferreira dos Santos (JFS)/ Cotton International Conference 2014). Seed cotton production exhibits large variability in response to farmgate price changes, as shown in Figure 10.

Figure 10: Seed Cotton Production and Minimum Farmgate Prices, 2005 -2014



Source: IAM 2014

Processing, Marketing, and Trade

Ginning companies purchase seed cotton from farmers and then process it. There are fifteen ginning companies in the country, with an installed processing capacity estimated at 260 000 MT per year. Most ginning capacity is installed in northern and central regions of the country, in line with the areas of concentration of seed cotton production. Current ginning outturn is relatively

low, averaging 38 percent;[18] cotton seed accounts for 61 percent of weight, and the remaining 2 percent is waste. Mozambique's relatively low ginning ratio is said to be due to quality issues (e.g., dirty cotton caused by poor picking techniques; use of mixed seed varieties; and cotton mixing when bulking, resulting in inconsistent fiber quality, per World Bank 2010, p. 6). The ginning byproduct cottonseed is either crushed locally to supply domestic cooking oil or exported to South Africa, while 12 percent of seed is redistributed to farmers for planting.

Volumes of lint exports vary greatly in line with world price changes. In the last ten years, average exports of lint amounted to 25,000 MT with lowest at 8,948 MT (INE, UNCTAD statistics). For the 2013/14 campaign, IAM expects exports in excess of 40,000 tons. Whereas in earlier years, European markets were the most important destination for Mozambican lint, in 2012/13 almost 80 percent of lint exports were sent to Asia, with Malaysia and China accounting for over 50 percent of exports that year.

Table 7: Comparison of Mozambique FOB & World Cotton Lint Prices, 2003/4-2013/4

Campaign	Average FOB Price, Mozambique ($/T)	World Price (CIF $/kg) (Yr1)	World Price (CIF $/T) (Yr1-Yr2)	85% World Price (FOB equivalent)	Ratio of Mozambique/ World FOB Price
2003/4	1070	1.37	1382	1175	91%
2004/5	990	1.22	1291	1098	90%
2005/6	1010	1.27	1242	1055	96%
2006/7	1130	1.40	1331	1131	100%
2007/8	1410	1.57	1485	1262	112%
2008/9	1150	1.38	1478	1256	92%
2009/10	1700	2.28	1833	1558	109%
2010/11	2310	3.33	2806	2385	97%
2011/12	1540	1.97	2648	2251	68%
2012/13	1770	1.99	1980	1683	105%
2013/14	1500*	2.00	1996	1697	88%

*Note: * Expected*

Sources: IAM and World Bank Historical Commodity Prices

The FOB price of Mozambican cotton lint prices tracks world prices, albeit imperfectly (Table 7). In some years, the FOB price received by Mozambique appears to overshoot, then undershoot, the world price, averaged over two years and adjusted downward by 15 percent to account for the CIF-FOB differential. The average ratio of Mozambique's FOB price to the world price over the 2003/4-2013/14 period is 95 percent. This somewhat lower price is said to be due to the fact that Mozambique has historically been a very smaller player on the world market than other, more significant exporters (Table 8). Africa, overall, has accounted for about 11 percent of world lint

[18] Tschirley et al.'s Table 11.4 reports the following ginning outturn ratios elsewhere in sub-Saharan Africa: Burkina Faso, 42%; Mali, 42%; Cameroon, 41%; Zimbabwe, 41%; Zambia, 40%; Tanzania, 36%; Uganda, 35% (Tschirley et al. 2009).

exports, and Mozambique only about 2% of Africa's share. The World Bank suggests that Mozambican lint is of inferior quality due to a variety of factors: poor harvesting practices; use of mixed seed varieties; and cotton lint mixing by ginners (World Bank 2010), whereas Mozambican stakeholders suggest that the lower price received by Mozambican exporters is due to the lower volumes it sells.

Table 8: World Cotton Lint Exports, 2005 and 2011 (Tons)

Region	2005	2011		2005	2011
World	8,807,502	8,198,818			
Africa	1,403,690	870,544			
SELECTED AFRICAN EXPORTERS					
Burkina Faso	194,600	158,793	Zambia	54,284	35,325
Zimbabwe	68,926	89,466	Tanzania	66,330	30,334
Mali	258,830	78,152	Mozambique	21,235	16,486
Côte d'Ivoire	129,304	70,169	Chad	45,034	14,995
Cameroon	116,396	55,803	Sudan (former)	81,064	7,442
Benin	161,271	52,298			

Source: FAOSTAT, FAO, accessed August 22, 2014

Cost Structure and Drivers

Information used for this analysis was drawn from IAM and complemented with information from smallholder farmers' interviews and meetings with a representative from the ginning companies.

When analyzed using a financial cost model, land, seed, and own-farm labor are costed at zero. Thus, financial seed cotton production is driven by the cost of purchased inputs (insecticides, sprayer and batteries, and protective materials). Although no hired labor is used in this traditional model, intensive use is made of family labor, which implies that the opportunity cost of labor is another cost driver of seed cotton production. Although one might expect some indirect resource boom effects through labor market impacts, as wages and opportunities arise and family labor today growing cotton seek opportunities in an expanding non-rural economy. However, according to Salinger and Ennis (2014a), it is not expected that the natural resource boom will put upward pressure on the wages of low-skilled, agricultural labor. Assessment of cotton profitability in economic prices uses the CIF price in Asia, adjusted back to Maputo, of $1.91 per kilogram, whereas the financial analysis is done using IAM's expected FOB price for the 2013/14 campaign of $1.50 per kilogram (IAM 2014).

Farm-level returns to own-labor are 59 MT/day. This is well below the current minimum wage in agriculture of 3010 per month, or about 115 MT per day. Of course, it would not be unusual for returns to family farm labor to be below the official minimum wage. In fact, MT 3010 per month

is about $100 per month, which is $3-4 per day, depending on the number of days worked per month.[19]

Downstream costs are assumed to be the same in both the financial and economic scenarios. In the economic profitability analysis, land is valued at 1,600 MT per hectare and own-labor is valued at the prevailing market wages (not official minimum wages for the agriculture sector), varying from 30 to 175 MT per day, depending on the task and the calendar.

Transportation costs from farm to gin and from gin to port and port charges are an important driver of ginning costs. Labor costs, both variable ginning labor and fixed labor costs, are also significant. The model also includes a fee of 2.5 percent charged by IAM on the FOB price for to promote the development of the cotton sector. Total ginning costs are in part offset by the value of the marketable (and exportable) by-products, cottonseed and cotton waste (linters), which are valued according to prices provided by IAM.

Table 9: Costs & Profitability Estimates: Smallholder Cotton

Cost Summary		Unit	Financial	Economic
Farm-level	Land	MT/ha	0	1,600
	Purchased inputs	MT/ha	1,202	1,287
	Labor	MT/ha	100	5,115
	Subtotal	MT/ha	1,302	8,002
	/ Yield (0.7 Tons/ha)	MT/ton seed cotton	1,859	11,431
	/38% ginning ratio	MT/ton cotton lint	4,893	30,081
Ginning, marketing, export	Labor	MT/ton cotton lint	2,940	2,940
	Transport (farm-gin, gin-port), port charges	MT/ton cotton lint	5,407	5,407
	Other (sacks, losses, packaging, energy, repairs, etc.)	MT/ton cotton lint	4,590	4,590
	IAM charge	MT/ton cotton lint	1,125	1,125
Minus value of	Cottonseed, waste	MT/ton cotton lint	(5,689)	(5,689)
TOTAL	**FOB**	**MT/ton cotton lint**	**13,265**	**38,453**

[19] This is significantly higher than factory wages in Southeast Asia, suggesting imbalances. Factory minimum wages in Bangladesh were raised to $68 per month in late 2013; in Cambodia, they are $100 per month; in Vietnam, $100-128 per month, depending on location; in China, minimum wages in the most industrial provinces of Shenzhen and Shanghai are over 1,800 yuan per month (almost $300) (http://www.clb.org.hk/en/content/wages-china). A report conducted by the U.S. Worker Rights Consortium (2013) compared real wages (based on the legal minimum wage and other compensation normally received, but *not* overtime pay) of apparel workers in countries that supply the U.S. clothing market. Their report found that wages in Peru, Guatemala, and Thailand exceeded those in China somewhat, with Bangladesh and Cambodia at the low end of the range.

Arguably, since labor productivity is much higher in Asian industrial settings, the minimum wage for agriculture in Mozambique appears high, relative to these benchmarks. In Mozambique, workers who can find employment at the official minimum wage in agriculture are considered fortunate (Jones and Tarp 2012). However, access to salaried work is rare for rural workers, most commonly held by young men who migrate for some or all of a season (Ali 2013).

Profitability Analysis		Financial	Economic	
FARMGATE				
Gross revenue		MT/ton seed cotton	11,750	
Costs		MT/ton seed cotton	1,859	
Net revenue		MT/ton seed cotton	9,891	
Cost-benefit ratio			0.16	
Return to family labor		MT/day own-labor	59	
FOB				
Gross revenue		MT/ton cotton lint	45,000	57,305
Costs		MT/ton cotton lint	13,265	38,453
Net revenue		MT/ton cotton lint	31,735	18,852
Cost-benefit ratio			0.29	0.67

Source: *JFS, Study Team Analysis*

Financial profitability is positive, with a financial cost-benefit ratio of 0.16 at farm level and an economic cost-benefit ratio of 0.67 ex-ginnery.

Potential Impacts of Dutch Disease

Exchange rate effect: What would be the impact if the metical appreciates from 30 MT/$ to 20 MT/$ on the cotton industry? A strong appreciation of metical would lead to a lower value of lint exports, set in dollars in Asia and expressed in meticais at Mozambique's border. The cotton industry becomes borderline non competitive, based on its economic cost-benefit ratio of 1.01.

Innovation effect: If, however, seed cotton yields were to rise to 1.5 tons per hectare, economic profitability would be restored.

Table 10: Impacts of Dutch Disease on Cotton Profitability

Profitability Analysis			Financial (Farmgate)	Economic (Ex-Gin)
EXCHANGE RATE = 20 MT/$				
Gross revenue		MT/ton	7,833	38,204
Costs		MT/ton	1,341	38,608
Net revenue		MT/ton	6,493	(405)
Cost-benefit ratio			0.17	1.01
Return to family labor		MT/day	39	
EXCHANGE RATE = 20 MT/$ & YIELD = 1 T/HA				
Gross revenue		MT/ton	7,833	38,204
Costs		MT/ton	938	29,993
Net revenue		MT/ton	6,895	8,210
Cost-benefit ratio			0.12	0.79

Source: *Study Team Analysis*

RICE

Mozambique has a 500-year tradition of rice cultivation, according to the International Rice Research Institute. Rice plays an important role in the diet of the Mozambican population, contributing about a quarter of all cereals calories consumed,[20] and is a source of cash income. Mozambique is either the fourth (measured in total consumption) or third largest (when measured in per capita terms) consumer of rice in Southern Africa (Table 11).

