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MOZAMBIQUE AGRICULTURAL VALUE CHAIN ANALYSIS

LEO
Leveraging Economic Opportunities

LEO REPORT # 31

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DISCLAIMER

The authors' views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

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ABBREVIATIONS AND ACRONYMS

ACB	American Cotton Bollworm
ACI	African Cashew Initiative
AIMS	Agricultural Input Markets Strengthening, USAID Project
ASC	Agribusiness Service Center
CEPAGRI	Centro de Promoção da Agricultura
CFF	Namialo Fruit Training Centre
DFAP	Development Food Assistance Program
ETG	Export Trading Group
EuroGAP	European Good Agricultural Practice
FAO	Food and Agriculture Organization
FO	Farmer Organization
FOSC	Farmer Owned Service Center
FTF	Feed the Future
HACCP	Hazard Analysis Critical Control Point
IIAM	National Agricultural Research Institute
IITA	International Institute of Tropical Agriculture
ITC	International Trade Centre
MASA	Ministério da Agricultura e Segurança Alimentar
MT	Metric Ton
MZN	Mozambican Metical
NGO	Nongovernmental Organization
OPV	Open-Pollinated Variety
PAPA	Food Production Support Program
RCN	Raw Cashew Nut
SDAE	District Services for Economic Activities
SPEED	Support Program for Economic and Enterprise Development
SPS	Sanitary and Phytosanitary Measures

TIA	Trabalho de Inquerito Agricola (Work of Agricultural Survey)
UAE	United Arab Emirates
U.S.	United States
USD	United States Dollar
USDA	United States Department of Agriculture
USG	United States Government
VAT	Value-Added Tax
VCA	Value Chain Analysis
ZOI	Zone of Influence

EXECUTIVE SUMMARY

USAID/Mozambique commissioned a value chain analysis (VCA) to prioritize and guide interventions within and across target value chains. The analysis targeted nine value chains, as summarized below:

1. Oilseeds: Soybean, sesame, groundnut
2. Pulses: Pigeon pea, common bean, cowpea
3. Banana
4. Cashew
5. Vegetables

VCA PROVINCES & DISTRICTS

1. **Nampula:** Angoche, Malema, Moma, Mogovolas, Murrupula, Monapo, Meconta, Mecuburi, Nampula
2. **Zambezia:** Alto Molocue, Gurué, Mocuba, Nicoadala, Gile
3. **Manica:** Gondola, Chimoio, Manica, Barué, Sussundenga, Mossurize
4. **Tete:** Angonia, Tsangano, Macanga

The analysis validates the selection of each value chain on the basis of its contribution to USAID/Mozambique's objectives of increasing smallholders' incomes and offering nutritional benefits to rural households, while also taking into account criteria such as its relevance to USAID target geography, impact on women farmers, market demand, and growth; and opportunity to develop market-driven interventions that build upon recent and current donor and private sector investments. The analysis also provides an overview of the structure and functions of each value chain, identifies priority end markets and constraints to realizing their benefits, and recommends potential value chain upgrading strategies. The results provide a foundation on which more detailed intervention strategies can be developed.

The highest potential value chains, based on the above criteria, were soy, sesame, and pigeon pea. A second tier of value chains—groundnut, common bean, and cowpea—have high-potential benefits but lack the large-scale "demand drivers" that mobilize broad-based investment and uptake of productivity-enhancing technologies and practices. The lowest tier of value chains—banana, vegetables, and cashew—present significant agroecological, market, and/or political constraints that limit potential gains, or have investment requirements that preclude broad-based inclusion of smallholder farmers. Major results are summarized for each value chain in turn, below.

Soy. Soy is a nutritious, but not traditionally consumed, crop in Mozambique. It is profitable for small- and medium-scale "emerging commercial" farmers, and there are examples of initiatives where women have been successfully integrated into different levels of the soybean value chain.

The domestic market for soy is estimated to be growing at about 60 percent per year, and about 60 percent of Mozambique's domestic demand for soy is currently met through imports. According to the International Trade Centre's (ITC) Trade Map, 2014 imports of soybean products totaled $28,281,000 of which 64 percent by value was soy bean oil (20,932 tons, mostly crude), 34 percent was soy cake (15,598 tons) and 2 percent was soybeans (715 tons).[1] The primary target end market for soy is the domestic market for animal feed. Animal feed producers are central demand drivers for the soy value chain. There is also also a domestic edible oil

[1] In 2014, Mozambique imported $18.1 million worth of soy oil, $9.485 million worth of soy cake, and $696,000 of soy beans (ITC Trade Map 2015).

processing industry that utilizes the oil produced as a byproduct to feed production. More market research is needed, but there is a reported strong domestic market demand for edible soy oil.

Constraints include the relatively limited area of the country that is agroecologically suited for soy production, limited availability of quality seed, limited use of inputs such as inoculants, and weak farm management practices, which limit yields. Strategies to develop the value chain should focus on linking farmers (via their producer organizations) to large commercial buyers, and evaluating and promoting (based on the results) small- and medium-scale production models that will allow a large base of suppliers to operate profitably and sustainably in the market.

Groundnuts. Groundnut production in Mozambique is dominated by smallholders, with women being very active in the value chain, including production. Groundnuts have high financial margins and are also highly nutritious, though high aflatoxin levels undermine their nutritional value. Despite the existence of unmet demand in export markets, high levels of aflatoxins mean that most of Mozambique's groundnut crop is consumed domestically. In addition to aflatoxins, poor domestic quality and weak sanitary and phytosanitary measures (SPS) certification capacity within Mozambique limit exports, as does inadequate domestic supply due to low yields and high post-harvest losses. Addressing the aflatoxin problem is key to increasing the competiveness of the groundnut value chain. Additional upgrades include intensifying production and reducing post-harvest losses, promoting alternative shelling options, and facilitating aggregation models.

Pigeon pea. Development of the pigeon pea value chain offers strong potential for improving smallholders' incomes and nutrition, particularly among women smallholders. The primary end market opportunity for pigeon peas is seasonal (October–December) sales to India, as there are high seasonal price premiums during this market window. Indian demand for pigeon pea imports is expected to increase six fold by 2025. A two-pronged value chain development strategy is recommended, focused on increasing production of pigeon pea and farmers' access to markets. It will also be important to ensure a supportive policy environment that promotes pigeon pea exports through the removal of tax and administrative barriers.

Common bean. Common beans are a profitable smallholder crop and a good source of protein and nutrients, and women are heavily involved in the value chain as producers, intermediaries, retailers, and end buyers. There is unmet demand for common beans to be sold domestically and to regional and overseas export markets. Constraints include the fragmented and informal nature of the value chain, which limits incentives for farmers to invest in yield-enhancing technologies and management practices. The intervention focus should be on a dual-pronged strategy aimed at increasing farm-level production while enhancing farmers' access to markets.

Cowpea. Cowpeas are centrally important to smallholder nutrition and food security, and more than half of households planting cowpea are headed by women. The crop is largely used for household consumption, with fewer than one farmer in 10 selling any of their cowpea production.

Overall, cowpea is not perceived as having dynamic market demand, and the private sector is generally lukewarm about investment in the sector given low demand and a weak and fragmented production base. While there are examples of donor-supported interventions (such as AgriFUTURO) that have engaged in the cowpea market, the multitude of constraints combined with the lack of dynamic market demand and catalytic demand drivers argue for the exclusion or de-emphasis of cowpea as a priority value chain for any future market-driven initiatives.

Cashew. Cashew is a smallholder crop that plays a critical role in poor households' livelihood strategies in Nampula and Zambezia where its production is concentrated. There are opportunities to increase farmer incomes from cashew production by addressing key constraints along the value chain; nonetheless, there are significant financial and political challenges to realization of these potential gains.

There is unmet demand for both unshelled and shelled cashew in overseas export markets; however, sales are limited by an unfavorable policy environment, inadequate production to meet demand, and difficulty meeting international market standards for shelled cashews. Other constraints include a lack of finance, particularly at the farm level; high costs along the value chain; and poor processing efficiency and quality.

A strategy to strengthen the cashew value chain should focus on improving the policy environment as well as increasing farm production of cashew by increasing smallholder access and utilization of inputs and services, and promoting medium-scale, block-style plantations. Complementary activities can be used to improve the availability of finance and upgrade industrial processors' ability to comply with importing market requirements.

Banana. Banana is a nutritious crop frequently produced by smallholders throughout Mozambique for home consumption or sales at local markets. Commercial activity in banana markets offers limited income potential for smallholder farmers. Domestic markets are easily glutted and have high price variability given the high perishability of bananas. Smallholder banana farmers are concentrated in Zambezia and Nampula where there is little irrigation and soils tend to be infertile. Banana plants extract high volumes of nutrients from the soil, making fertilization critical. Export markets—both regional and overseas—have quality standards that smallholders would have difficulty meeting without extensive and costly technology transfer.

Vegetables. Vegetables are a nutritious product that offers significant income potential to smallholder farmers; however, barriers to entry to profitable market channels are high. Vegetables are produced by a significant share of Mozambican farmers, though they typically sell relatively small shares of what they produce. Female producers are under-represented in vegetable markets.

The most promising end-market opportunities are for fresh vegetables to substitute for imports in domestic markets and off-season production of traditional vegetables. Constraints to supplying these markets include limited availability of finance and farmers' constrained liquidity given the capital-intensive nature of investment to enter these markets; the need for irrigation; limited availability of quality seed; limited technical and management capacity among farmers; and lack of post-harvest facilities.

Interventions to develop the vegetable value chain should be directed to higher-capacity farmers who are located in proximity to their target markets, have access to water, and have the capacity to bear the significant financial risk and investment requirements entailed in producing for these markets. Interventions should be made in coordination with large-scale buyers of vegetables for the target markets and should be based on careful analysis of local market conditions and requirements. It is be critical that production increases are tightly coordinated to respond to demand in order to avoid local gluts that depress prices and exacerbate price fluctuations. Working through producer organizations can help to facilitate effective technology transfer as well as coordinating supply to avoid market gluts.

INTRODUCTION

To guide USAID/Mozambique's agricultural and economic development programming, a VCA was commissioned to prioritize interventions and identify intervention points that provide leverage for competitive upgrades. Data collection took place October 4–November 7, 2015, with supplemental field research conducted during the first two quarters of 2016.

The analysis targeted nine value chains, as summarized below:

1. Oilseeds: Soybean, sesame, groundnut
2. Pulses: Common bean, cowpea, pigeon pea
3. Banana
4. Cashew
5. Vegetables

Following a discussion of the research methodology employed, the report addresses cross-cutting considerations that are common across each of the value chains. These include the structure of Mozambique's farming sector, broad-based constraints affecting development of the agricultural sector in general, and characterization of major supply- and demand-oriented approaches to promoting smallholder-inclusive value chains.

The individual value chain analysis chapters are organized in five parts. First, the report validates the selection of each value chain on the basis of its contribution to critical Feed the Future (USAID) objectives. These objectives include a value chain's potential to increase smallholders' incomes; potential to bring nutritional benefits to rural households; relevance to the target geography; impact on women farmers; strong market demand and potential for growth; and potential to develop market-driven interventions that build upon recent and current investments by U.S. government (USG) agencies, other donors, and the private sector

Second, the value chain structure and function section provides an overview of how each value chain is presented, addressing the overarching characteristics of farm production, structure and organization of the value chain, and current end markets. Of critical importance to this aspect of the analysis is the degree to which smallholders in general, and women in particular, participate in production and marketing of the product; the predominant channels by which the product flows to market and the presence of alternative market channels that may offer improved prospects for smallholders; and the presence of major demand drivers (in particular, large-scale industrial buyers) whose activity in the market can help to motivate investment at scale by other market participants.

Third, the analysis identifies promising end markets for each value chain and identifies their specific requirements, for example varieties sought, seasonal market windows, grades, and other product attributes.

Fourth, this analysis identifies fundamental constraints to smallholder and value chain performance in promising end markets.

Fifth, overarching upgrading strategies for each value chain are presented, and current and recent initiatives that can be leveraged in carrying out these strategies are presented. Additionally, there are productivity-related statistics for each value chain located in the appendices section.

METHODOLOGY

This value chain analysis considered the individual stages from production to end market of the target commodities in the Nampula, Zambezia, Manica, and Tete provinces and their respective districts. The team traced production from the target districts to in-country end markets (including exporters), and consumption from in-country sources (production and imports) to the target districts. Additionally, the team assessed cross-cutting services, both sector-specific (inputs, extension) and cross-sector specific (finance); cross-cutting issues (gender and climate); and the enabling environment (policies and norms).

Figure 1: Value Chain Analysis Framework

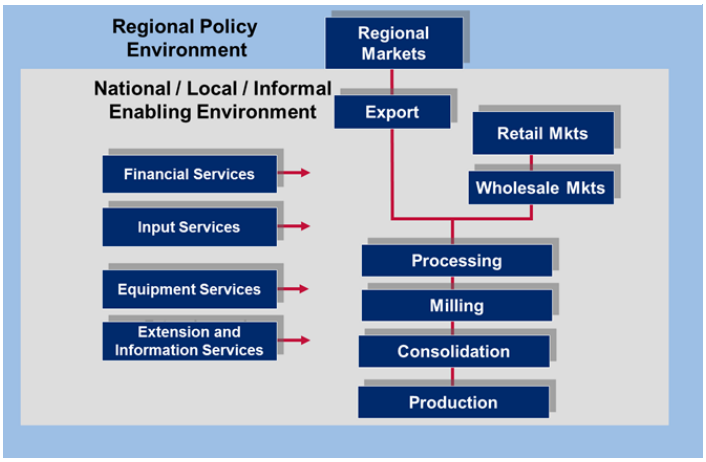


Figure 1 depicts the USAID value chain analysis framework that the research team followed. The analysis combined secondary and primary (individual interviews and focus groups) research and used both qualitative and quantitative data. For a full list of organizations interviewed, see the meeting list in Appendix II.

STUDY AREA

The research was conducted in the Nampula, Zambezia, Manica, and Tete provinces, with a focus on 15 of the 23 districts in these provinces. Table 1 lists the provinces and districts, with bold type indicating those districts that the field team visited. Figure 2 depicts the geography of the USAID zones of influence (ZOI).

Figure 2: USAID Zones of Influence, Mozambique

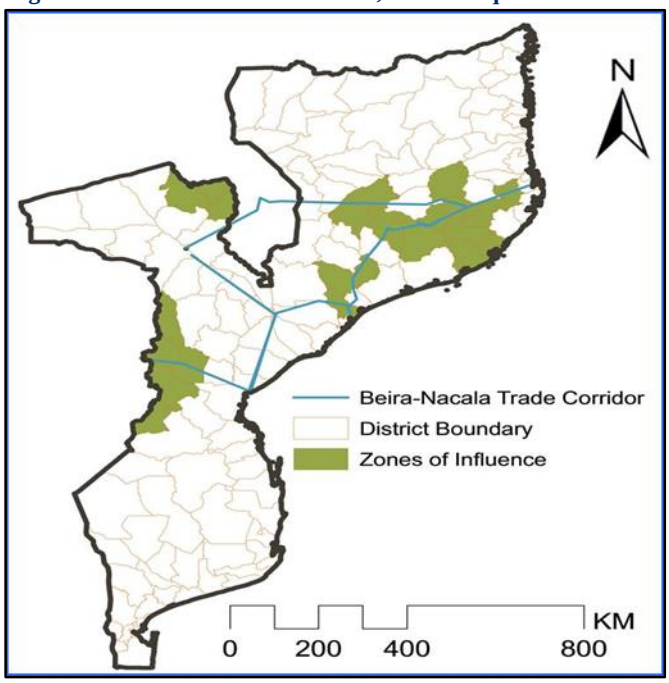


Table 1: Research Area, Provinces, and Districts

Province	Districts
Nampula	Angoche, Malema, Moma, **Mogovolas, Murrupula**, **Monapo, Meconta**, Mecuburi, **Nampula**
Zambezia	**Alto Molocue, Gurué, Mocuba, Nicoadala**, Gile
Manica	**Gondola, Chimoio**, Manica, **Barué, Sussundenga**, Mossurize
Tete	**Angonia, Tsangano**, Macanga

RESEARCH PROCESS AND TEAM

Prior to fieldwork, the field research team and ACDI/VOCA staff conferred with the USAID Mission and conducted desk research on the target commodities and regions. From early October through early November 2015, a team of four researchers conducted the fieldwork. The fieldwork began in Maputo, and then the team split into two smaller teams to cover the Nampula and Manica provinces in tandem. They conducted interviews with value chain actors and other key informants. Afterwards, one team proceeded to Tete, with the other team transferring to Zambezia to continue fieldwork, which included daily writing and team debriefs. The team converged back in Maputo in the last week to focus on writing, undertake additional interviews and analysis, and then concluded with a debrief at the Mission.

Upon completion of the draft report, it was determined that additional field research with value chain actors and industry leaders was needed to collect and analyze information in order to expand on and validate findings. Additional field research was conducted in January/February and April of 2016, and the data was then incorporated into the final report.

STAKEHOLDERS CONSULTED

- Small-, medium-, and large-scale producers
- Associations (producers, processors, marketing)
- Processors
- Traders
- Wholesalers
- Retailers
- Consumers
- NGOs
- Bi- and multilateral donors
- National, regional, and subregional agricultural and livestock officers
- Senior ministerial agricultural and livestock representatives
- Customs
- Input providers
- Equipment dealers
- Financial institutions

RESEARCH AND ANALYSIS METHODS

The analysis involved the following research activities:

1. **Desk research**: Beginning prior to fieldwork and continuing through final report completion, the team undertook secondary research using pertinent studies and reports on the target value chains, focus regions, and cross-cutting services and issues; production and trade statistics databases; climate and meteorological databases; and government policy documents.

2. **Key informant and value chain actor interviews:** As noted in the box above, the team interviewed a diverse set of stakeholders along each value chain. These interviews utilized both quantitative and qualitative survey questions. The list of interviewees is included in Appendix II.

3. **Data analysis and interview synthesis**: Team members synthesized interviews to identify and prioritize key constraints and issues (e.g., fertilizer and seed availability and affordability; access to finance; women's participation and empowerment); characterize value chain dynamics; and evaluate economic, production, and demand data such as pricing at each level of the value chain, yields, consumption, and imports.

4. **Mission briefings and report reviews**: The team leader and senior researcher conducted a pre-field-work brief with USAID to align on initial commodities and a fieldwork plan. USAID identified some key contacts and issues to note in the field. The team lead and senior researcher conducted a brief with USAID after the fieldwork to present initial findings and gather additional questions to address in the report. USAID provided comments on draft reports thereafter, with ACDI/VOCA collaborating with field researchers to finalize the report.

BACKGROUND

In this section, relevant background on Mozambique's agricultural sector is presented, beginning with an overview of farm size and structure in Mozambique, and followed by an overview of farm- and market-level constraints in the development of market-oriented agricultural value chains with a brief summary of gender and nutrition issues.

FARM SIZE AND STRUCTURE

Mozambique's Ministry of Agriculture characterizes farms as small, medium, or large scale on the basis of the area cultivated—small-scale farmers cultivate up to 10 ha and medium-scale farmers cultivate up to 50 ha, while large-scale farmers cultivate more than 50 ha (Ministério da Agricultura e Segurança Alimentar (MASA) 2014). As shown in Table 2, small-scale farmers represent nearly 99 percent of Mozambique's farms, with medium-scale farmers only accounting for 1 percent and large commercial farms less than 0.02 percent.

While large-scale farms are recognized as predominantly commercial enterprises, small- and medium-scale farms are recognized to include both subsistence-oriented producers (those who produce primarily for their own household needs using production systems that rely almost entirely on farm-source inputs such as recycled seed) and "emerging commercial" or "commercial" producers. "Emerging commercial" producers are characterized as small- or medium-scale farmers whose production is increasingly oriented to markets, with respect to both their choice of what crops to produce and how to produce those crops. Specifically, emerging commercial farmers choose to produce at least some of their crops on the basis of their perceived market potential, and seek out and use off-farm sourced inputs such as improved seed and fertilizers to some extent. The term "emerging" reflects the perception that these farmers are undergoing a transition from subsistence to commercial production. Finally, commercial farmers are farmers of any scale whose production and marketing decisions are primarily driven by commercial considerations.

Table 2: Distribution of Mozambican Farms by Scale

	Small (up to 10 ha)	Medium (up to 50 ha)	Large (over 50 ha)	Total
Number	~4,200,000	45,320	626	~4,300,000
Share	98.92%	1.06%	0.016%	100%

Source: MASA, 2014, p.7.

FARM-LEVEL CONSTRAINTS

Mozambique's agricultural sector faces a number of constraints that limit farmers' ability to expand output and take advantage of market opportunities. These are identified and briefly described below.

DEGRADED SOIL FERTILITY AND CROP GERMPLASM

A study of nutrient mining in Mozambique estimated that current farming practices are depleting 33 kg N, 6 kg P_2O_5, and 25 kg K_2O per hectare per year (Folmer et al. 1998). To increase productivity without the environmentally destructive expansion of area under production, this trend can only be reversed through improved soil management and improved inputs, including synthetic fertilizer to replace lost nutrients, and improving seed stock to better utilize nutrients that are available. For Mozambique to achieve these goals, it will need to dramatically improve the reach of commercial input supply and extension advisory systems.

LACK OF APPROPRIATE VARIETIES AND QUALITY SEED

Most studies estimate that only one out of 10 food crop producers utilize improved seed, with the remaining using landrace seed recycled at the farm or village level (International Fertilizer Development Center 2015). Most farmers using recycled seed are not using effective phenotypic selection or seed storage practices, leading to continuous decline in germination and yields season after season.

Most foundation seed originates from the National Agricultural Research Institute's (IIAM) Basic Seed Production Unit; volumes from these seeds are typically too low for sufficient multiplication and wide-scale distribution. Private sector companies are slowly expanding their own foundation seed development programs, though they complain of a lack of basic seed, capacity constraints, and delays in getting new varieties approved for commercial sale. New varieties (or foreign varieties seeking entry into the Mozambican market) require two years of field trials to be submitted to the National Directorate of Agricultural Services (DSNA) for review and approval. Many seed producers are sourcing basic seed from Zimbabwe (SeedCo and Cymmit) or South Africa (Pannar), though regulatory hurdles for introduction of new varieties are steep (SDC 2011; interviews).

There are also problems with the quality of seed that is sold through commercial channels, hurting farmer demand for commercial seed. This perception is driven by two factors. First, the weak breeding and multiplication capacity at IIAM and commercial companies leads to quality for even basic seed being often no better than landrace seed—respondents interviewed stated that it was common for basic seed from IIAM research facilities to achieve 40–60 percent germination rates at the multiplication stage. Second, most smallholder farmers' only experience with improved varieties of any kind has been through the Ministry of Agriculture's Food Production Support Program (PAPA), the primary seed subsidy and distribution scheme. Seed distributed through PAPA has consistently been poor quality and is often distributed without explanation of variety or with respect to farmers' unique agroecological requirements or consumer taste preferences (SDC 2011). As a result, many interviewed respondents stated that demand for improved seed across value chains is very limited.

LIMITED USE OF FERTILIZER OR OTHER PRODUCTIVITY-ENHANCING INPUTS

Less than 4 percent of Mozambican farmers use fertilizer, and this use is virtually nonexistent outside of the context of commercial outgrower schemes. In 2010, total fertilizer consumption nationwide was 51,400 metric tons (MT), with 90 percent of that total applied to tobacco and sugarcane (International Food Policy Research Institute (IFPRI2012). Limited use of fertilizer is attributed to its high cost, limited availability, and limited awareness among farmers. There is also extremely limited use of other productivity-enhancing inputs such as biological inoculants or pesticides.

LIMITED AND WEAK EXTENSION SERVICES

Farmer access to public sector extension services declined from 13.5 percent in 2002 to 8.3 percent in 2014 due to reductions in funding. Most funding for extension site visits is paid through donor-supported programming. NGO and other donor-funded programming provide a large percentage of public sector extension services by default, though objectives, crop focus, and quality of extension advice varies, and most programs have poor coordination in overlapping beneficiary groups.