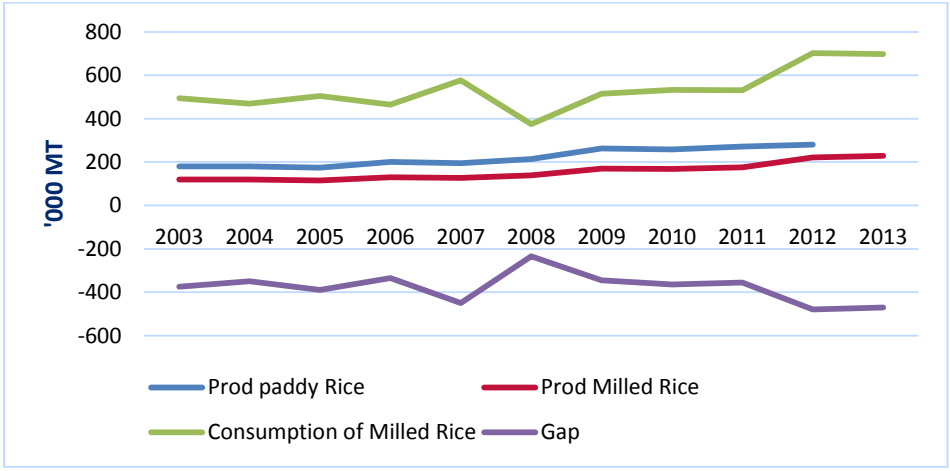
Table 11: Rice Consumption in Southern Africa

	TOTAL CONSUMPTION - MILLED RICE ('000 tons)			PER CAPITA CONSUMPTION - MILLED RICE (Kg per Capita)		
Country	**2010**	**2011**	**2012**	**2010**	**2011**	**2012**
Madagascar	3202	2902	2810	151.9	133.9	126.0
Tanzania	1030	1090	1100	22.9	23.5	23.0
South Africa	700	850	900	13.8	16.5	17.2
Mozambique	533	551	582	22.2	22.4	23.1
Angola	266	322	335	13.6	16.0	16.1
Congo, DR	317	317	317	5.1	5.0	4.8
Malawi	78	79	91	5.2	5.1	5.7
Mauritius	65	55	70	50.7	42.8	54.2
Zambia	40	40	41	3.0	2.9	2.9
Swaziland	3	3	3	2.5	2.5	2.4

Note: Data not available for Lesotho, Namibia, Seychelles, or Zimbabwe.

Source: IRRI World Rice Statistics, accessed August 21, 2014

Figure 11: Rice Production and Consumption in Mozambique, 2003-2013



Source: Index Mundi, sourced from USDA and confirmed with IRRI statistics.

[20] According to the FAO 2011 food balance sheet for Mozambique. Maize contributes half of all cereals calories consumed.

Despite favorable agro-ecological conditions, the country depends on imports for two-thirds of total consumption. In 2012 milled rice imports reached about 480,000 MT, domestic production of milled rice was 222,000 MT. Figure 11 illustrates the milled rice balance (market size) in the last 10 years.

Production Characteristics

Mozambique's potential for rice production is an estimated area of 900,000 hectares, of which an estimated 300,000 hectares are currently used for paddy production, according to the FAO. About 60 percent of this is cultivated under lowland wet conditions, the remainder under upland dry (Kajisa and Payongayong 2011). With only minor strategic support to improve productivity and convert rice cultivation into a cash and (potentially) export crop, current production is unable to satisfy total domestic demand, estimated at 700,000 tons of milled rice, of which between 450 and 500,000 tons are imported annually (USDA 2014b).

Today, considerable initiatives are underway to raise rice production through expanded area and increased yields in Zambézia, Nampula, Sofala, Gaza and Maputo; with major irrigations investments in Zambézia and Gaza provinces. Intergovernmental cooperation with China has led to new developments in the Chokwé and Xai-Xai irrigation perimeters of Gaza province. A chart of the value chain is presented in Figure 12.

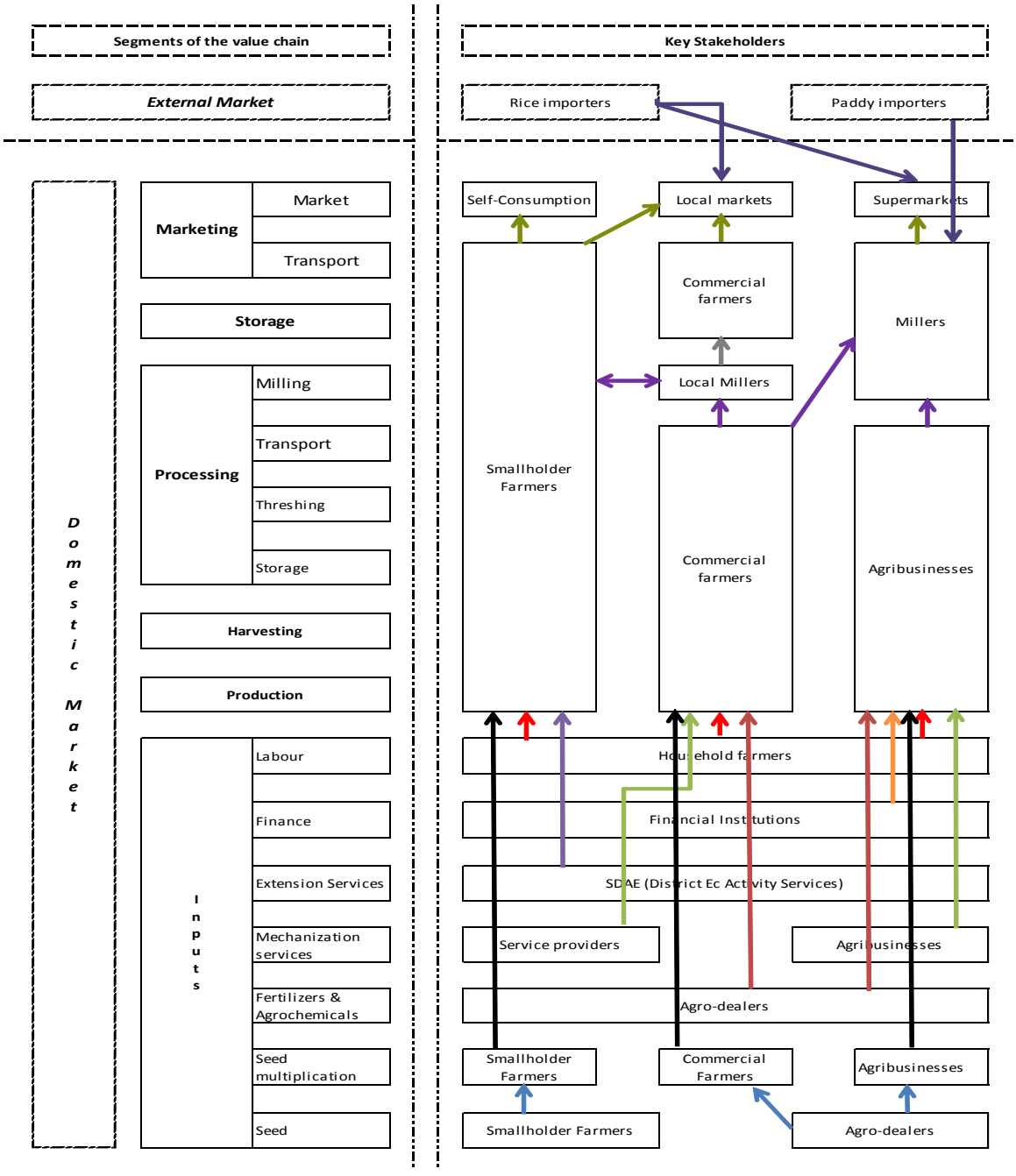
Current rice production in Mozambique is on traditional, smallholder-based systems on areas ranging between from 0.5-1hectare. Yields are low, ranging from 0.5-2.5 tons per hectare, although the top 20 percent of farmers in Gaza province's Chokwé perimeter attain 4 tons per hectare (Kajisa and Payongayong 2011, 619). Chokwé perimeter was developed during colonial times, had fallen into disrepair, was severely damaged by flooding within the last ten years, but is now receiving rehabilitation investments. One crop of rice is produced in Mozambique per year, but the irrigation authority in Xai-Xai (*Regadio do Baixa Limpopo*, RBL) hopes to move to two seasons per year in the near future.

Large-scale production is being experimented through a public-private partnership with a Chinese company, Wanbao Grain and Oil Investment Limited, in the Lower Limpopo region of Xai-Xai (and to some extent, in Chokwé). Wanbao's production technology currently yields about 5 tons per hectare with potential for 10 tons.[21] The Chinese company currently offers a training program to teach their methods – involving leveling of land (by tractor) prior to seeding to enhance water

[21] Wanbao's work in Mozambique's rice sector attracted attention when accusations regarding Chinese motivations ("land grabs," "producing for export to China") were raised in the popular press and online. This, in turn, has brought researchers to nuance or dispel such claims; see D. Brautigam and S. Ekman, "Rumours and Realities of Chinese Agricultural Engagement in Mozambique," *African Affairs* 111 (2012): 483-492; A. Ganho, " 'Friendship' Rice, Business, or 'Land-grabbing'?" *Land Deal Politics Initiative* Working Paper 32 (May 2013); S. Chichava, "Xai-Xai Chinese rice farm and Mozambican internal political dynamics: A complex relation," LSE IDEAS Africa Programme, Occasional Paper 2 (July 2013). While concerns over local land rights and government granting of use rights to foreign investors are an important issue, attention from local and international press, NGOs, civil society, etc. has politicized Chinese technical cooperation projects in Mozambique's irrigated perimeters at a time when access to promising, new technologies to raise food production productivity is sorely needed.

utilization, use of pre-germinated seed, and transplanting of seedlings after germination as sowing gaps become evident – to local farmers on outgrower schemes. These innovations require discipline and a focus on results by farmers, especially in the first 40 days of the rice season to achieve the expected/indicated yields. Farmers are first trained on one hectare; after demonstrating mastery of techniques and commitment to the process, farmers are allowed to expand their operations to as much as four hectares. Other large-scale, commercial farming investments in rice production are being made by OLAM, a private, international agribusiness company, in Namacurra, Zambézia.