Farmers also have limited access to private sector extension. Two types of private sector extension services exist—extension embedded in outgrower schemes and through input supply providers. In practice, most farmers seek out the nearest agroinput retail shop for extension advice related to input utilization, whether for

fertilizer or crop protection. Nonetheless, the quality of private sector extension from retailers tends to be poor, with many retailers providing counterfeit products or inaccurate application information.

WEAK AGROINPUT SYSTEM

There is currently one agrodealer for every 20,000–25,000 farmers, as compared to one agrodealer to 2,800 in Tanzania; one to 1,500 in Malawi; and one to 1,400 in Zambia (USAID AIMS III Impact Assessment). While the total number of agroinput retail shops remains small relative to population, the numbers of shops has increased over the past decade from 150 in 2006 to between 750 and 1,000 in 2015 (USAID AIMS III Impact Assessment). This has been driven primarily by donor investment in expanding the agroinput sector, mainly through technical assistance and material support to strengthen existing dealers and establish new dealers.

LIMITED ACCESS TO MECHANIZATION SERVICES

Smallholders lack access to mechanized services, making planting and post-harvest processing very labor intensive. Mechanized tillage is utilized by only 1.55 percent of small and medium farms in the Beira and Nacala corridors. John Deere and several other mechanization companies have established distributor operations in the greater Maputo area, primarily focused on commercial farmers in southern provinces. Due to the challenges of north-south transportation logistics, the majority of commercial operations have sourced tractors from the closest border, either Zimbabwe or Malawi in the Beira and Nacala corridors, respectively. Commercial operations, particularly in Nampula and Zambezia, reported significant challenges in tractor service and repair, with delays of up to 60 days between ordering a part and its arrival. This lack of a local support system for mechanization leads to significant risk from costs due to transport and production delays for any scheme.

Limited availability of mechanization services also limits expansion of agricultural land. Mozambique has extensive unused land that can only be farmed with mechanization, and some regions have a hard pan under the soils that must be broken with a mechanized plow to allow roots to penetrate (Abt Associates 2015).

POST-FARM GATE CONSTRAINTS

A number of post-farm gate constraints affect the development of demand-driven value chains. Several of these are addressed below.

WEAK INFRASTRUCTURE

Support to infrastructure, particularly all-weather roads, is an ongoing need across all value chains and must underpin any "extensification" strategy aimed at developing a value chain by increasing the number of producers or areas produced of a commodity.

Mozambican farmers, particularly in northern provinces, have limited access to major transportation routes compared to farmers in neighboring countries. This limits their access to markets for inputs, goods, and services, and curtails the reach of commodity buyers. Only 27 percent of Mozambicans live within 2 km of a year-round passable roadway, compared with 38 percent in Malawi and Tanzania; 64 percent in Zambia; and 65 percent in Zimbabwe.[2] Several respondents cited transportation costs and limited knowledge of what farmers in their areas would purchase in terms of inputs as key reasons they do not actively attempt to expand their market catchment.

[2] World Bank Rural Access Index data.

Port inefficiency is also a major issue, as described in the section on bananas and as detailed in the Nacala and Beira port efficiency studies commissioned by AgriFUTURO (Abt Associates 2015).

LACK OF TESTING AND CERTIFICATION CAPABILITIES

Sales to relatively demanding export markets are curtailed by the limited availability and high cost of SPS testing and certification. For example, groundnuts must be tested for *Salmonella* and *E. coli* before export to the European Union or the United States. In order to complete these tests, exporters must incur the cost of sending (and obtaining export approval for) a 30 kg sample to South Africa for testing and certification (Reynosa, personal communication 2016).

Testing and certification is also a critical issue for addressing aflatoxins. AgriFUTURO funded a lab capable of testing for aflatoxins at the Lurio University in Nampula. At the time of project closeout, the laboratory was beginning the process of obtaining certification of its testing capabilities (Abt Associates 2015). Further development of these capabilities will be critical to effectively address aflatoxins as a critical constraint to domestic health and exports.

FINANCE

Finance is a constraint throughout the Mozambican economy, including in the target value chains. Various projects, including AgriFUTURO and FINAGRO, for example, have attempted to facilitate agricultural value chain players' access to finance, with mixed results. AgriFUTURO had limited success working with USAID's Development Credit Authority to increase smallholder producers' and processors access to financial services. While the initiative did increase access to working capital and increase liquidity of small and intermediate value chain players, it failed to make inroads on smallholder lending due to "excessive delinquency." This further led the participating banks, Banco de Oportunidade de Moçambique and Banco Terra, to try to protect themselves through increasingly cumbersome bureaucratic checks (Abt Associates 2015).

The AgroCredito program was a separate AgriFUTURO initiative that worked to increase the liquidity of primary buyers for commercial and emerging smallholders (small and medium traders; cooperatives and producer associations; retailers, and large "anchor" farms) and banks through activities to develop mutual trust that would provide a foundation for sustainable lending relationships. This program leveraged these value chain players' critical roles as intermediaries between banks (from which they were able to obtain financing to buy produce from farmers) and producers (who were able to obtain some financing for inputs and have a secure market). AgriFUTURO reflects, in its final report, that "the project did find a viable short-term alternative in getting buyers to provide advances so that FOSCs [farmer owned service centers] could purchase and agglomerate members' production. It also encouraged short-term financing for agricultural inputs by agribusiness service centers and vendors, but even these were somewhat constrained during the first quarter of FY 2015 due to producer delinquency in previous years." (Abt Associates 2015). USAID's FinAgro program complemented the AgriFUTURO grants program and is scheduled for completion in late 2016.

Likewise, input suppliers and wholesalers as well as retail agrodealers cited high repayment failure rates as the primary reason they do not offer credit to their customers (retailers or farmers, respectively).

POLICY

A number of policy and enabling-environment issues affect development of demand-driven value chains. Salient issues identified during key informant interviews include lobbying by some large industrial players for export taxes on unprocessed pigeon peas and the application of value-added tax (VAT) to domestic sales made along agricultural value chains; competing imported agricultural commodities are exempt from these taxes.

GENDER

Women are an important focus of agricultural development initiatives due to their central roles in the production and consumption ends of the household economy, as well as their generally disadvantaged status in society.

Women are heavily involved as producers in agriculture in Mozambique: they account for the majority (up to 95.3 percent) of unskilled laborers in agriculture and the informal economy (Tvedten 2011). In female-headed households in particular, which comprise 24 percent of Mozambican households, (MASA 2012), women are more likely to undertake all relevant agricultural tasks—from clearing and preparing land for planting, to seeding, weeding, harvest, and post-harvest activities (Tvedten 2011). In general, regardless of the household structure, women typically have a heavier workload than men. In addition to agriculture activities, they also cook, fetch water, collect firewood, clean, process food, and care for children as well as sick and elderly family members.

Recent analysis shows that gender-integrated, household-based approaches to behavior change are critical to bringing about lasting change in gender relationships (Abt Associates 2015). Women—whether in female- or male-headed households—tend to dedicate their agricultural production to household consumption and so tend to have lower participation in markets than men do. There are opportunities to improve women's well-being through value chain interventions that introduce technologies and practices that reduce women's labor: for example, mechanized peanut shellers (Abt Associates 2015). Likewise, there are opportunities for women to benefit through participation in member-based organizations such as farmer associations. An assessment of gender-oriented results of USAID-funded agribusiness programming in Mozambique showed that farmer organizations (FO) were a particularly effective means to incorporate women into value chains and facilitate their access to credit. The assessment also showed that women-only groups are more beneficial to women than mixed-gender groups (Hackenberg et al. 2013).

NUTRITION

Smallholders and their families are not consuming sufficient micronutrients. Mozambique has a dietary diversity index score of 21 percent: nearly 48 percent of women are anemic, and 69 percent of preschool children are vitamin A deficient (Food and Agriculture Organization (FAO) 2011). Improving and increasing household production and local sale and consumption of traditional vegetables, as well as protein- and nutrient-rich pulses and oilseeds has significant potential to increase incomes and reduce nutritional deficiencies. Given the prevalence of groundnuts in traditional Mozambican diets and high aflatoxin levels in Mozambican groundnuts, aflatoxin is a pressing nutritional issue facing Mozambique.

VALUE CHAIN INTERVENTION CONSIDERATIONS

Benefica et al. (2014) finds strong correlation between market participation and productivity—that is, greater market access is associated with higher farm-level productivity. Nonetheless, they point out that, in most respects, uptake of productivity-enhancing, farm-level inputs (such as improved seed, fertilizer, and mechanization, and with the noted exception of hired labor) is still low. The study emphasized that it is important to also promote productivity improvements at the farm level along with improved market access.

For most of the value chains analyzed in this document, the movement of product from smallholder farmer to industrial buyers or end users traditionally begins with sales to a local trader at the farm gate. Movement continues through successive aggregations until a large-scale trader delivers the product to a wholesale market for retail distribution or to a large industrial buyer that will process or export it. This traditional value chain structure tends to be fragmented and informal, and it dampens the transmission of incentives and information that allows farmers to confidently respond to market opportunities. Thus, development of demand-driven value chains requires alternative organizational approaches that emphasize direct communication between buyers and suppliers. Due to their scales of operation, large-scale industrial buyers can play a critical role in the development of such "demand-driven" value chains. FOs are an important but under-utilized platform for interventions aiming to reach many smallholder beneficiaries in an effective manner. FOs could help facilitate the economies of scale and the aggregation needed for price bargaining.

Three major models are used to enable smallholder-inclusive, demand-driven value chain development in Mozambique: contract farming, agribusiness service centers, and FOs.

CONTRACT FARMING

Under contract farming, buyers and farmers enter into an agreement for farmers to provide their output to the buyer. Typically the buyer then provides financing (monetary or in-kind) to enable farmers to access inputs (improved seed, fertilizers, etc.) and services (mechanization). In some cases, such as with AgriFUTURO, project support can also enable these buyers to provide services such as mechanized land preparation or extension to contracted farmers.

Heavy competition for output at harvest, combined with farmers' limited liquidity and the presence of independent traders in major production areas at harvest, commonly give rise to "side-selling" in which farmers sell their output to local traders who are offering cash payments at attractive prices. Farmers sometimes engage in side-selling rather than adhering to their contracts, which may involve lower cash payments (either because the value of production financing is to be subtracted or because negotiated prices are lower) or delayed payments.

The prevalence of side-selling has undermined numerous contract farming arrangements. As a result, it is common for buyers to argue that there is a need for "concessions" in which a buyer is authorized as the sole authorized buyer in a geographically defined area, thereby precluding opportunities for farmers to sell to competing buyers. Historically, the tobacco and cotton value chains have operated on a concessionary basis, and this arrangement is broadly seen as advantageous to many buyers.

There are also opportunities for organizational structures to be tweaked to reduce the prevalence of side-selling, as well as for development projects to play a role in reducing side-selling. For example, a report by Kleijn et al. discusses how a SNV/Export Trading Group (ETG) contract farming initiative in the sesame value chain was able to mitigate side-selling by organizing farmers in "trust groups"; these groups leveraged peer pressure as a means of reducing individual farmers from acting against the group's interests. Likewise, allowing FOs to serve as intermediating players can reduce side-selling if the organizations are better able to monitor and influence member farmers than the buyers would be. Finally, development projects have had some success in reducing side-selling through activities such as helping to mediate contracts so that farmers feel more empowered and thus have greater commitment to their agreements, as well as through trainings and communications that emphasize the long-term gains of successful contracts.

AGRIBUSINESS SERVICE CENTERS

Agribusiness service centers (ASC) leverage outgrower relationships between large commercial farmers and nearby smallholder farmers that serve as outgrowers to increase the availability of inputs and services to the smallholders. ASCs were used under AgriFUTURO as a means of increasing the availability of services to "emerging commercial" farmers by targeting anchor farms as recipients of project grants and services that enable it to provide services (such as machinery services for land preparation) and inputs (such as improved seed and fertilizers) to farmers.

FARMER ORGANIZATIONS

FOs are a means of organizing smallholder farmers and enabling them to collectively access markets (through joint sales), inputs, and services. FOs were largely set up as extension delivery mechanisms under previous NGO-led programs, and they continue to be a leading source of extension knowledge for a large minority of farmers. As of 2008, 7.2 percent of all producers were members of producer groups (MASA 2012).

Under AgriFUTURO, for example, FOs (called FOSCs under AgriFUTURO) became the locus of purchase contracts with large industrial buyers. These contracts detailed stipulations such as price, delivery date, quality parameters, and volumes, and they enabled compliance with the traceability requirements of more demanding export markets. They also served as conduits for value chain financing that enabled farmers to access the inputs and services that allowed them to respond to the contracts.

Overall, in discussing lessons learned in its final project report, AgriFUTURO reflected on the central role that project-supported FOSCs played in linking smallholder farmers to markets and enabling their success in these markets. They also reflected on the tendency for FOSCs to successfully integrate women into commercial farming arrangements.

Both AgriFUTURO and an independent evaluation, however, emphasize that the leadership and management capacity of FOSCs tends to be low; they also noted the importance of ongoing investments to develop this capacity and to enable transparency and accountability in management, if gains achieved by FOSCs are to be sustained (Easterling et al. 2013; Abt Associates 2015).

The following two additional models are oriented to farm-level productivity enhancement and do not rely on market opportunities to drive uptake of yield-enhancing inputs and management practices.

TOBACCO AND COTTON CONCESSION COMPANIES

As part of their social responsibility, tobacco and cotton concession companies provide farmers with packages allowing for production of grain and pulses. This way, rainfed and some near-to-floodplain production

plots in upper Tete, lower Nampula, and upper Zambezi, as well as intensive production plots in Cabo Delgado and Niassa, benefit from improved seeds and fertilizers, which could improve the quality of soil and transform these areas into very productive land for smallholder farmers. These activities are associated with increases in use of yield-enhancing inputs on some crops, such as application of fertilizer to cowpeas, in some areas.

DEVELOPMENT FOOD ASSISTANCE PROGRAMS

USAID-funded Development Food Assistance Programs (DFAP) (formerly known as Multi-Year Assistance Programs) are implemented by nongovernmental organizations (NGO) in specific geographic areas of Mozambique. They undertake farm-level interventions aimed at improving uptake of beneficial agricultural practices, strengthening nutrition practices, and improving integration between agriculture and nutrition. DFAP activity has been instrumental in increasing use of productivity-enhancing inputs in many of the target value chains, particularly those with important food security and nutritional roles.

SOYBEAN

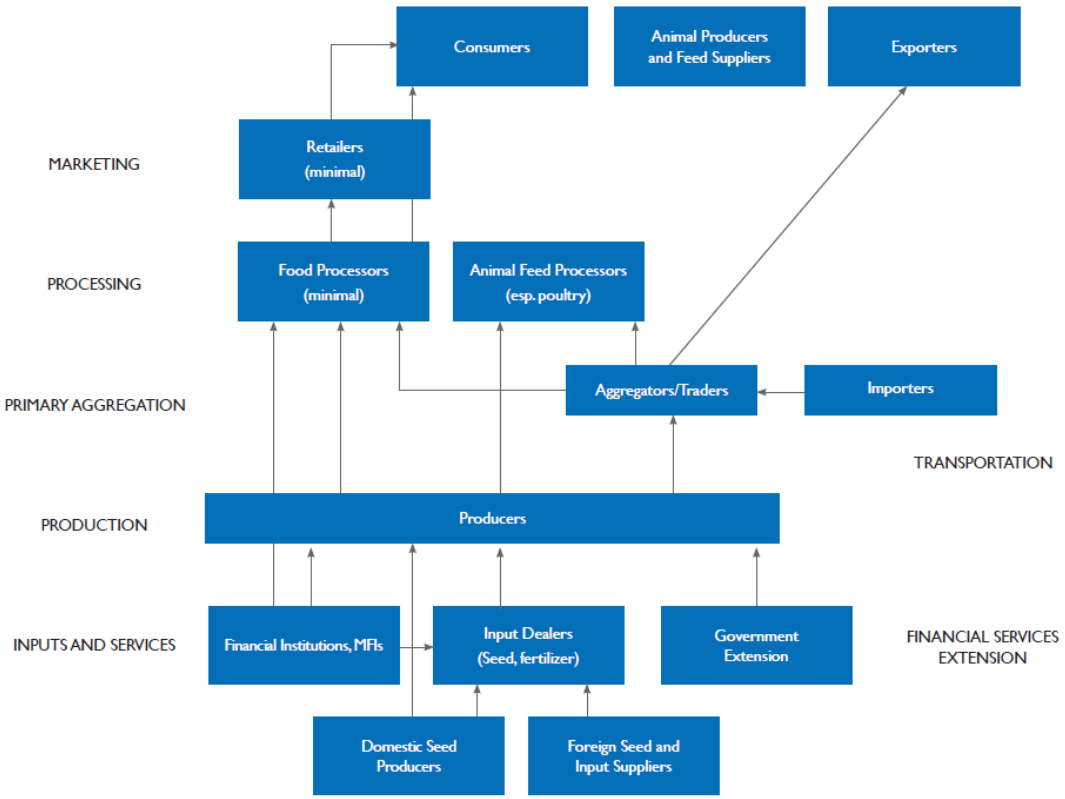
RELEVANCE TO USAID OBJECTIVES

Soy is a nutritious, but not traditionally consumed, crop in Mozambique. It is profitable for small- and medium-scale "emerging commercial" farmers with gross margins averaging from $306 to $371 (Payongayong 2012). Additionally, women have been successfully increasing their involvement in different levels of the soybean value chain. The domestic market for soy is estimated to be growing at about 60 percent per year, and about 60 percent of Mozambique's domestic demand for soy is currently met through imports. There is a relatively limited geographic area suitable for soy production—this area is largely limited to highlands in central and northern Mozambique, with only 5–10 districts perceived to have "high potential" for sustainable and profitable production given current and anticipated world prices that mediate local competitiveness (Walker 2016b). Several current and recent donor-funded initiatives offer rich examples of promising interventions and opportunities to develop the supply base and expand the competitiveness of the value chain.

VALUE CHAIN STRUCTURE AND FUNCTIONS

A map of the soy value chain is depicted in Figure 3.

Figure 3: Soy Value Chain, Mozambique



End Markets

The major end markets for soy are animal (primarily poultry) feed companies as well as exports to Malawi. Domestic demand for soy for processing into feed is estimated at 75,000 MT/year. Currently, Manica is reported to be responsible for about 30 percent of feed demand in the country in large part due to the activities of Abilio Antunes. In Nampula, Frango King/Novos Horizontes and Proalimentar are prominent feed companies.

Edible oil is a byproduct of processing soy cake for animal feed. It has a market in both Mozambique and nearby markets such as Malawi. Several processing plants in the major cities and corridors concentrate on refining palm oil imported from Asia for sale in domestic and regional markets. These plants have the capacity (and in some cases interest) in also refining and marketing edible soy oil, although few currently work with soy. More research is needed to investigate the opportunities for developing the soy oil value chain.

There is limited domestic value-addition for soy into foods for human consumption such as soy milk and soy bread. This value addition is often related to NGO- and donor-funded initiatives; an example is the USAID beneficiary Agropecuaria de Manica, which processes and markets soy flour. There are also limited exports of the highest quality soy to highly demanding export markets such as Japan. Finally, there are also some exports of soy (as grain) to regional markets such as Malawi. Regional exports typically are dominated by informal traders who place themselves in production areas during harvest time. These traders are often accused of motivating side-selling on the part of farmers who have otherwise committed their production to larger buyers (and often received inputs to support that production). Development organizations such as NCBA CLUSA and TechnoServe are working to mitigate side-selling by strengthening farmer-buyer linkages and reducing incentives for side-selling.

MARKETING AND VALUE ADDITION

From the farm, soy typically moves through structured supply chains to processing plants where it is converted to animal feed, with soy oil as a byproduct. Often producer associations serve as intermediaries and also may support producers with provision of seed, mechanical services, post-harvest handling, and in-kind finance for inputs. Generally, large-scale buyers buy directly from farmers or farmer associations under contracts of varying intensity. Donor-funded projects such as AgriFUTURO and NGOs such as TechnoServe and NCBA CLUSA typically play an important role in the creation and maintenance of these buyer-supplier relationships, providing technical assistance and training and other forms of assistance to help ensure the success of the relationship, in particular adherence of both parties to agreed-upon contract terms. While there is demand for soy (for animal feed) in southern Mozambique (Maputo area), transport from the center-north where it is produced is prohibitively expensive, and southern buyers most commonly import from South Africa, Brazil, or Latin America. These sources also offer consistent quality, which is important for efficient processing. In the center and north of the country, the growing market for animal, particularly poultry, feed translates to an expanding market for soy.

The quality of soy meal that is used for animal feed is determined in large part by its protein content, which is largely an outcome of the variety[3] and/or processing method. There are only four plants in Mozambique that

[3] "Safari" and "TGX" were mentioned by one processor as having higher protein contents; however, they were also mentioned as being lower yielding by other actors interviewed.

have the solvent-based extraction capability required to produce top-quality (Grade A1) soy cake with 47 percent protein. Other plants use less-expensive expresser extraction processes, which lead to a lower-protein soy cake with a higher oil content (Grade A2 and below) (TechnoServe 2009). Only two of these plants—Abilio Antunes in Manica and Alfa Quimica in Nampula—are currently working with soy. The largest poultry producers tend to have their own feed production facilities and constitute an important end market for domestic soy production.

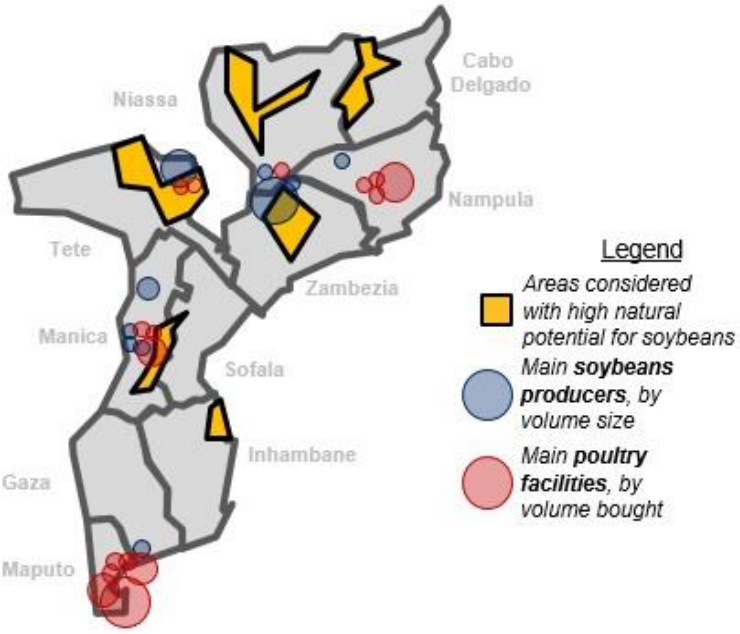
PRODUCTION

Soy production has grown rapidly in Mozambique, with most of that growth being credited to donor interventions as well as the impetus provided by a rapidly expanding market. In 2013/14, a total of 30,000 farmers produced approximately 50,000 MT on 39,000 ha of land (Perreira 2015).

Soy is a nontraditional crop in Mozambique, and its production is overwhelmingly oriented to the market rather than consumption. Zambezia, particularly Alta Zambezia, is responsible for just over 60 percent of annual soy production (with 50 percent of total production from just one district, Gurue). Tete accounts for approximately 24 percent of national production. (Table 4 in Appendix I presents data on soy production in Mozambique and USAID target provinces.)

Large commercial farms (>50 ha) account for only about 16 percent of total soy acreage. They often operate as part of a vertically integrated system linked to a processing and poultry enterprise, with satellite small-and medium-scale farmers complementing production. The large-scale commercial production system is comprised of farms that typically manage around 1,000 ha of land and is very capital intensive. These costs are not reliably offset by elevated yields, bringing its competitiveness and sustainability into question for Mozambique (Walker 2016).