Figure 12: Rice Value Chain Flowchart



Source: Study Team Analysis

Farmers acquire certified seed from both public and private outlets. Rice producers typically use local, drought-tolerant seed varieties with production cycles of 5 to 6 months and yield potential of 2.5 ton/ha.[22] Improved, shorter cycle, high-yielding varieties are not drought-tolerant and require fertilizers, with potential yields of 6 tons/ha.[23] The *Instituto de Investigação Agrária de Moçambique* (IIAM) has released four rice seed varieties,[24] multiplied by *Sementes de Moçambique* (SEMOC) for the market. MozSeeds, a subsidiary of MozFoods, imported pre-basic seed from South Africa and India and conducted rice varieties research, resulting in the release of 7 varieties,[25] all found suitable for Chokwé and other agro-ecological zones in Mozambique. MozSeeds also does varieties maintenance of those released by IIAM. Until last year, MozSeeds produced certified seeds for the market. Demand for MozSeeds' seeds decreased substantially in the last year, particularly in Gaza, possibly due to the closure of *Mozfer Industrias Alimentares* (a rice producing subsidiary of MozFoods) in 2013 after the floods and subsequent distribution of seeds by Wanbao. Government approval of Wanbao's recommended seed varieties was granted on the basis of prior certification approved in Tanzania.

Rice production is heavily dependent on water availability. Both large and small irrigation perimeters are found in Mozambique. Production in Gaza province is carried out in large irrigation perimeters in Chokwé and Xai-Xai, both along the Limpopo River. These are managed by public institutions, namely the *Hidraúlica do Chokwé Empresa Publica* (HICEP) and the *Empresa Publica do Regadio de Baixo Limpopo* (RBL). Differences between the two schemes govern access to irrigated land, which in turn influences the scale and efficient use of land. In Chokwé producers have acquired rights to the use of land (referred to by the Portuguese acronym, DUATs, for *direitos de uso e aproveitamento dos terras* or rights of land use and exploitation) from the provincial government; for reasons that are unclear, this seems to result in idle irrigated land.[26] In contrast, smallholder producers in the Xai-Xai perimeter do not have DUATs, instead they use *contractos de exploração* (exploration contracts) granted by the RBL. This form of access to irrigated land, along with Wanbao's technical assistance, seems to result in higher rates of active land use and higher rice yields. It appears that change in work-culture, involving greater farmer discipline regarding land preparation and crop management, is key for better results. This merits further research. Access to water in Chokwé and Xai-Xai is for a flat fee of MZM 800 per hectare, regardless of the volume of water actually consumed.

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[22] The most important local varieties are Chupa, Chibiça, Agulha, Faia, Mamima, Ndegue, and Muana muiangani.

[23] In 2006 four improved varieties were available: c4-63, IR – 64, ITA-212, and ITA 312. In 2011 five new varieties adapted to the southern provinces (irrigated rice) were released: BR IRGA 409, BR IRGA 417, farox, BRS Alvorada, and Macassane.

[24] IITA 312, Limpopo, Macassame, and IGA.

[25] BR IGA 409, BR IGA 417, BR S Alvorada, Farox, Teotama, Moz 114, and Vazomate.

[26] A formal land rental market does not yet exist in Mozambique, although anecdotal evidence suggests that farmers in Chokwé hope to be compensated for their DUATs if foreign investors seek to produce on their land. For more information, see USAID (No date) and Bruce (2007).

In other rice producing provinces, small-scale irrigation, perimeters managed by water users' associations, predominate. There, users pay a utilization fee that covers infrastructure, water use, and management.

Rice cultivation is fairly labor-intensive, particularly at planting and pre-harvest stages. Guarding against predation by birds as the rice matures in the field is especially labor-consuming. Kajisa and Payongayong (2011) observed that labor constraints are an issue for rice cultivation in Mozambique, unlike in Asia where landless laborers are readily available for hire by rice farmers. Although exchange labor among farmers and paid labor by task both exist in Mozambique's rural sector, the authors maintain that labor supplies are insufficient for large-scale, Asian-style rice cultivation. Farmer interviews in Xai-Xai did not raise labor supply constraints as an issue, however. In addition to seeds, water, and labor, purchased inputs (e.g., fertilizers, pesticides, and land mechanization services) are used in rice production in Chokwé.

Milling

Although Mozambique's rice milling capacity is installed in several location of potential production, the supply of paddy is far below the existing processing capacity.[27] Most of the rice produced by smallholders in Zambézia is processed at home, using either traditional processing methods or small household processing manual machines. In Gaza there two existing rice milling factories: one in Palmeiras, Inácio de Sousa, which sells milled rice in Maputo, the other in Xai-Xai, operated by Wanbao. HICEP is also building a new rice mill in Chokwé, scheduled to be complete in mid 2014. In Zambézia two milling companies operate: *Empresa Orizícola da Zambézia* (100 tons/day), property of the Federation of Associations of Zambézia in Nicoadala; the other is the *Instituto de Cereais de Moçambique* (ICM) (150 ton/day). New rice processing infrastructures have been established with government support in Limpopo and Zambeze Development Corridors.

A report on Mozambique's rice sector suggested that poor post-harvest practices (threshing, drying) and outdated installed rice milling capacity create suboptimal conditions for competitive rice milling in Mozambique (Agrifood Consulting 2005). Although Mozambique's average rice milling ratio is a respectable 67 percent,[28] milled rice in Mozambique exhibits a fairly high degree of broken grains, comparable to the 15-25 percent brokens rice exported by Thailand. Also according to Agrifood Consulting, the average cost of rice milling in Mozambique is five times higher than benchmark costs in Southeast Asia ($54 per ton versus $11 per ton, in 2005), owing to several factors. Most mills in Mozambique are diesel-, rather than electricity-operated. Labor and handling costs are also much higher, due to higher wage rates and lower labor productivity in Mozambique. Thirdly, all other costs – packaging, transport, and other variable and fixed costs –

[27] Capacity use rates are said to be "significantly below 50 percent" (Agrifood Consulting 2005, 95).

[28] Agrifood Consulting Inc. reports much higher shares of milled rice obtained from small-scale mills, whereas larger mills are reported to produce 50 percent whole grain and 15 percent of fine, broken rice. The same report cites international best practices of 72-73 percent in Asia.

are also significantly higher in Mozambique. Moreover, transport costs from mill to wholesale are higher in Mozambique, affecting value-chain costs for rice and all other commodities as well.

Trade

Mozambique imports milled rice mainly from Thailand, Pakistan, Vietnam, and India. Larger importers include ADC (formed through the merge of Delta Trading with Africom), OLAM International, Phoenix Commodities, and DALIMA Trading, in addition to about twenty small traders/importers. Given the current market structure including the actual rice technology frontier it will require enormous investment in technology to achieve higher yields and production in scale to compete and progressively substitute imports.

Cost Structure and Drivers

The cost structure of the rice value chain is built from interviews held with HICEP, RBL, and the Provincial Directorate of Agriculture in Zambézia, smallholder farmers, milling companies, and traders/importers. Actual cost data used for a high-input, smallholder farm in Chokwé were provided by HICEP. The structure represents a typical, market-oriented smallholder farmer, using seed, chemicals, irrigation, mechanization, fertilizers, and mainly family labor.[29]

In the financial analysis, the main cost drivers at farm level are associated with purchased inputs (46% of farm-level costs); mechanization (26%); and labor (24% of financial cost is hired labor), especially the costs associated with guarding against bird damage. The rental use of tractors in mechanized operations such as land preparation, planting, and harvesting drives the cost, due fuel consumption. Although a fuel subsidy exists for agricultural uses (and has been incorporated in the analysis), its access has been cumbersome.

Processing costs are derived from a detailed 2005 study of Mozambique's rice sector, including small-scale diesel, small-scale electric, and medium/large-scale milling costs (Agrifood Consulting 2005). These were averaged, and adjusted by Mozambican inflation to 2014 prices. Total milling costs are driven by labor (33 percent), capital costs (22 percent), fuel, maintenance, and electricity (19 percent), and fixed costs (17 percent). Milling costs also reflect the burden of underutilized capacity. Of the final cost of milled rice delivered to Maputo, farm level costs represent about 71 percent of total cost, ginning costs are 23 percent, and the rest is the cost of transport from mill to Maputo.

In the economic cost analysis, all labor inputs are valued, including family labor (initially valued at 75 MT per day), bringing total labor costs to 30 percent of total farm-level production cost, in economic terms. If valued at 100 MT per day, the official minimum wage, economic profitability decreases further.

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[29] In our financial analysis, costs reflect actual expenditures by farmers, with family labor valued at zero and financial returns estimated per day of family labor spent in cultivation. In our economic analysis, we apply opportunity costs to value all labor, whether hired in or contributed by the farm household.

A domestic financial price of 9 MT/kg was used to value paddy at farmgate and 22.5 MT/kg for a kilogram of milled rice in the Maputo wholesale market.[30] The price used to estimate economic profitability is based on the FOB price of 25% broken rice from Thailand ($390 per ton), adjusted to Maputo and converted into meticais. The net return at farmgate per day of family labor is about 75 MT per day. However, when the value of family labor is included in the economic analysis (valued in the base case at 100 MT per day, as per the official minimum wage for agriculture), rice cultivation is not profitable at the farm level, as indicated in Table 12.

Should this farmer achieve yields of 5 tons of paddy per hectare, however, the economic cost-benefit ratio becomes 0.88, i.e., the system is once again profitable (the breakeven yield is about 4.5 tons per hectare). At the wholesale level, milled rice is economically uncompetitive as well, given the significantly lower import parity price and the inclusion of all labor costs. [31] As at the farm level, a higher yield on-farm would improve the profitability of milled rice as well (however, the breakeven yield is much higher, inclusive of milling and transport costs: 7 tons of paddy per hectare would be required to achieve a cost-benefit ration of 0.98).

Table 12: Costs & Profitability Estimates: Smallholder Rice

Cost Summary		Unit	Financial	Economic
Farm-level	Land, water	MT/ha	1,400	2,000
	Purchased inputs	MT/ha	15,490	15,490
	Mechanization	MT/ha	8,733	10,333
	Family labor	MT/ha	0	3,913
	Hired labor	MT/ha	8,000	8,000
	Subtotal	MT/ha	33,623	39,736
	/ Yield (4 Tons/ha)	MT/ton paddy	8,406	9,934
Rice milling	Labor, fuel, electricity, packaging, fixed costs, net of husks & bran	MT/ton paddy	2,827	2,827
Subtotal		MT/ton paddy	11,233	12,761
	/ Milling ratio (67 percent)	MT/ton milled rice	16,766	19,047
Transport	Rice mill to Maputo	MT/ton milled rice	1,000	1,000
TOTAL	**Maputo Wholesale**	**MT/ton milled rice**	**17,766**	**20,047**

[30] The former is based on field interviews, while the latter is taken from a Famine Early Warning System Network July 2014 market price, adjusted by 90% to infer a wholesale price.

[31] These findings confirm those in Agrifood Consulting International (2005).