Figure 4: Soybean and Poultry Production, Mozambique (Monitor 2012)



Approximately 5 percent of soy area is accounted for by "emerging commercial" farmers who operate on a medium scale (20–50 ha is typical) and who rely on mechanization and the use of commercial inputs such as seed and soil inoculants. Together, large- and medium-scale producers are responsible for approximately 50 percent of Mozambique's soy output.

The remaining area under production (approximately 79 percent) belongs to small-scale commercial farmers, approximately 75 percent of whom participate in farmer associations or other organizations that facilitate access to inputs and markets (Perreira). These producers typically manage four or fewer hectares of soy, and obtain yields averaging approximately 1.2 MT/ha (Perreira 2015). This small-scale production base is responsible for approximately 50 percent of Mozambique's total production of soy.

END MARKET PRIORITIES AND CONSTRAINTS

The most prominent end market opportunity for soy in Mozambique is the domestic market for animal feed in the center-north of the country. Offshoot markets for exports to regional markets (e.g., Malawi) also exist, as does the market for edible oils. The market for soy for industrial processing seeks a consistent and standardized quality product that is high in protein and free of stones and impurities.

The primary constraint to realization of gains in these priority end markets is inadequate production to meet demand. There are several issues that underlie this constraint.

- **Limited agroecological area that is well suited for production:** From a production standpoint, a relatively limited area of the country, including five to 10 of USAID's 35 target districts, has agroecological conditions that are well suited for soy production (Walker 2016b). Soybeans are most productive when grown from 700 m of altitude with annual rainfall above 800 mm. According to these parameters, the highlands in Manica, Tete, Zambezia, and Niassa are most suitable for the cultivation of soy. Walker (2016b) posits that only areas able to produce yields of at least 2 MT/ha will be able to competitively produce soy, given anticipated market conditions.
- **Limited availability of quality seed**, either hybrid or open-pollinated variety (OPV), is a critical factor limiting productivity and the expansion of production. Large commercial farms typically import soy seed from abroad, but these imports are impeded by bureaucratic constraints, exchange rate fluctuations, and cost; and there is no assurance that the seed will be well suited to local production systems. Several large associations (such as IKURU) are expanding their production of certified soy seed, for re-sale to their own local association members. Local varieties of soy used by smaller producers do not typically yield well, and there is a need to expand domestic capacity to multiply high-quality certified seed of appropriate varieties.
- **Limited use of improved inputs and suboptimal farm-level management practices** also reduce yields and profitability, particularly of small-scale farms. Timely planting is essential to high yields (each day of delayed planting is linked to a 65 kg/ha decrease in yield), and yields are also highly responsive to the use of soil inoculants (Walker 2016b), though awareness and availability of quality inoculants is limited.
- **Inadequate mechanization services** curtail medium-scale production of soy and lead to significant shortfalls in yields when planting is delayed.
- **Inconsistently successful linkages between buyers and suppliers** are also an issue, particularly given tendencies toward side-selling by farmers who are offered more attractive cash prices for their product by itinerant traders at harvest; these buyers are often seeking soy to sell to processors in Malawi.

UPGRADING STRATEGIES

- **Develop locally adapted improved seed varieties.** This could be done by building on the work of the Tropical Legumes project, which focuses on identification of locally adapted, high-yielding varieties that also meet feed processors' demand for minimum protein content. The International Institute of Tropical Agriculture (IITA) and IIAM have worked to develop five new high-yielding and locally adapted soy varieties that are in the latter stages of development as of 2014 (Walker 2016). These varieties should be promoted through lead firm-driven production schemes and commercially oriented farmer associations.

- **Expand soy production by targeting emerging commercial farmers (both small and medium scale) in high-potential areas**. Through recent initiatives such as AgriFUTURO, TechnoServe and NCBA CLUSA have identified and created sustainable relationships between demand drivers (particularly poultry feed processors) and farmer associations to ensure production, marketing, and finance. Another example was USAID/Mozambique's $30-million 2014 public-private partnerships (involving NGOs, FOs, financial service companies, and mechanization suppliers, for example) aimed at increasing market availability and access to inputs in USAID's ZOIs. Farmer associations played a key facilitation and aggregation role for small- and medium-scale soy production in such schemes.
- **Promote adherence to contracts and sales agreements** to limit side-selling and encourage development of sustainable linkages between buyers and producers.
- **Evaluate profitability of alternative smallholder models** under different price and production scenarios. For instance, analysing smallholder farmer models with a variety of input systems (e.g., quality OPV seed and inoculants and good management practices) to determine the most appropriate input regime for smallholders.
- **Evaluate alternative means to mitigate mechanization constraints** to medium-scale production, such as minimum tillage (Walker 2016).

SESAME

RELEVANCE TO USAID OBJECTIVES

Sesame is highly relevant to USAID's interest in creating income-earning opportunities for smallholder farmers, with 85 percent of sesame farmers located in USAID target provinces. It is uniquely suited to diversified smallholder production systems. While labor intensive in its principal phases of production (land preparation though germination, then harvest), once germinated, crop maintenance needs are low until harvest. Financial margins are also high at $261/ha (Payongayong 2012). Increases in production are largely attributable to increasing numbers of smallholders participating in the market rather than increased average areas cultivated or higher yields.

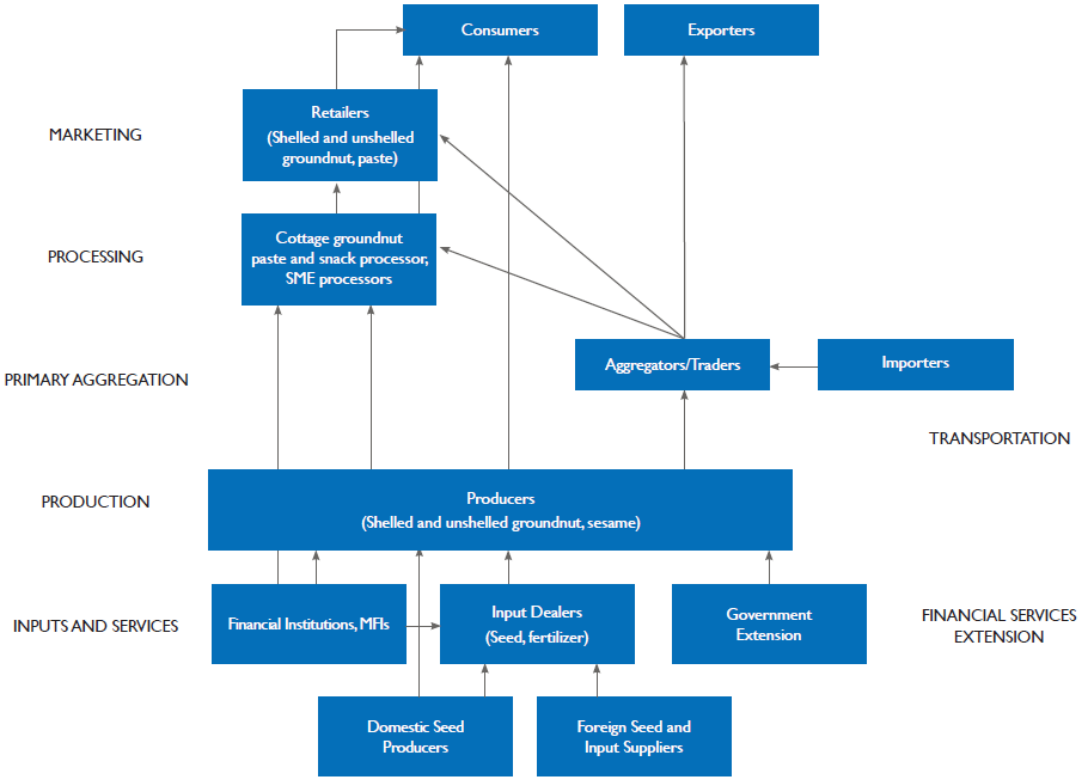
Sesame is nutritious with a high oil content and unsaturated fats, as well as antioxidants (Jasse 2013); it also preserves well in storage. There is little evidence on the relevance of sesame to women, although its high commercial value could potentially lend it to dominance by males while its labor-intensive nature could lead to it creating a heavy burden on women.

Sesame has a vibrant and growing international market, as well as a number of strong demand drivers within Mozambique that are seeking to expand their export sales of sesame. There are several current and recent donor-funded initiatives that can be learned from and leveraged in the sesame value chain.

VALUE CHAIN STRUCTURE AND FUNCTIONS

Figure 5 depicts the sesame value chain.

Figure 5: Sesame Value Chain, Mozambique



END MARKETS

Mozambique's sesame crop is overwhelmingly exported (98 percent) as graded but undifferentiated grain.[4] Major importing markets are in Asia: China imported 61 percent of total sesame imports while Japan, the largest importer of sesame internationally, imported 13.5 percent of Mozambique's sesame exports in 2015. Other importing countries include Turkey (8 percent), South Africa (3.3 percent), and Canada (3.1 percent).

The national sesame crop is exported by industrial traders; ETG is the dominant player in the market with an estimated 65 percent market share. Other major traders include OLAM, Indo Africa, GANI, and Casa Modi. In recent years, there has been an increased presence of medium-scale traders representing Chinese importers buying directly from farmers' fields, presenting competition to the larger industrial buyers that are established in Mozambique. While SNV estimates that 77 percent of the sesame produced is sold on an individual basis, there are also farmers' organizations such as IKURU, which aggregates for their constituent farmers before selling to major traders. This collectively marketed product is estimated to represent about 23 percent of total production, according to SNV.

While there are market opportunities for sesame of the quality that is currently produced, price premiums are available for higher-quality sesame. Export markets grade sesame on the basis of color, oil content, and organoleptic attributes like purity, cleanliness, and humidity. With respect to color, white or black, not mixed, sesame is preferred. High oil content (greater than 52 percent) is also preferred.

There is a limited domestic market for sesame to be used as an input in oil production or as snack food. For example, San-Oil uses sesame as a cleaning agent in its production of cotton seed oil; Irmãos Semedo in Nacala processes sesame oil; and the NGO ADPP sells roasted sesame and cashew locally as a snack food. Overall, local value-added markets represent a small share (less than 2 percent) of total production.

MARKETING AND VALUE ADDITION

Following harvest, farmers typically market their crops—on average less than 100 kg—on an individual basis to local traders who then transmit them to large-scale buyers. Consistent with their small areas cultivated, farmers tend to sell small quantities of seed—on average less than 100 kg (2014, Kleijn et al.). There tend to be large numbers of local traders, and they often operate on behalf of the large traders who provide finance to support purchases. Small-scale traders often conduct limited value addition in addition to their role as aggregators—in particular they may undertake basic cleaning of the crops to remove impurities and off-color (black) seeds. In addition to local traders, the major buyers also often set up buying points along major roadways where they aggregate from local traders or larger producers before sending 30 MT-ton trucks to their central facilities in Nampula, Nacala, or Beira where the sesame will undergo additional processing prior to export. Processing is again limited to cleaning, with the exception of ETG which has a dehulling machine.

PRODUCTION

Sesame is produced by smallholder farmers, primarily in the USAID provinces of Nampula, Zambezia, and Manica, which are collectively responsible for 54 percent of the national area under production and 85 percent of sesame producers. Production areas are small, averaging only 0.39 ha in the USAID provinces (MASA 2012, 2014). Although sesame can be intercropped with maize or beans, it is often produced as a monoculture. Farmers typically rely on local seed recycled from their harvest or purchased in the local market; there is

[4] There are niche export markets as well for "bald varieties" and safari variety, which is sesame and black sesame; this second variety has a higher oil content and is exported to Japan. However, Mozambique is not known to be currently participating in these markets.

virtually no use of other productivity-enhancing inputs such as improved varieties or fertilizer. Yields are low—averaging 300 kg/ha compared to potential yields of 650 kg/ha (SNV). Rainfed production makes the crop vulnerable to climatic anomalies, which can cause wide fluctuations in output and even crop failure. Pests, particularly the flea beetle, are also an important factor in production although they can be mitigated through use of resistant varieties, insecticide-treated seeds, or in-field treatments (Jasse 2013). Harvest practices are particularly important for maintaining yields—delayed harvests can lead to pods opening in the fields and shedding sesame seed. (Table 5 in Appendix I presents data on sesame production in Mozambique and USAID target provinces.)

END MARKET PRIORITIES AND CONSTRAINTS

Primary constraints to realization of end-market opportunities in the sesame value chain include inadequate volume of production, low yields, poor quality of output, and poor linkages between buyers and producers.

Inadequate volumes of production to meet demand – Key interview respondents among large traders report having unmet demand for sesame, such that they are able to absorb larger volumes of production. ETG, for example, reports it could procure significantly more sesame if it were available.

Low yields – Low productivity is a result of poor quality seed and suboptimal management practices. The flea beetle is also a factor in low yields. Additionally, suboptimal harvest practices—in particular, delayed harvests—cause substantial losses of the product in the field.

Low quality sesame crop – A major issue in sesame growing is that varieties are degraded and mixed. This results in low-quality, mixed-color sesame (white mixed with dark), which leads to price discounts in export markets. Mixed varieties also result in variable grain sizes, which affects product quality. Mozambican sesame is also often discounted on the basis of excess humidity, which is a result of poor post-harvest practices; in addition, Mozambican sesame is not cleaned and sorted due to poor post-harvesting handling practices such as farm-level threshing against the ground, which introduces extraneous material.

Poor linkages between producers and buyers – Weak linkages between producers and buyers limit farmers' incentives and ability to invest in increasing productivity and yields. The weak linkages also lead to distrust among market actors, with large traders complaining that some growers add sand to their bags to increase weight.

UPGRADING STRATEGIES

Increase area of production (via number of producers) and yields – Facilitate access for farmers to resistant varieties, treated seed, and spraying services. As part of one productivity-enhancing technology, seed is pelletized with insecticide to help control the leaf beetle (besouro). This technology reduces the human health hazards associated with distributing seed and insecticide separately.

Strengthen market linkages between exporters and producers – Work through FOs as an entry point to strengthen linkages between farmers and buyers in order to closely manage harvests to ensure timeliness. This will prevent pods from opening unexpectedly in the fields and will facilitate access to appropriate varieties such as white or black sesame, which has a high oil content. Additionally, productivity-enhancing practices, particularly harvest and post-harvest, should be promoted and marketed to farmer groups..

Promote niche varieties with higher-capacity producers – Interviews with main aggregators (IKURU, OLAM, and Export Trading Group) indicated the existence of niche markets that would pay higher premiums. These include markets for safari sesame in Japan; hulled grain or "bald" varieties; white seed; and black

sesame, which is valued by Japan due to its higher oil content. However, value chain actors are not yet investing in on-farm grading or other efforts to develop such niche markets.

Build off of previous value chain interventions – Leverage experience and initiatives of organizations such as SNV (which partnered with ETG), AgriFUTURO, and others to strengthen the sesame supply base through market-driven initiatives.

GROUNDNUT

RELEVANCE TO USAID OBJECTIVES

Groundnuts are a traditional crop in Mozambique, whose production is dominated by smallholders. Groundnuts are a profitable crop for smallholders, with gross margins averaging $280/ha[5]. Groundnuts are drought resistant, and their short-season production cycle of approximately 95 days fits well into smallholder production systems. Women are very active in groundnut production, post-harvest management, and local transport and sales; this implies opportunities to improve women's livelihoods through interventions to strengthen market opportunities and increase efficiency and productivity.

Nutritionally, groundnuts are high in vitamins, protein, and digestible fats, and they factor into traditional Mozambican cuisine. Unfortunately, groundnuts are marked by high aflatoxin levels, which reduce groundnut digestibility, prevent absorption of nutrients, and cause negative long-term consequences such as stunting and other adverse health impacts.

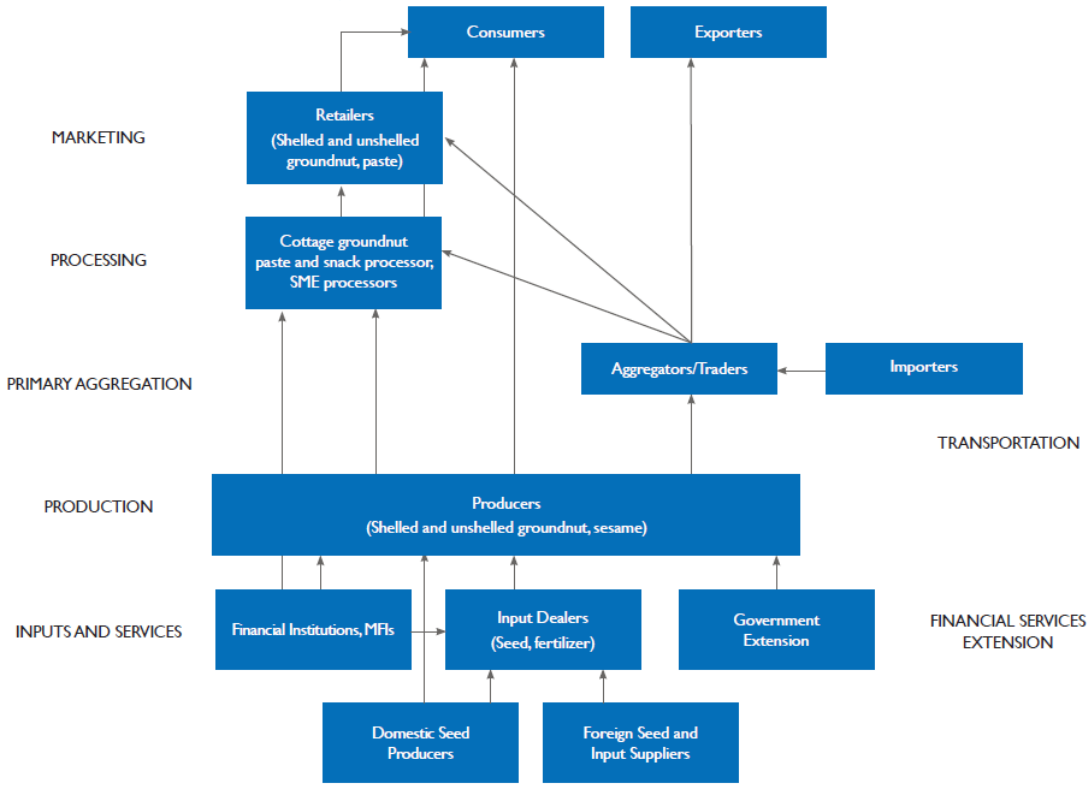
There is strong domestic market demand for groundnuts as well as strong international demand in countries such as South Africa, Europe, and the United States. Unfortunately, current aflatoxin levels in Mozambican groundnuts have seriously impeded producers' access to higher-value markets, and they are also severely detrimental to the health of Mozambican consumers.

[5] AgriFUTURO (USAID 2012).

VALUE CHAIN STRUCTURE AND FUNCTIONS

Figure 6 depicts the groundnut value chain.

Figure 6: Groundnut Value Chain, Mozambique



END MARKETS

Most of Mozambique's groundnut crop is consumed domestically, in part due to current aflatoxin levels, limiting any exports to low-value markets. Export prices for groundnuts are subject to international prices, with adjustment for aflatoxins, nut size (larger nuts are preferred to smaller), and cleanliness. The prevalence of aflatoxins impedes entry to many export markets, and some companies such as ETG, are relegating exports to low-grade uses such as bird feed.

Export volumes and value vary widely from year to year, as do buyers. As shown in Table 3, however, Indonesia has consistently been the largest importer of Mozambican groundnuts over the past few years, accounting for an average of 65 percent of sales from 2011–2015. The United Arab Emirates (UAE), South Africa, India, and Malaysia have also been significant buyers, though each individually accounted for only less than 10 percent of the value exported.

Table 3: Importers of Mozambican Groundnut by Value and Import Share

	Average 2011–2015 (dollars, thousands)	Average export share
Total	770	100%
Indonesia	502	65%

	Average 2011–2015 (dollars, thousands)	Average export share
UAE	76	10%
India	46	6%
South Africa	44	6%
Malaysia	43	6%
Others	59	8%

Source: ITC Trade Map, 2016.

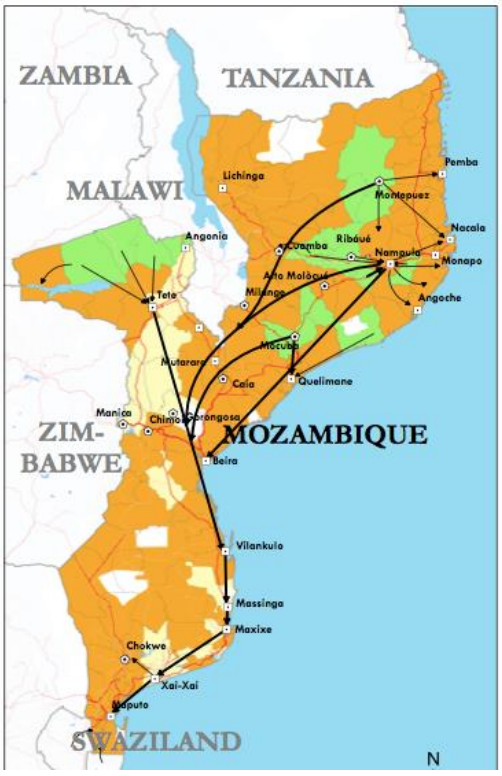
MARKETING AND VALUE ADDITION

The groundnut market has multiple channels for aggregation and marketing. More than 90 percent of groundnut growers sell to local market intermediaries, while a smaller share transport groundnuts by bicycle to the warehouses of larger aggregators. There are numerous aggregators in Nampula including Olam, ETG, AMTrading, IKURU, CISTER, and Gani Comercial. These buyers report a ready market for groundnuts both domestically and abroad if production can be increased, and in the case of exports, aflatoxin contamination addressed.

Larger-scale intermediaries send their product to buyers at the Maputo wholesale market, which is the central aggregation point for groundnuts in the country. The main market is Maputo where traders take advantage of truck back-haul opportunities from the north. Domestic buyers often transport the crop to southern Mozambique to sell to retailers in its unprocessed form for household consumption. Some buyers are speculators who own warehouses; they buy and store the groundnuts, waiting for the price to rise. A few local trading companies purchase small quantities for export.

Figure 7 indicates internal market trade flows of shelled groundnuts, with thicker lines indicating larger flows, green representing surplus areas, and gold indicating deficit areas. In general, product flows from the northwest and north central areas to the south and east coast ports. There is little industrial processing of groundnuts, and any processing that takes place is done on a small scale: groundnuts are processed into a cake that is used in cooking. Value addition along the value chain largely consists of drying and grading of nuts. Groundnut shelling is a labor-intensive process (one person can shell only up to 20 kg/day) that is carried out primarily by women on the farm. Traditional shelling methods, which involve soaking the nuts in water, and traditional farm-level storage are both associated with increased incidence of aflatoxins (Carana Corporation and ACDI/VOCA 2011). Women are also heavily involved in transport and local sales of groundnut.

Figure 7: Groundnut Trade Flows, Mozam-



PRODUCTION

Groundnut production is dominated by smallholder growers who produce for their own consumption and market any surplus. Production is concentrated in northern Mozambique, including in coastal Nampula and Inhambane. Nampula accounts for 35 percent of Mozambique's groundnut area, more than half of its producers (56 percent), and just under half (49

percent) of its production. Nationally, the average area cultivated is less than a third of a hectare. Low yields predominate—nationally, average yields are less than 350 kg/ha. Most farmers use recycled seed of traditional varieties, and groundnuts are generally grown as part of a low-input production system. (Table 6 in Appendix I presents data on groundnut production in Mozambique and the USAID target provinces.) Women are very involved in groundnut production and marketing, and women head 25–45 percent of groundnut-producing households (USG 2011).