Profitability Analysis			Financial	Economic
FARMGATE				
Gross revenue		MT/ton paddy	9,000	9,000
Costs		MT/ton paddy	8,406	9,934
Net revenue		MT/ton paddy	594	(934)
Cost-benefit ratio			0.93	1.10
Return to family labor			19	
MAPUTO, WHOLESALE				
Gross revenue		MT/ton milled rice	22,500	14,219
Costs		MT/ton milled rice	17,766	20,047
Net revenue		MT/ton milled rice	4,734	(5,828)
Cost-benefit ratio			0.79	1.41

Source: *HICEP, Study Team Analysis*

These findings underscore the technological challenges faced as policies and programs strive to support significant yield increases and scale up production. Without such productivity improvements, Mozambique will be unable to compete, i.e., unable to economically substitute domestic production for rice imports.

Potential Impacts of Dutch Disease

Sharply rising inflows of foreign exchange from export sales (for example, of natural resources such as coal and natural gas) can lead to strengthening of the value of the local currency, relative to foreign currencies. The immediate "exchange rate effect" can be an appreciation of the currency, which may set in motion a set of economic consequences. How might this impact the rice value chain? Table 13 shows the potential shifts in profitability.

Exchange rate effect: If we assume metical appreciation from the current USD exchange rate of 30 MT/$ to 20 MT/$, this would result in lowering both the cost in meticais of imported inputs and the price in meticais of imported rice. Both financial and economic profitability become negative under such a scenario.

Innovation effects: If we assume adoption of higher yielding technology, such as the Wanbao package, and more disciplined work culture, paddy rice yields could increase from their current level of 4 to at least 6-8 tons per hectare. However, a yield of 9 tons per hectare would be required to break even, in terms of economic profitability, at an exchange rate of 20 MT/$.

Table 13: Impacts of Dutch Disease on Rice Profitability

Profitability Analysis			Financial	Economic
EXCHANGE RATE = 20 MT/$				
Gross revenue		MT/ton		9,646
Costs		MT/ton		16,757
Net revenue		MT/ton		(7,111)
Cost-benefit ratio				1.74
EXCHANGE RATE = 20 MT/$ & YIELD = 9 T/HA				
Gross revenue		MT/ton		9,646
Costs		MT/ton		9,497
Net revenue		MT/ton		149
Cost-benefit ratio				0.98

Source: *Study Team Analysis*

SOYBEANS

The cultivation of soybeans in Mozambique is experiencing rapid growth. Attempts to introduce soybeans in Mozambique date back to the 1980s. However, early efforts were disrupted by the civil war. In 2005 production of soybeans was reintroduced, mostly by NGOs such as World Vision and CLUSA,[32] focusing initially on the development of improved seed varieties. Zambézia, Tete, and Manica provinces are the targeted areas for soybean production.

Since 2008/09 TechnoServe and CLUSA have promoted the scale-up of soybean production to supply the poultry industry in substitution for imported soybean cake. In the last five years soybean production has grown more than six-fold (about 60% annual average growth).[33] Key private sector investments in outgrower production and soybean processing have been made by MOCOTEX, Africa Century Limitada, Corredor Agro, Rei do Agro, Hoyo-Hoyo, AgroMoz, Alif Quimica, and Alan le Grange. In 2009 Mozambique's total consumption of soy cake, primarily by a growing poultry industry, was estimated at 35,000 MT, of which 78 percent was imported. Demand for soy cake continued growing to 42,000 MT in 2010, and is expected to reach 137,000 MT in 2020. Soybean thus has huge potential growth in the Southern Africa region and is becoming a major cash crop for smallholder farmers (Monitor Group 2012).

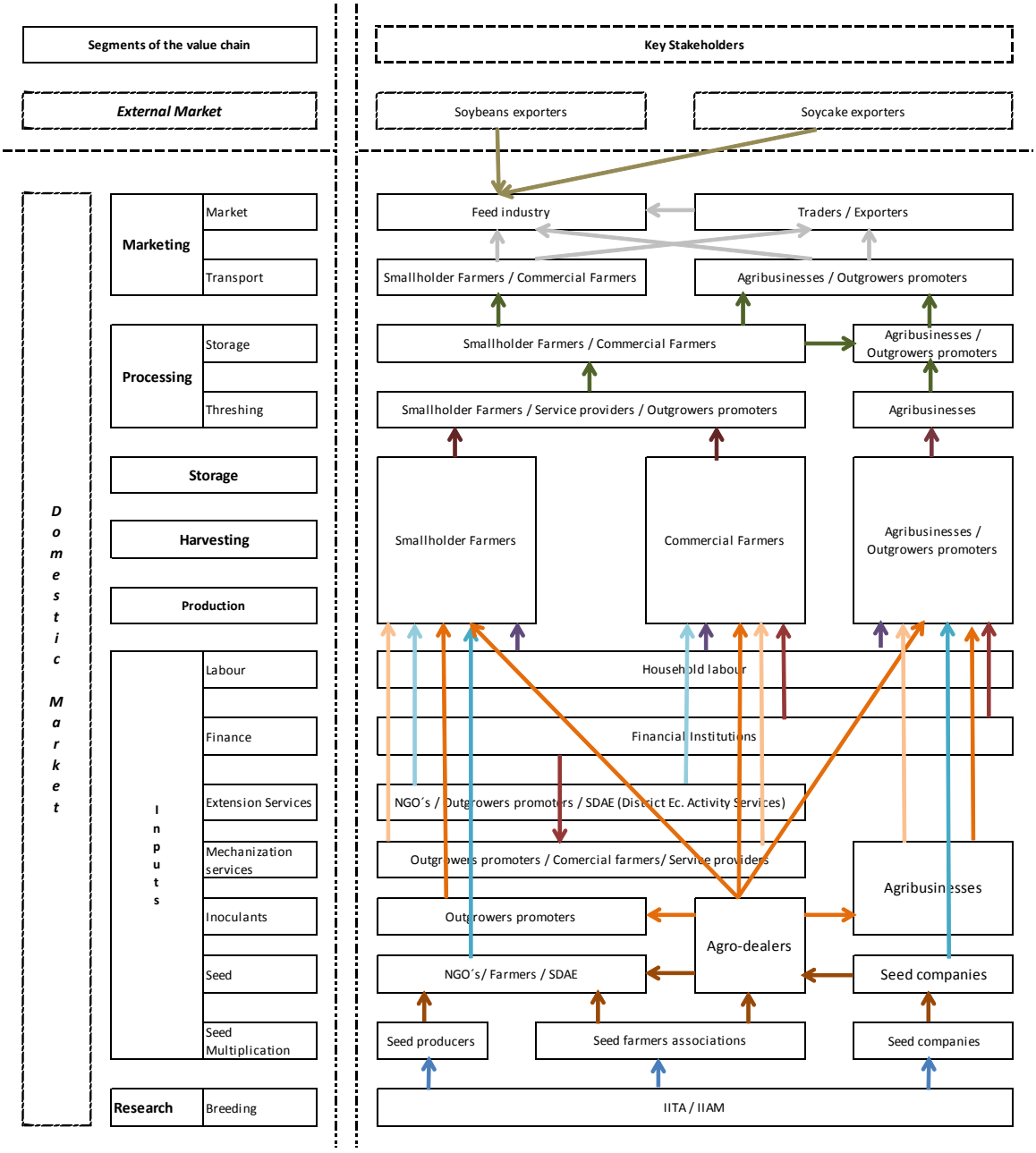
Small numbers of "small" farmers are now "emerging" as commercial farmers, growing soybeans on larger plots of land (over 1.5 hectares to a few growing on over 4 hectares, according to Hanlon and Smart (2012, 3)) and earning substantial profits (equivalent to several hundred dollars to over $1,000). However, progression to the commercial level requires secure markets, access to

[32] The Cooperative League of the USA (CLUSA) is the international arm of the National Cooperative Business Association, which provides technical assistance to develop cooperatives internationally.

[33] Interview with Luis Pereira, agricultural program director of Technoserve.

credit in order to rent in mechanization services or purchase the equipment, particularly for land preparation as well access to quality seed

Figure 13: Soybean Value Chain Flowchart



Source: Study team analysis

Production Characteristics

Soybean agronomic research and development, led by the IIAM in collaboration with the International Institute for Tropical Agriculture, has been instrumental in enhancing productivity of smallholder soybean farmers through increased access to improved varieties and crop production practices.

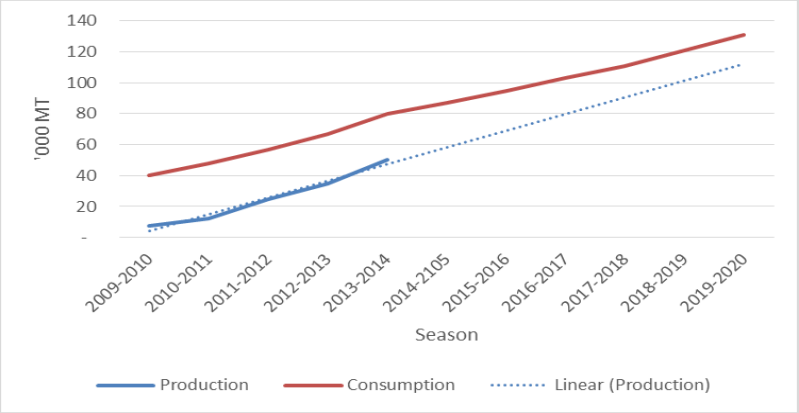
Three main production systems exist in Mozambique: (1) smallholder farmers, growing on plots of 0-10 hectares, with no mechanization and generally little or no use of inoculants,[34] achieving yields of around 1.2 tons per hectare; (2) medium-sized producers, cultivating 10-20 hectares, using mechanization, inoculants, and improved seeds, with yields of 1.5 tons/ha, and (3) large, commercial companies, using their own production equipment, improved seed varieties, and inoculants, with yields around 1.5-2.2 tons per hectare. Mozambique's average soybean yield today is approximately 1.3 tons per hectare (versus 0.5 tons per hectare four years ago), as compared with yields in South Africa, currently 1.7 tons/ha.

Smallholder farmers' access to seeds is mainly through Agricultural departments, TechnoServe's and CLUSA's seed distribution programs.[35] Private companies outsource their own needs of seeds and distribute these to their outgrowers' schemes. Smallholder farmers use mostly family labor.

Marketing

Smallholder farmers harvest, thresh, and store soybeans at their premises before marketing. Soy cake processing is done by companies in Nampula (African Century Limitada, New Horizons, and Gani Comercial), Chimoio (Abílio Antunes), and Maputo (Companhia Industrial da Matola, MEREC Industries, and Higest). It would appear that full-fat soy cake is being used in the feed industry, as soybean oil is not widely consumed in the domestic market, nor is it exported.