END MARKET PRIORITIES AND CONSTRAINTS

There are ample opportunities to export groundnuts; however, realization of these opportunities is heavily dependent on addressing aflatoxin contamination. Export market opportunities for aflatoxin-free groundnuts include the United States, the European Union, Europe, and South Africa. There are also strong domestic markets for groundnuts. Groundnuts should be clean and graded. Large groundnuts generally receive higher prices, while the smaller groundnuts that are most commonly produced in Mozambique are valued for confectionary uses.

In addition to high levels of aflatoxins, realization of potential sales in priority end markets is constrained by inadequate volume of production to meet demand and a domestic inability to meet the SPS requirements of major importers.

Lack of domestic quality and SPS certification capacity – The overriding constraint affecting the realization of livelihood and nutritional gains from groundnuts is aflatoxin. Current aflatoxin levels affect both market outcomes for groundnuts (particularly exports) and the health of domestic groundnut consumers. Groundnuts must be tested for *Salmonella*, *E. coli*, aflatoxins, and other contaminants before export to more demanding countries like the European Union and the United States. These tests are not available in Mozambique; instead, samples (30 kg) must be sent to South Africa, which is very costly. There is also the added bureaucratic cost of preparing SPS documentation, which must be in order for the samples to be "exported" to South Africa. Current aflatoxin levels are above acceptable levels due to the agroecological conditions in which groundnuts are produced. Poor post-harvest management conditions further exacerbate them. Meanwhile, the highly fragmented and largely informal value chain combined with limited capacity to detect or enforce legislated aflatoxin limits impedes the production of aflatoxin-free groundnuts.

Inadequate volume to meet demand – Low yields are due to a lack of access to appropriate varieties (high yielding and adapted to local agroecological conditions) and quality certified seed for groundnuts, which results in farmers relying on recycled seeds of low-yielding varieties. While Mozambique imports seed from South Africa and Malawi, these seeds represent only about 10 percent of the national seed requirement.

Sub-optimal PHH methods – Groundnut shelling is a labour-intensive process—a single laborer can only shell about 20 kg of groundnuts per day—that is primarily the responsibility of women. Suboptimal shelling methods are associated with high post-harvest losses and increased aflatoxin levels, along with increased time and labor burdens for women.

UPGRADING STRATEGIES

Establish aflatoxin testing capacity – Investigate needs and advisability of supporting Lurio University in Nampula in its efforts to obtain certification of its aflatoxin-testing capacity. Additionally, partnership with IITA, to scale up means of drastically reducing aflatoxin during the production process should be explored.

Work with export buyers to establish premium markets for aflatoxin-free groundnuts – Facilitate multiple aggregation models that link farmers to buyers and have the potential to motivate intensification of aflatoxin-free production of groundnuts.

Promote intensification of production by improving access to quality seed and appropriate varieties. While developing a domestic certified seed system is critical toward this effort, there are companies currently in Nampula producing certified seed (Pannar and ORUWERA). Additionally, there is a need for more support to producers through buyers or input dealers to help reduce post-harvest losses and improve grain quality by promoting appropriate practices for cultivation, harvest, and post-harvest management of groundnuts.

Promote alternative shelling options such as mechanical harvesters and shellers, which reduce women's labor burdens and maintain grain quality without exacerbating aflatoxins. Investigate and build on the experiences of AgriFUTURO in this area, particularly the challenge of finding cost-effective mechanization options for these purposes.

COMMON BEAN

RELEVANCE TO USAID OBJECTIVES

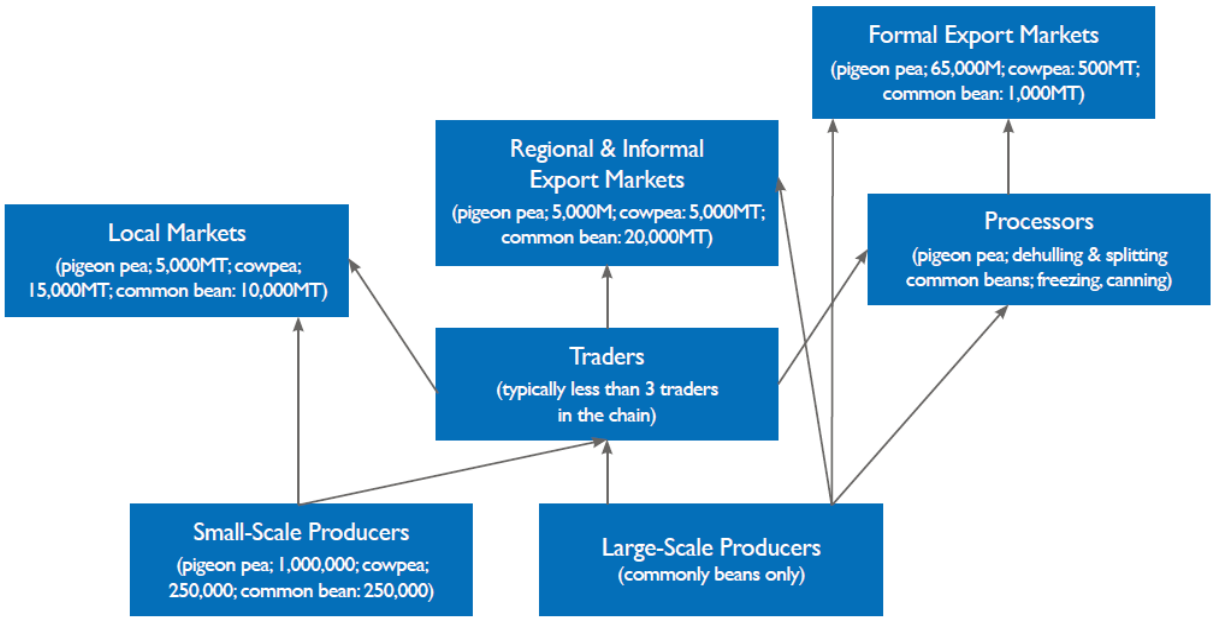
Common beans are produced by smallholder farmers throughout the USAID ZOI. From a nutrition standpoint, they are well established in Mozambican food culture and are a good source of protein and nutrients. Women are estimated to be responsible for 80 percent of common bean production (CIAT 2004); however, survey data (MASA 2008) show that female-headed households produce substantially less than those headed by males (52 percent of male-headed household production). Women also market a lower proportion of their crop, producing mainly for household consumption—only 3 percent of women sell compared to 32 percent of men (MASA 2008 in Kiala 2012). Thus, there are opportunities to enhance economic opportunities for women and nutritional outcomes by improving their productivity and sales of common bean by women. The nutritional and gender-differentiated benefits of common bean could be strengthened through targeted interventions to increase production for consumption and/or sale.

There are strong markets and unmet demand for common bean. Large industrial buyers, who could act as demand drivers, rely largely on traditional value chain structures for their procurement. However, buyers have recently collaborated with initiatives such as AgriFUTURO to develop more structured procurement; this has helped to motivate uptake of productivity-enhancing technologies and practices such as improved seed and fertilizer. Improvements to common bean production and marketing offer opportunities for broad-based increases in productivity, incomes, and nutrition, with particular potential benefits for women.

VALUE CHAIN STRUCTURE AND FUNCTIONS

Figure 8 shows a map of the value chains for common beans, pigeon pea, and cowpea in Mozambique.

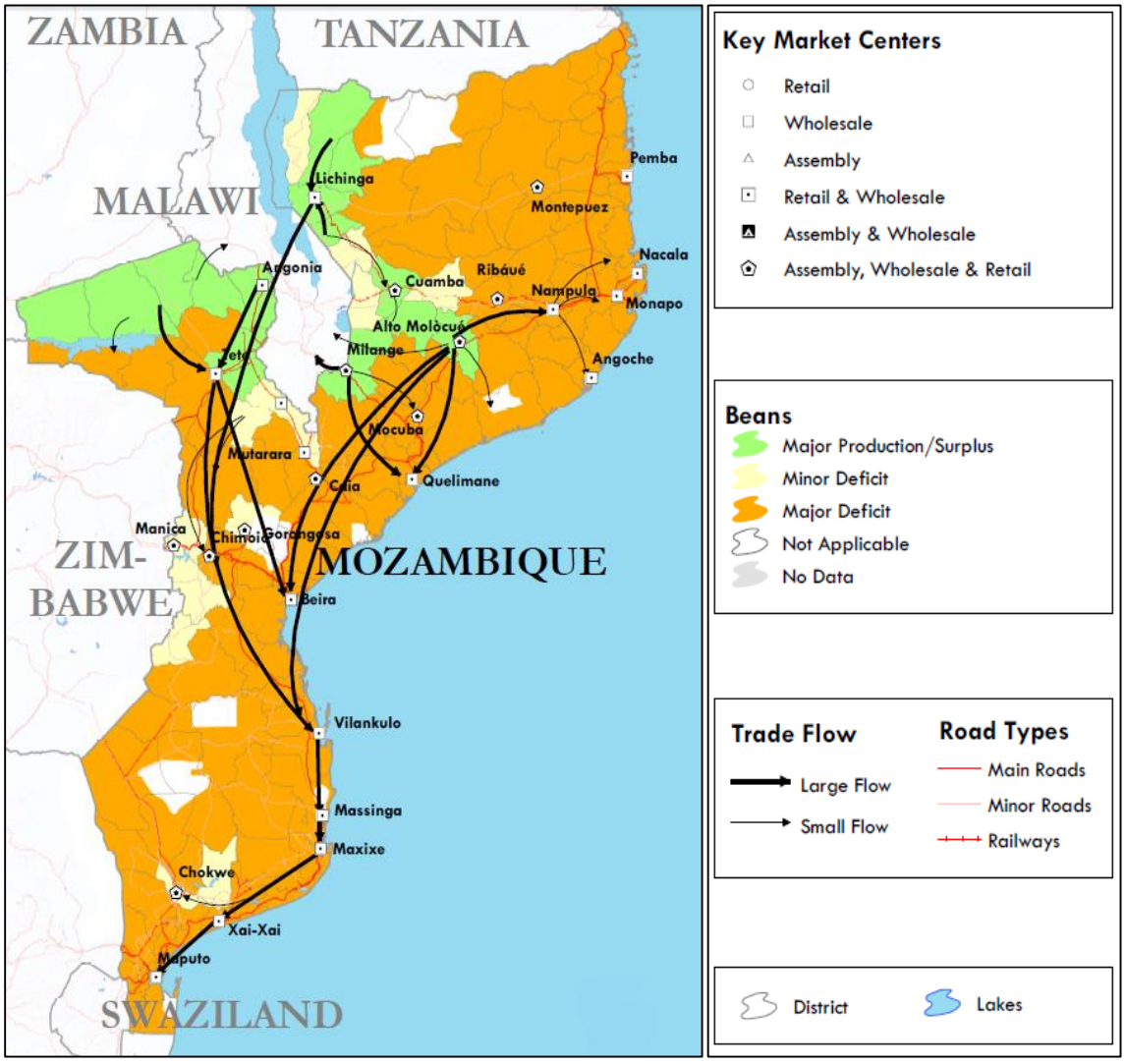
Figure 8: Pulses (Common beans, pigeon pea, and cowpea) Value Chain, Mozambique



END MARKETS

Informal trade between Mozambique and Malawi is particularly dynamic with rapid responses to price movements, and exports from Mozambique to Malawi dominate net trade flows (FEWS NET 2012). Figure 8 depicts the flow of common beans through Mozambique as they move from production areas to the Maputo market. In addition to domestic and regional markets, Mozambique has also historically exported common beans overseas to countries such as India, the UAE, China, and the United States (Gungulo 2013, 30).

Figure 9: Domestic Trade Flows of Beans, Mozambique



Source: FEWS NET, 2009a.

Marketing and Value Addition

Common bean producers tend to grow common beans primarily for their own consumption: nationally, 35 percent of farmers sell some of the common beans that they grow (MASA 2012). Smallholder farmers sell their common beans to local intermediaries who in turn sell to larger aggregators. Sales are cash based without advance contracts. Given the predominance of production in the north, there is an overall flow of common beans toward the south or other deficit areas including neighboring regional markets. Women traders tend to dominate informal cross-border trade and are recognized as dynamic and responsive to price signals

in the market. Large buyers involved in the value chain include OLAM, Patel Trading, ETG, GANI Commercial, and CISTER.