Figure 14: Mozambique's Soybean Production vs Consumption Trends



***Source**: TechnoServe (Southern Africa Regional Soy Study, 2011) and Team Analysis*

The poultry industry does not contract in advance with farmers for soybeans, but rather buys beans from farmers and traders in bulk at nearby market points. Demand for soybeans in central and northern Mozambique is met by domestic production of soybeans in the same region.

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[34] Inoculants introduce commercially prepared sources of bacteria to promote nitrogen fixation by soy plants and improve yields. They are used instead of chemical fertilizers. The use of inoculants was introduced by TechnoServe. Inoculants are imported from Brazil by private agri-input suppliers Agrifocus and Biochem.

[35] While encouraging farmers to adopt new technologies, the existence of free input distribution may undermine efforts to establish private input distribution networks.

Demand in Maputo for soybeans is met fully by imports, accounting for about 50% of the total of 67,000 MT (Figure 14) of soybeans that are consumed per year.

Imports of soybean cake into southern Mozambique from South Africa, Argentina, India, and Malawi compete with domestic supply, as transport and logistics costs from central and northern regions to Maputo are relatively high, costing approximately 50 meticais per ton-kilometer, according to a private transporter.

A key to competitive growth of soybean production is continued growth in domestic poultry industry demand for the beans as a feed input. Relative per capita poultry consumption figures are suggestive of the opportunities for expansion, ranging from 1.03 and 1.56 kg per capita in Tanzania and Mozambique, respectively, to 31.94 kg per capita in South Africa (OECD-FAO Agricultural Outlook, 2014-2023). TechnoServe reports that Mozambique's poultry industry grew from a $25 million industry in 2005 to over six times that size by 2009, despite the presence in the domestic market of low-cost, frozen chicken from Brazil, by way of extended shelf lives in Middle Eastern supermarkets.[36] In addition to promoting soy production, TechnoServe has worked on local sourcing advertising campaigns and support for an emerging Mozambican Aviculture Association to deliver technical industry to poultry integrators and to lobby government for increased efforts to protect against potentially unsafe poultry imports. The result has been significant expansion of market share for Mozambican broilers, now accounting for three out of four broilers sold. In addition to domestic investors, South African companies see Mozambique as a lucrative market with great potential for growth (Visser 2012).

Some soy stakeholders in Mozambique anticipate that demand for soybeans from the domestic poultry industry may be met in the coming 3 to 4 years, leading Mozambique to become a net surplus producer of soybeans. Should that scenario be realized it will be of paramount importance to explore prospects for alternative value-added markets in the domestic industry, through the promotion of consumption of soybeans as a fresh legume or value-added products such as soy oil, soy milk, or soy tofu (a protein substitute that is very popular in Asia). Some initiatives in Gurué and Manica already seek to introduce value-added products such as soybean milk, yogurt, and powder. Alternatively, regional markets may become of interest, to export soybeans or to process locally for soybean oil and export soy cake to net deficit countries in the region.[37] In the case of exports, Mozambique's viability as a competitive producer will have to be evaluated relative to global FOB prices, not CIF prices, which would be $50-60 lower.

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[36] Technoserve, "Poultry Promotes Prosperity in Mozambique," (no date); http://www.technoserve.org/our-work/stories/poultry-promotes-prosperity.

[37] Opperman and Varia (2011) report that Southern Africa is largely deficit in soybeans, producing 861,000 tons of soybeans in 2010 compared with total demand of 2 million tons, for both soy cake and soybean oil for human consumption. Poultry consumption

Cost Structure and Drivers

The structure of production costs for soybeans was estimated using the data gathered via stakeholder interviews, including with Lozane Farms, TechnoServe, soybean farmers, traders, INOVAGRO, and CLUSA. The costs are representative of a typical smallholder in an outgrower scheme, producing using a low input/low yield technology, with minimum use of mechanization (exception being a small threshing machine), and using hired labor for one-third of his/her needs.

In this production system, accounting for financial costs on-farm and through to entry of the soy crushing plant, purchased inputs (inoculants, seed, and bags) account for nearly half of on-farm costs, and labor the other half. Production costs are about 70 percent of total cost, with transport and marketing accounting for the remaining 30 percent. When land and labor are fully costed, in the economic analysis, labor costs are over 70 percent of total production cost, which is 83 percent of total cost, delivered to the soy mill.

At 2014 cost structure and prices, soy beans appear to be quite profitable at farm level. The financial producer price used to value farm production is 15 MT per kilogram. The local price is said to vary significantly throughout the season, however, and reports of producer prices as low as 7 MT were reported during the summer (though this may be due to post-harvest market pressures). The financial farm-level cost-benefit ratio is 0.39, with a return to family labor of around 35 MT per day (well below the official minimum wage), while the economic cost-benefit ratio, based on a reference output price derived from the 2014 world price for soybeans of $550 per ton (CIF Rotterdam), for the total value chain is somewhat higher, albeit still profitable (0.71).

Table 14: Costs & Profitability Estimates: Soybeans

Cost Summary		Unit	Financial	Economic
Farm-level	Land	MT/ha	0	600
	Purchased inputs	MT/ha	4,427	4,427
	Family labor	MT/ha	0	5,427
	Hired labor	MT/ha	2,673	2,673
	Subtotal	MT/ha	7,100	13,127
	/ Yield (1.2 Tons/ha)	MT/ton soybeans	5,917	10,940
Transport	Soy farm to poultry farm	MT/ton soybeans	2,200	2,200
TOTAL	**Maputo Wholesale**	**MT/ton soybeans**	**8,117**	**13,140**

Profitability Analysis			Financial	Economic
FARMGATE				
Gross revenue		MT/ton soybeans	15,000	
Costs		MT/ton soybeans	5,917	
Net revenue		MT/ton soybeans	9,083	
Cost-benefit ratio			0.39	
Return to family labor		MT/day own-labor	35	

Profitability Analysis			Financial	Economic
ENTRY, SOY CRUSHING MILL				
Gross revenue		MT/ton soybeans		18,568
Costs		MT/ton soybeans		13,140
Net revenue		MT/ton soybeans		5,428
Cost-benefit ratio				0.71

Source: *JFS, Study Team Analysis*

Potential Impacts of Dutch Disease

Exchange rate effect: How would the Mozambican soybean subsector "survive" and continue growing if the metical were to appreciate from 30 MT/$ to 20 MT/$? A strong appreciation of metical would lead to a lower price of imported soy-cake, making it more attractive for poultry feed blenders to import soy or soy cake. Furthermore, this would lead to a lower domestic price of soybeans. However, farm-level financial profitability would still be positive, albeit smaller on a per ton basis (from 9,083 MT/ton in the base case to 5,313 MT/ton in this scenario). Economic profitability, however, would be borderline uncompetitive (cost-benefit ratio of 0.96).

Innovation effect: Increasing yields from 1.2 tons per hectare to 1.5 tons per hectare, even with metical appreciation, would strengthen financial profitability and return the economic cost-benefit ratio to 0.81, indicating profitability.

Table 15: Impacts of Dutch Disease on Soybean Profitability

Profitability Analysis			Financial (Farm)	Economic (Value Chain)
EXCHANGE RATE = 20 MT/$				
Gross revenue		MT/ton	10,000	12,378
Costs		MT/ton	4,687	11,910
Net revenue		MT/ton	5,313	469
Cost-benefit ratio			0.47	0.96
EXCHANGE RATE = 20 MT/$ & YIELD = 1.5 T/HA				
Gross revenue		MT/ton	10,000	12,378
Costs		MT/ton	3,750	9,968
Net revenue		MT/ton	6,250	2,411
Cost-benefit ratio			0.37	0.81

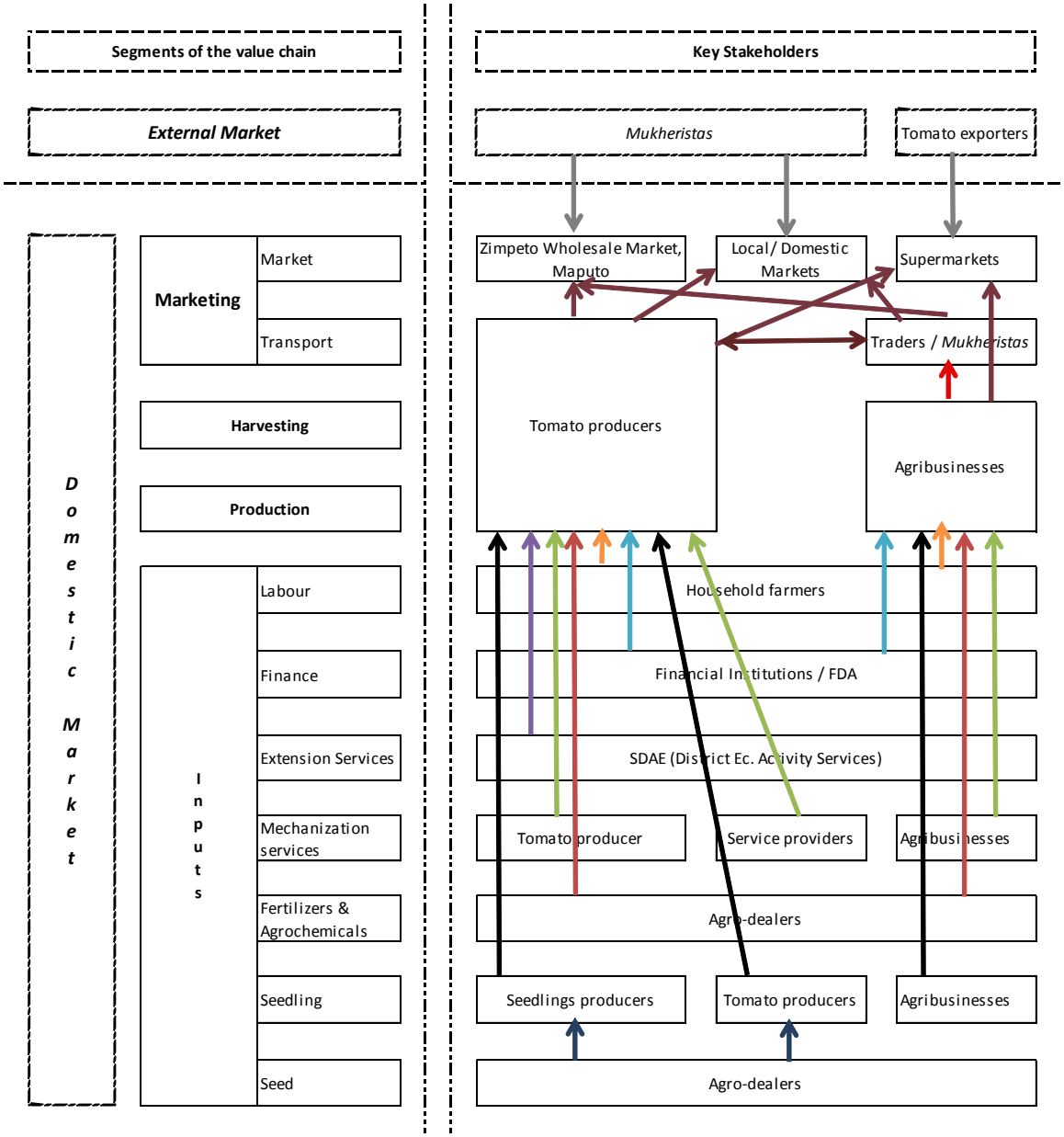
Source: *Study Team Analysis*

TOMATOES

Tomatoes, consumption of which is widespread in the Mozambican diet in both urban and rural settings, are a high-value crop, produced in Mozambique predominantly by smallholder farmers. According to the 2010 agricultural census, tomatoes are cultivated by approximately 271 thousand farms, of which 99 percent are small farms. These are located mainly (80 percent) in

Nampula, Zambézia, Tete, Manica, and Sofala provinces. The value chain map for tomatoes is outlined in Figure 15.

Figure 15: Tomato Value Chain Flowchart



Source: Study team analysis

Production Characteristics

Tomato production in Mozambique is seasonal, grown from February to August. Currently, tomatoes are imported in the off-season (summer), mainly from neighbouring South Africa. However, some private investment in greenhouses is being made in/near Maputo by both commercial and small households, with support from the Ministry of Agriculture. In addition, the Mozambican government is providing support for investments in greenhouse nurseries for tomato seedling production.

Two cost models are explored here, based on smallholder production in the Maputo province, District of Moamba, and in the Chokwé irrigated perimeter managed by HICEP, Gaza province. Smallholder farms are market-oriented and use modern inputs (e.g., seedlings, chemicals, irrigation, mechanization, fertilizers). Yields in both models are 40 tons per hectare, although with different cost structures. Both use largely hired labor. In Moamba market-oriented smallholders have access to irrigation systems,[38] pumping water from the Incomati River, though Government-run perimeters such as the *Associação de Moamba,* for example. Supply of agriculture extension services is limited to irrigated perimeters, including both public (Ministry of Agriculture) and donor-funded outsourced extension services.

The Ministry of Agriculture has released six tomato varieties to market.[39] Farmers in Moamba have also been using HTX 14 and Monica, sourced as plant seedlings from South Africa and not cleared by Mozambican authorities, a practice that brings phytosanitary risks. Despite the fact that South Africa does its own screening of plant material, Mozambican growing conditions are sufficiently different that new viruses, fungi, etc., can take hold in Mozambique. Mozambique has been gradually increasing domestic production of vegetables seedlings and reducing its imports.

Marketing

The bulk of Mozambican tomato production is sold fresh, in 20 kg crates, to domestic retail markets. There is no cold storage; tomatoes are sold in open spaces to local supermarkets and bazaars located in Grande Maputo and its surrounding areas, including the rest of the country. The Maputo suburb of Zimpeto hosts the nation's most important wholesale produce market.

Mukheristas, or informal traders, are the most important tomato importers in Mozambique.[40] They source mainly from the Mpumalanga and Limpopo provinces of South Africa, supplying imported tomatoes to the fresh/informal food markets of Mozambique, and even to some supermarkets, although the supermarket chains also bring in their own supply.

Mozambique is the largest export market for Southern Africa Development Community (SADC) countries, accounting for 72 percent of total South Africa tomato exports to the SADC region (RSA DAFF 2012). In 2011 South Africa exported over 20,000 tons of tomatoes, of which nearly 18,000 were sent to Mozambique. Whereas South Africa produces tomatoes year-round, tomato production in Mozambique is seasonal.

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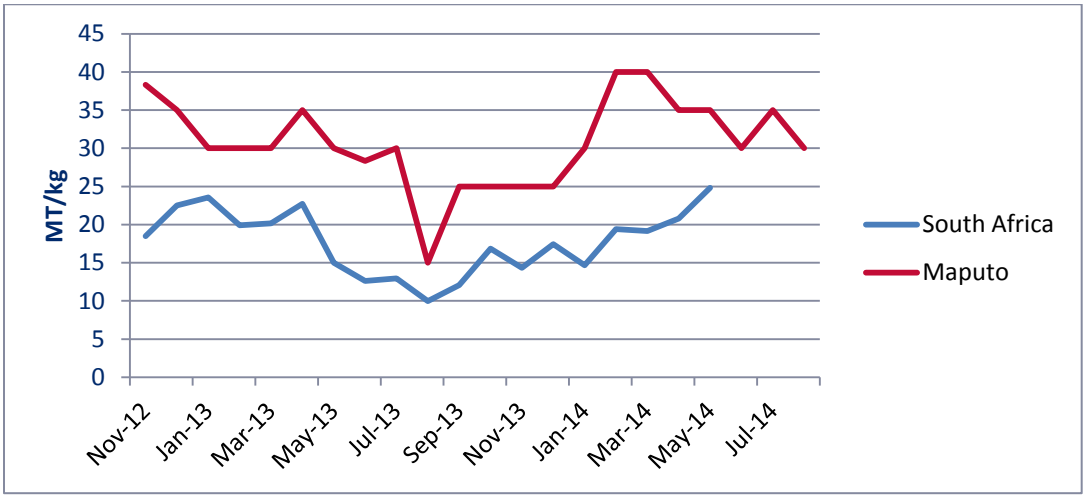
[38] Some farmers operate outside the perimeters, accessing irrigation water via private pumps.

[39] Hotstuff F1 (Hybrid), Campbell 35, Campbell 37, Rome, Marglobe, and Moneymaker (identified in 1988).

[40] See Matsimbe (2013) for deeper discussion of *mukheristas.*

Figure 16: South Africa & Mozambique Tomato Prices, November 2012-May 2014



Note: South Africa prices are an average of Johannesburg and Tshwane monthly average wholesale market prices, whereas Maputo prices are retail prices from the last week of each month.

Sources: South Africa, Department of Agriculture, Forestry, and Fisheries, Market Information Service; Mozambique Sistema de Informação de Mercados Agrícolas de Moçambique (tomato prices were not collected by the SIMA prior to November 2012). Rand prices converted into meticais using exchange rates from Standard Bank.

As seen in Figure 16, Mozambique and South Africa prices track each other. Although South Africa's prices appear to be lower than prices in Mozambique during the Mozambican harvest, they have not been adjusted for transport from South Africa to Maputo. Also, the team was informed by the *Associação dos Mukheristas* of an informal agreement between informal traders and domestic tomato producers to refrain from importing from South Africa during the tomato production season in Mozambique (de facto, a voluntary ban on imports).

Cost Structure and Drivers

The costs of imported inputs drive the costs of tomato production in Moamba, and account for almost 50 percent of total financial costs. Hired labor is the next most important financial cost category (38 percent). The remaining 10 percent covers the cost of water and mechanization services. Downstream marketing costs, which represent 37 percent of total wholesale cost, are driven by transport (46 percent), packaging (32 percent), and labor (21 percent). In the Moamba model, the only difference noted between financial and economic costs are the costs of management/ supervision by the farm owner. The Chokwé model suggests lower production costs overall, although yields are reportedly the same (40 tons per hectare). Transport costs to Maputo are significantly higher.

Nevertheless, both tomato cost structures under current market conditions exhibit good profitability, as shown in Table 16 and Table 17 below. The financial cost analysis uses the wholesale price in Maputo (25 MT per kilogram), whereas the economic analysis takes the (lower) South African wholesale price, adjusted to Maputo (16.6 MT per kilogram), as its reference price. The only distinction in costs between the two scenarios in Moamba is the cost of farm owner supervision labor, which is included in the economic scenario only. In Chokwé, there is no difference between financial and economic costs. Both financial and economic analyses

result in cost-benefit ratios that are substantially below 1, i.e., 0.25 and 0.43, respectively in Moamba, and 0.21 and 0.32, respectively for Chokwé.

Table 16: Costs & Profitability Estimates: Tomatoes (Moamba)

Cost Summary		Unit	Financial	Economic
Farm-level	Land, water	MT/ha	4,100	4,100
	Mechanization services	MT/ha	16,000	16,000
	Purchased inputs (seedlings, fertilizers, other chemicals)	MT/ha	79,370	79,370
	Hired labor	MT/ha	61,500	61,500
	Farm supervision	MT/ha	0	30,000
	Subtotal	MT/ha	160,970	190,970
	/ Yield (40 Tons/ha)	MT/ton tomatoes	4,024	4,774
Transport	Farm to wholesale	MT/ton tomatoes	2,348	2,348
TOTAL	**Maputo Wholesale**	**MT/ton tomatoes**	**6,373**	**7,123**

Profitability Analysis			Financial	Economic
MAPUTO WHOLESALE				
Gross revenue		MT/ton tomatoes	25,000	16,624
Costs		MT/ton tomatoes	6,373	7,123
Net revenue		MT/ton tomatoes	18,627	9,501
Cost-benefit ratio			0.25	0.43

Source: *Study Team Analysis*

Table 17: Costs & Profitability Estimates: Tomatoes (Chokwé)

Cost Summary		Unit	Financial	Economic
Farm-level	Land, water, irrigation infrastructure	MT/ha	2,400	2,400
	Mechanization services	MT/ha	8,840	8,840
	Purchased inputs	MT/ha	60,210	60,210
	Hired labor	MT/ha	20,800	20,800
	Subtotal	MT/ha	92,250	92,250
	/ Yield (40 Tons/ha)	MT/ton tomatoes	2,306	2,306
Transport	Farm to wholesale	MT/ton tomatoes	2,944	2,944
TOTAL	**Maputo Wholesale**	**MT/ton tomatoes**	**5,250**	**5,250**

Profitability Analysis			Financial	Economic
MAPUTO				
Gross revenue		MT/ton tomatoes	25,000	16,624
Costs		MT/ton tomatoes	5,250	5,250
Net revenue		MT/ton tomatoes	19,750	11,373
Cost-benefit ratio			0.21	0.32

Source: *HICEP, Study Team Analysis*

Potential Impacts of Dutch Disease

Sharply rising inflows of foreign exchange from export sales (for example, of natural resource such as coal and natural gas) can lead to strengthening of the value of the local currency, relative to foreign currencies. The immediate "exchange rate effect" can be an appreciation of the currency, which may set in motion a set of economic consequences. How might this impact the tomato value chain? Table 18 summarizes potential impacts.

Exchange rate effect: If we assume metical appreciation from the current USD exchange rate of 30 MT/$ to 20 MT/$, this could result in lowering both the cost in meticais of imported inputs and the economic reference value of tomatoes. There is no expected impact on the financial price of tomatoes, given the voluntary import ban during Mozambique's tomato season. In the Moamba sensitivity analysis presented below, the financial price of tomatoes does not change (because of the voluntary import ban), but the prices of tradable inputs decline, leading to a slightly improved financial cost-benefit ratio, from 0.25 to 0.23. Economic profitability, however, declines somewhat, as the output parity price declines in meticais terms from 16,624 MT per ton to 13,032 MT per ton, thus raising the economic cost-benefit ratio to 0.51.

Innovation effects: One possible innovation scenario is the introduction of greenhouse technology in Mozambique, which is expected to permit two production cycles per year and thus a doubling of expected revenues. Costs to evaluate the economic profitability of such a scenario were not available.

Table 18: Impacts of Dutch Disease on Tomato Profitability (Moamba, Wholesale)

Profitability Analysis			Financial	Economic
EXCHANGE RATE = 20 MT/$				
Gross revenue		MT/ton	25,000	13,032
Costs		MT/ton	5,711	6,628
Net revenue		MT/ton	19,289	6,404
Cost-benefit ratio			0.23	0.51

Source: Study Team Analysis

4. Summary & Key Messages

This review has reviewed factors driving the competitiveness of five agricultural value chains in Mozambique. Although the emphasis here is on cost analysis, other qualitative dimensions such as productivity or "innovation," quality, agro-processing services, processed value-added, and risk management issues also were considered.

Summary information about the five value chains that have been reviewed here is presented below.

Table 19: Summary Value Chain Information: Production Parameters

	Use of:						
	Improved seed, Planting materials	**Mech**	**Fertiliz**	**Other Agro-chem**	**Irrig**	**Base Case Yields**	**Total Number of Labor Days**
Bananas			Yes	Yes		40 T/ha	*N/A*
Cotton		Yes*		Yes		700 kg/ha	117
Rice	Yes	Yes	Yes	Yes	Yes	4 T/ha	32 (family) 80 (hired)
Soybeans	Yes		Yes			1.2 T/ha	*N/A*
Tomatoes	Yes	Yes	Yes	Yes	Yes	40 T/ha	110 days + Permanent labor & Farm owner supervision

Note: Mechanization only used by emerging cotton farmers cultivating more than 2 hectares.

Source: Study Team Analysis

Table 20: Economic Cost-Benefit Ratios (Base Case, Exchange Rate, and Yield Simulations)

		Economic Profitability		
	Reference Market	**Base Case (Yield)**	**@ 20 MT/$**	**@ 20 MT/$ with Yield Increase**
Bananas	CIF Europe	0.40 (40 T/ha)	0.52	0.44 (52 T/ha)
Cotton	FOB	0.67 (0.7 T/ha)	1.01	0.79 (1 T/ha)
Rice	Maputo	1.41 (4 T/ha)	1.74	0.98 (9 T/ha)
Soybeans	Entry, soy mill	0.71 (1.2 T/ha)	0.96	0.81 (1.5 T/ha)
Tomatoes	Maputo	0.43 (40 T/ha)	0.51	*Not needed*

Source: Study Team Analysis

For largely homogeneous agricultural commodities, however, competitiveness is mostly a cost issue, which is a function of costs at several stages in the value chain:

Costs of Production Family labor is not valued in the financial analysis, because it is not a financial outlay for farmers. Nevertheless, it represents an opportunity cost, and one that farmers weigh as they consider alternative uses for their and their household members' labor.

The cost of labor is included in the economic analysis, at local market wages. Even if upward pressure due to Dutch disease is not expected on rural wages, it is possible that growth in the informal sectors around extractive industry growth poles or urban areas will provide incentive for rural workers to migrate into cities. It is also possible that infrastructure investment programs, should the government decide to spend some of its natural resource boom revenues in that sector, would also raise the demand for low-skilled labor and thus increase rural wages as alternative livelihood opportunities present themselves.

Economic Profitability Value chain models of cost competitiveness suggest that two – bananas and tomatoes – do not face significant pressures on economic profitability, as both are extremely competitive in both financial and economic cost scenarios, even if the metical appreciates significantly. Both face other threats or challenges, however, including plant pathologies (bananas) and low levels of investment that until now have limited domestic production to specific seasonal windows (tomatoes, produced open-air only). The competitiveness of tomatoes in Mozambique is also limited by scale, wide agroecological diversity that makes it difficult to develop larger scale operations, lack of supply consistency, and the need to improve farm management practices. Also, lack of tomato agro-processing capacity in Mozambique means that excess fresh production cannot be utilized.

Rice profitability at current costs and yield of 4 tons per hectare is negative, in economic terms. This is aggravated by an exchange rate scenario of strong appreciation, and requires a yield improvement of 9 tons to the hectare, which is exceedingly ambitious, to break even, in economic terms, at an exchange rate of 20 MT/$. Evidence of promising technologies is found in Xai-Xai where Chinese cooperation is helping to train Mozambican farmers.

When the same exchange rate sensitivity analysis is undertaken for the remaining two value chains – cotton and soybeans – they shift to borderline profitability in economic terms. Both make relatively low use of modern inputs and would benefit from innovations to raise yields. In the case of cotton, ginning companies are interested in pursuing closer cooperation with "emerging" outgrowers who are able to take their farms to the next level in terms of areas cropped, mechanization, and use of improved inputs. The same is true of soybeans, whose economic profitability is strong today at current exchange rates, but the market for which could be threatened if the Mozambican poultry industry falters. There could be potential for greater value-addition in soybean processing or expanded regional trade of soybeans, but logistics costs to move soy out of the center/north into Maputo (or neighboring countries) are high.

High Costs of Logistics Mozambican value chains must contend with high costs of transportation, port inefficiencies, and the general unreliability of electricity for processing. Such high and unreliable logistics costs impose heavy challenges to export to crops such as bananas and cotton. They also provide a "natural protection" against imports up-country for soybeans and rice, whose main markets in Maputo and other coastal urban centers are readily serviced by imports, but which remain competitive for smaller markets inland.

However, the issue of logistics is also important because it results in disincentives to invest in agro-industry. Unless factories are well organized and well connected to help them navigate around these disincentives, they must contend with a host of costs and uncertainties: weak port management that makes consideration of coastal cabotage systems (water-based transport, usually smaller scale, that would deliver goods between and among Mozambique's main urban centers along the coast), port delays that raise obligatory demurrage charges, promises of electricity supply that are not fulfilled when investors arrive, transport costs and risks (especially on the N1 in recent months, with renewed security risks in the center of the country), and border crossings that do not function smoothly.

Costs of Processing In both the cotton and rice value chains, agro-processing facilities are noted for being inefficient and thus costly. Mozambique's average cotton ginning outturn ratio is low, compared with benchmarks, lint quality may be inferior, and seeds are returned to farmers after ginning without treatment. Rice milling costs are said to be high, due to fuel/energy, labor, and other high costs.

Competition from Imports or into Export Markets On the export side, South Africa is a very convenient market for Mozambican banana plantations, but only if local pathology issues can be controlled. Regarding cotton lint exports, Mozambique's smaller volumes hamper its ability to negotiate for top prices with Asian buyers. In at least one case, this has led ginners to seek other, more niche markets abroad, focusing on higher end lint quality requirements (e.g., Mauritius, Portugal) outside of Asia, where volumes rule. Mozambique might also be able to improve its average FOB prices through greater attention to seed variety development, consistent seeding by variety, improved raw cotton picking so as to minimize the amount of foreign matter in the harvest, and greater emphasis on consistent lint quality by ginners.

Regarding the three import-substitutes examined here, Mozambique is, and will likely remain for some time, a net importer of milled rice to satisfy domestic consumption needs. However, the Chinese package being disseminated by Wanbao, if sustained, offers real promise for raising Mozambique's technological ceiling and vastly expanding domestic rice production. Soy production competes with imported soy cake, but only if the local poultry sector is economically and commercially viable. Also, to be able to grow expand commercial soybean cultivation requires larger plots and hence mechanization (and access to credit to finance mechanization). Though Mozambican tomato production is competitive in-season, the growing calendar is limited by lack of greenhouse infrastructure to compete with South Africa during the summer. South African tomatoes would normally compete year-round in the Maputo market, except for an informal agreement by *mukheristas* to refrain from importing during Mozambique's growing season.

Policy Issues This work has surfaced a wide range of policy issues that need to be addressed, if the competitiveness of Mozambican agriculture is to be sustained:

- **Land** Confusion over land use rights, and the rights of the government to assign use to foreign investors seeking access to land, muddy the incentives to actively farm land or sell to others who would actively farm it. Without strong land markets, land may go unused or under-utilized.

- **Labor** Official minimum wages in agriculture are significantly above labor productivity (Jones and Tarp 2012) and higher than wages of industrial, i.e., more productive, labor in Asia. Such high minimum wages threaten the competitiveness of Mozambique in general, and Mozambican agriculture, specifically, especially when viewed from a comparative lens. For rural labor, gaining access to wage work (especially for men), on- or off-farm, is considered a significant benefit, especially at the official minimum wage. The latter is 50-100 percent higher than market wages observed in the field. Competition for wage labor, on sugar plantations for example, is heavy in Mozambique (O'Laughlin and Ibraimo 2013).

- **Improved inputs** The low rates of utilization of improved inputs by Mozambican farmers are widely discussed in the literature. It is surprising, in particular, to find that cotton ginners do not provide fertilizer as part of the input package to outgrowers, given how common the practice is elsewhere in Africa and even in Mozambique, as practiced in the tobacco sector. Some indirect benefit of fertilizer distribution for the cash crop is often noted for non-cash crops; why is this not practiced in the cotton sector?

  Another input issue that surfaced is the distribution by NGOs of free (or low-cost) soybean seed to farmers. While this may improve soybean productivity, it runs the risk of undercutting the development of private markets for dealers to distribute an array of inputs.[41]

  A fertilizer blender in Beira observed that work is underway to develop soil maps and train agricultural extension agents in their use in order to be able to recommend tailored agro-chemical packages specific to specific soil conditions to Mozambican farmers.

- **Promotion of foreign investment in agriculture** Negative publicity around foreign investments in agriculture, despite the ability of foreign investors to extend promising new technologies to farmers, makes local governments wary of inking new deals with those who may be able to raise productivity thresholds in Mozambique.

- **Price policy** Only in the case of the cotton subsector are minimum producer prices still set by an official body, in the rest of the value chains examined here, prices are market-determined. The formula for seed cotton pricing used annually by a council comprised of IAM, the Cotton Association of ginners, and farm producers, includes all the right terms. However, the world price is drawn only from the recent past, i.e., no futures price is averaged into the mix. This makes it difficult for ginners to protect themselves against adverse future price movements. While large, international companies operating in this sector may utilize formal commodity market hedging agreements, it is likely that smaller, Mozambican companies do not have this capacity, leaving them vulnerable to adverse price movements.

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[41] An interview held by the manufacturing study team (Salinger and Ennis 2014b) with a fertilizer blending company in Beira underscored that development of a competent and viable input distribution market also requires investment by the government in soil mapping and (possibly) soil testing capabilities in order to be able to sell farmers the appropriate package of fertilizers needed, by crop and by soil deficiency.

- **Post harvest operations** A variety of post harvest issues create disincentives to invest. Existing rice milling capacity is very under-utilized, yet public investments in new rice milling are being made.

  Mozambique's main cereals crop, maize, is not used by its main maize processor, the *Companhia Industrial de Matola,* allegedly because local maize is not of an acceptable, consistent quality for milling into maize flour; instead, maize is imported from South Africa for processing into supermarket-ready maize meal packages, suggesting that there is an opportunity to invest in maize collection, drying, storage, and delivery into urban centers for processing. More investigation is needed into the bottlenecks that prevent such investments from occurring.

  Delivery of food to emerging extraction industry urban or settlement centers – e.g., Tete, Palma, etc. – is *not* made by Mozambican companies, rather, food supplies for mining and construction site canteens is said to be air freighted in from South Africa. Anecdotal explanations refer to the inexistence, lack of capacity, or inability to meet food safety/quality standards of Mozambican food processors. Again, further investigation into these issues would help to baseline the bottlenecks faced.

- **Infrastructure** Stories of infrastructure weaknesses abound in Mozambique. Road density is weak, which translates into high domestic transport costs, which in turn means that large tracts of arable land are virtually unusable.[42] This in turn means that it is often easier to import products from South Africa or abroad than to distribute food internally within Mozambique. Port management is also inefficient, resulting in long delays and high demurrage charges, which thwarts initiatives to invest in coastal cabotage that could potentially deliver goods more efficiently between Nacala, Beira, and Maputo. Electricity supply is erratic and new electricity connections are often unavailable. This discourages investment, particularly in expensive, capital-intensive agro-processing equipment.

- **Trade** Imports of frozen poultry products from Brazil by way of the Middle East have been reportedly dumped into Mozambican markets, thereby undercutting Mozambican poultry production. TechnoServe first highlighted this issue, and has been working with the government to investigate, document, and log complaints, if needed. The group has also launched a public media campaign to sensitive consumers to "sourcing local chicken," in order to reinforce demand for local product.

  Ports inefficiencies are bothersome for exporters of bananas and cotton lint, as well as importers of soy and rice from world markets. Anecdotes were heard from traders, who complained about the cost of scanning in ports, and demurrage charges associated with delays in on-/off-loading, as well as about charges to use the new single electronic window.[43]

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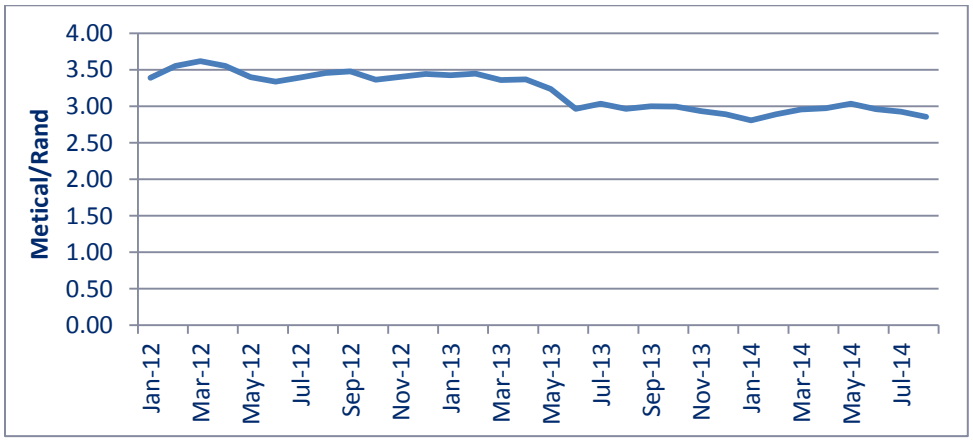
[42] See Heady, Muyanga, and Jayne (2014).

[43] Claypole (2013) conducted an assessment for SPEED of user reactions to the Single Electronic Window in Mozambique in the early months of implementation, before all modules were in place. It is not known whether a follow-up assessment has been conducted.

Numerous reports about difficult border crossings into or from South Africa were also heard. It is reputed to be difficult not only for *mukheristas* bringing goods across, but also for foreigners who are receiving new scrutiny from an immigration point of view. While the latter is certainly understandable and justifiable, the goal of SADC protocols is to encourage seamless movement of goods across regional borders with minimal delay. Given the ever-increasing growth of commerce between South Africa and Mozambique over the EN4, and given the growing importance of Maputo port to Pretoria/ Johannesburg (especially as congestion and delays in Durban become increasingly of issue), assuring smooth trade at this particular border crossing is essential.

- **Exchange rates/Competitiveness** South Africa is Mozambique's most important trading partner, furnishing 27 percent of all goods *into* Mozambique and buying 20 percent of all goods coming *from* Mozambique in 2012 (as measured by value of trade in US dollars, INE 2013). In the last two years, the South African rand has fallen in value, due to international monetary politics. This has had the indirect effect of a strengthening of the metical versus the rand, in terms of nominal exchange rates, of nearly 20 percent since the beginning of 2012. Such appreciation has served to accentuate the competitiveness of South African goods into the Mozambican market. Deep penetration of South African processed foods into Mozambique is well established. Casual review of the range of packaged food products available in one supermarket in Beira suggests how little in the way of processed foods is actually made in Mozambique (despite government efforts to brand "Made in Mozambique"), whether cereals, canned fruits/vegetables/beans, soups, spices, beverages, snacks, frozen foods, etc. While there is little that Mozambique can do about the falling value of the rand, this experience serves as a bit of a preview of "coming attractions" in terms of how Mozambique's food and agricultural sector may fare if the metical strengthens versus other world currencies as well.

Figure 17: Monthly Average Metical/Rand Exchange Rate, 2012-2014



Source: Standard Bank

KEY MESSAGES

In the face of the potential threats from the natural resource boom – that is, possible appreciation of the market value of the metical, shifts in relative prices in favor of non-tradables over tradables, and declining incentives to produce certain traditional, tradable agricultural

commodities – Mozambique needs to recognize the potential threat and build a strategy to anticipate, manage, and respond to it.

This will involve, in part, a commitment to management of foreign exchange revenues from natural resource exports. Options include keeping some proportion of total revenues in offshore savings accounts or investing them in sovereign wealth funds to control the flow of foreign exchange into the local economy.[44] It will also be important that government target public spending to investments that will offset the threat of the stronger currency through productivity and infrastructure improvements to enhance the competitiveness of the agricultural sector. It may also be important to encourage investments in agro-processing to strengthen the competitiveness of local products through productivity and quality improvements and value-addition.

Investments in infrastructure (transport and electricity) will be crucial to contribute to lower marketing and transport costs of agricultural produce and provide improved incentives to agro-industry investments, thereby contributing to an emerging, more competitive agricultural sector in Mozambique.

Another part of the government's natural resource boom response strategy should be the development of a plan to monitor and publicly exhibit indicators of Dutch disease (such as market exchange rates, real effective exchange rates, production and trade trends, prices of non-tradables such as the wages of skilled, semi-skilled, and low-skilled labor; labor market migration; land, real estate, and construction services; transportation costs; etc.).

[44] See Armas (2014) for a somewhat more extensive set of options.

Annex A. Stakeholder Interviews

Private Sector (General)

- Danilio Abdula, Banco Terra
- Philip Ashcroft, MOZFOODS
- Hipolito Hamela, Advisor, CTA
- Carlos Henriques, MOZFOODS
- Jose J. Jeje, Banco Terra
- Joao Jeque, APAMO, Sugar Processors' Association
- Mario Almeida Matos, BIOCHEM (inputs supplier)
- Paolo Negrao, GAPI
- Kekobad Patel, President, CTA
- Filipe Raposo, CEO, *Distribuidora Nacional de Açúcar*
- Arnaldo Ribeiro

Bananas

- Rui Santana Afonso, Director, AgDevCo
- Antonio Gomes, Director, Beluzi
- Tricia Wallace, Chief Financial Officer, Matanuska

Cotton

- Francisco Ferreira dos Santos, PCA, JFS Holding
- Luis Rodrigues, JFS Holding
- Osvaldo Catine, Head of Department, IAM-Maputo
- Frederico , OLAM
- Norberto Mahalambe, Director, IAM
- Gabriel Paposseco, Deputy Director, IAM
- Vasconcelos, Provincial Manager, IAM-Montepuez, Cabo Delgado

Rice

- Estrela Alberto, R&D, Mozseeds
- Mario Artur, Technician, SDAEs-Niacoadala
- Ilidio Bande, Provincial Director, *Direcção Provincial de Agriculture da Zambezia*
- Rufino Bila, Director, ICM Zambezia
- Ercilia Cau, Administrator, HICEP-Chokwe
- Jose Dias, Co-Owner, Inacio de Sousa, Lda Palmeiras (rice mill)
- Sebastiao Joao Ferro, RBL-Limpopo, Xai-Xai
- Nilza Pedro Francisco, Manager, Orizicole da Zambezia – Nicoadala Rice
- Veronica Matala, Finance Manager, HICEP-Chokwe
- Raul Naela, Extension Agent, SDAEs-Niacoadala
- Carlos Nedson, Production Technician, SPA Zambezia
- Augustino Ofinar, Farmer, Matemuziva Irrigation Perimeter
- Firoz Rawje, ADC SA

- Lidia Sambo, Cooperativa de Poupanca – Chokwe
- Armando Ussivane, CEO, RBL-Limpopo, Xai-Xai
- Soares Xerinda, CEO, HICEP-Chokwe
- Justino Taelane, HICEP-Chokwe

Soybeans

- Vasco Emílio, *Associação de Mpampa*
- Bakir Lozanne, Lozanne Farms
- Higino Marrule, TechnoServe
- Silvia Olimpio, Lozanne Farms
- Luis Pereira, TechnoServe
- Narciso Rodrigues, TechnoServe
- Paulo Teixeira, INOVAGRO
- Jaime , INOVAGRO

Tomatoes

- Alex Cossa, Elcídio José, and Sérgio Vasco, Tomato traders
- Lucas Matola Associação dos produtores do Bloco 1
- Sudikar Novela, *Associação Mukhero*
- Ernesto Paixão Pedro Lowis, Associação dos produtores do BlocoI da Moamba
- Rui Ramos, Horta Boa - Agribusiness

Government

- Raimundo Matule, National Director of Economics, Ministry of Agriculture
- Aderito Mavie, Ministry of Agriculture, Commercial Agriculture Promotion Center (CEPAGRI)
- Luis Eduardo Sitoe, Economic Advisor, Ministry of Agriculture

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