PRODUCTION

Common beans are produced primarily by smallholder farmers on small plots in intermediate and high-altitude growing regions (Niassa, Tete, and Manica together are responsible for approximately 96 percent of national production). Nationally, about 9 percent of farmers grow common beans, and 13 percent in the USAID provinces. Among the USAID provinces, production of common bean is most common in Tete, where 31 percent of farmers grow it, accounting for 35 percent of national area cultivated with common bean and 29 percent of production. Zambezia is the second major producing area in the USAID ZOI with 14 percent of national area cultivated. (Table 1 in Appendix I presents data on common bean production in Mozambique and the USAID target provinces.)

Common bean production systems are rainfed, use recycled seed, and use little to no external inputs (2012, Cachomba, nd). About 15–20 percent of common bean producers receive extension advice (Walker 2015), and about 12.5 percent of farmers use improved seed (MASA 2012, 2014). Use of improved seed and other inputs is highest in cotton and tobacco concession areas where seeds and some inputs are distributed to concession smallholders as part of companies' corporate "social responsibility" programs. Farmers typically cultivate common bean on small areas—averaging 0.3 ha nationally and less than .25 ha in the USAID provinces. Nationally, yields range widely from under 200 kg/ha in Gaza to over 700 kg/ha in Niassa. Yields in the USAID target provinces cluster around the national average of 535kg/ha, ranging from 379kg/ha in Nampula to 548kg/ha in Manica (MASA 2012, 2014).

END MARKET PRIORITIES AND CONSTRAINTS

There are strong markets and unmet demand for common beans for informal/domestic regional trade and for export to countries such as India. For example, the large industrial trader ETG reports unmet domestic demand of about 10,000 MT/year. Large buyers seek common beans that are clean, graded by size, and of consistent (not mixed) varieties in order to facilitate targeting of the product to market demand. Southern markets (e.g., Maputo) prefer khaki and khaki-speckled beans; while Malawian markets prefer darker, small red beans (2012, Cachomba).

Constraints include the fragmented and informal nature of the value chain, which limits the transmission of incentives to motivate farmers to invest in yield-enhancing technologies and management practices. The fragmented nature of the value chain limits farmers' access to and information about markets. There is also inadequate domestic production to meet demand due in part to a lack of quality seed.

UPGRADING STRATEGIES

There are opportunities to promote the USAID objectives of improving smallholder incomes and nutrition and gender outcomes through interventions in the common bean sector. Trade is largely informal, but there are some large-scale demand drivers that have the potential to catalyze uptake of productivity-enhancing inputs, as shown in the example of AgriFUTURO's work with CISTER, below. Specific strategies include:

- **Intensification of production** through increased availability and uptake of improved seed offers the potential to increase farm-level productivity.

- **Target female-headed households/female producers** who dominate common bean production but who tend to be less productive and less involved in common bean markets. Targeting women has the potential to decrease gender differentials in productivity and sales, while also helping to increase the availability of nutritious common bean for household consumption.
- **Link farmers to markets through producer associations** and learn from and leverage organizational approaches discussed in the Value Chain Considerations section to leverage contract farming arrangements to link common bean producers to large buyers. Learn from and leverage AgriFUTURO's work with companies like CISTER to link smallholder producers to markets via FOs.

PIGEON PEA

RELEVANCE TO USAID OBJECTIVES

Development of the pigeon pea value chain offers strong potential for improving smallholder incomes and nutrition. Pigeon pea has a long history in Mozambique, including in traditional cuisine (for example, dishes such as *mukapata*), and is produced by 30 percent of smallholders in USAID target provinces.

Pigeon pea production is uniquely suited to smallholders, and they dominate production in Mozambique. It is well suited to intercropping; has low input requirements, including a low seed-production ratio; and performs well with stable yields in smallholder systems (Walker 2015).

Pigeon pea production is for both consumption and sale, and pigeon pea is a healthy source of proteins and other nutrients from both the beans and leafy greens, which are harvested during the production season. Women are strong potential beneficiaries of pigeon pea production and sales: the small areas cultivated on a per-household basis, the low labor requirements for production following planting, and profitability under low-input systems can favor participation by women who tend to be constrained by time, land, and cash.

Pigeon pea has a robust export market, with particularly strong demand from India, whose market offers strong seasonal price premiums that are aligned with Mozambique's harvest window. Despite this, there have not been major development initiatives engaged with pigeon pea. Indeed, its expansion over the past decade is credited as benefitting from "benign neglect": it emerged as an increasingly important crop despite the lack of major attention given to it by the Mozambican government or the development community. Future activities could be built around the experiences of several smaller-scale interventions, including public-private partnerships.

VALUE CHAIN STRUCTURE AND FUNCTIONS

Figure 8 (on page 30) shows a map of the pigeon pea value chain in Mozambique.

END MARKETS

India is the primary market for Mozambican pigeon pea, importing an estimated 60,000 MT valued at $40 million in 2014 (Walker 2015). There is also informal cross-border trade to Malawi. Nearly all exports (95 percent) are of whole peas. An analysis by Walker (2015) shows that the biggest factor affecting prices, historically, is the month in which pigeon peas are exported to India: prices rise as India's harvest approaches, peaking in October and staying high through December. Recent analysis showed a seasonal price differential of approximately $200/ton between February and October (Walker 2015). In contrast, there is relatively little price variation on the basis of quality and country of origin, and only about a 20 percent price premium for split compared to whole pigeon peas (implying a negative return on splitting peas for export to India, given a conversion ratio of about 0.7). Mozambique, with its harvest beginning in August and trade concentrated between September and November, is well positioned to benefit from seasonal price premiums in its exports to India. Most imports to India from Mozambique are graded "Fair-to-Average Quality" (FAQ), and there is little impetus to focus on improving quality to increase price premiums given unmet demand for large volumes of pigeon pea during market windows offering large seasonal price premiums.

MARKETING AND VALUE ADDITION

Only 24 percent of smallholder farmers market any output (Trabalho de Inquerito Agricola/Work of Agricultural Survey (TIA) 2012, 39). These farmers rely primarily on cash sales to local intermediaries. Industrial exporters, such as ETG and Olam, also purchase from FOs in addition to sourcing from independent

traders who source from farms and local markets. There is little contracting of production, though in some cases industrial buyers will advance funds to trusted traders to finance purchases on their behalf. There are also reports of a growing presence of small-scale intermediaries buying directly from the production regions on behalf of importers in South Asia, with these small-scale players presenting some competition to the larger industrial buyers.

There is little processing of pigeon pea beyond cleaning and drying. A recent analysis shows that there is little benefit to splitting pigeon peas prior to export to India (the main international market) as large-scale industrial processors can undertake the same operation more cost effectively (Walker 2015). Nonetheless, there is limited processing of pigeon pea in Mozambique, particularly by ETG, which has a plant (with 7,000 MT/year capacity) in Gurue, Alta Zambezia. ETG is also in the process of investing in two larger processing facilities—one in Nacala and one in Beira; these new plants will have a combined capacity of 60,000 MT/year. These plants are intended to add value (dehulling and splitting) to pigeon peas for export to Europe and the Middle East.

PRODUCTION

Pigeon pea has not received a strong emphasis in Mozambique's development arena over the past decade, yet production increased an average of 8 percent annually from 2002 through 2012, largely as a result of increases in area cultivated. This increase in production is credited to growing demand for pigeon pea, particularly in the Indian market, and Mozambique was estimated to be the third largest exporter of pigeon pea worldwide in 2012 (Walker 2015).

Pigeon pea is credited as offering smallholder farmers stable yields, low production costs, and a ready and growing market, and has relatively low labor demands. By far, the top production area is Zambezia with two thirds of the production area, 70 percent of total production, and 45 percent of the producers; Nampula is a distant second with only 15 percent of the production area and production volume and 27 percent of producers.

More than a million smallholders cultivate pigeon pea across Mozambique, and approximately 850,000 of these are in USAID target provinces. Areas cultivated are small, averaging only .21 ha in USAID provinces (MASA 2012, 2014). Very few producers cultivate more than one hectare of pigeon pea, and there are no large-scale producers (MASA 2012). Approximately 10 percent of producers used improved seed; the use of yield-enhancing inputs is otherwise negligible (Walker 2015). While extension service coverage is limited in Mozambique overall, pigeon peas have a considerably higher rate of coverage (60 percent compared to only 15–20 percent for cowpea or common bean, for example) due to the concentration of production in Zambezia; promotion through private sector players such as ETG; the active presence of donor-funded implementers such as World Vision and DAI; and public sector extension services. (Table 2 in Appendix I presents data on pigeon pea production in Mozambique and in the USAID target provinces.)

Globally, pigeon pea is highly sensitive and susceptible to the American cotton bollworm (ACB), although its effects have not been pronounced to date in southern Africa due to the relatively cooler seasonal temperatures that prevail when the crop flowers and matures. Given the relatively low prevalence of ACB in Mozambique, and difficulty and cost of combatting it with pesticides or other means, producers commonly use non-intervention and acceptance of minor associated losses as their most economical strategy to mitigate its effects (Walker 2015). Pigeon pea yields average only 350 kg/ha (Integrated Agricultural Survey), although donor-funded projects such as AgriFUTURO are associated with increases in yields up to 483 kg/ha and corresponding gross margins of $147/ha (Payongayong 2012).

END MARKET PRIORITIES AND CONSTRAINTS

The highest potential end market for Mozambican pigeon pea is the Indian market, specifically targeting seasonal exports timed to hit October–December price peaks. India's demand for pigeon pea imports is expected to rise from its current level of 500,000 MT to 3 million MT annually by 2025 (Walker 2015, 18).

The primary constraints to expansion of exports to this market are inadequate volumes of production to meet demand and limited awareness among farmers of pigeon pea's market potential and conditions.

Inadequate production to meet demand

- **Inappropriate varieties:** Hitting India's seasonal window requires use of short- or medium-cycle varieties (five months). With respect to varieties, there is a need to continue to develop appropriate short- and medium-cycle varieties that are suited to the production conditions (700–900 meters above sea level) that are common in Mozambique's primary production areas. Current varieties, such as the International Crops Research Institute in the Semi-Arid Tropics' ICEAP 00040, were developed for the lowland conditions prevalent in Malawi and Tanzania. Development of appropriate varieties and production of adequate foundation seed has been proposed as a key area of intervention for the Tropical Legumes II project's next phase (Walker 2015).
- **Poor farmer access to quality seed:** Along with adequate foundation and breeder seeds, strategies for the commercialization of improved seed need to be developed, with market actors leading the way to promote and market these improved seeds to farmers.

Limited awareness of market potential and conditions

- Most farmers who sell pigeon pea market to intermediaries at the farm gate. Given the broad supply base for pigeon pea production and the recommended strategy (discussed below) of "extensification," increasing farm-level investment in pigeon pea production will require increasing awareness among a large number of smallholder farmers on the potential and conditions of the pigeon pea market. For example, awareness could be raised on the timing of seasonal price windows and requirements to reach them.

UPGRADING STRATEGIES

Extensification – Focus on increasing smallholder production through extensification, particularly in the Nacala and Beira corridors, which are well positioned for product aggregation and export. Extensification means a focus on increasing the number of farmers producing pigeon peas, as well as the number of hectares under production by current farmers. Successful extensification also requires investment to improve roads and infrastructure. Walker (2015) highlights the fact that expansion of pigeon pea production in Mozambique has been a result of increasing numbers of farmers producing pigeon pea and increasing areas of production devoted to pigeon pea, rather than to increasing pigeon pea yields. He also points out that pigeon pea production is relatively stable under smallholder conditions, despite the use of otherwise yield-enhancing inputs such as fertilizer. Thus, he encourages an "extensification strategy" of increasing the number of producers growing pigeon pea and the area under pigeon pea cultivation, rather than promoting intensification of production aimed at increasing yields.

Improve seed supply – Focus on the medium-duration (150–180 days) varieties ICEAP 00554 and 00557 to ensure that production reaches the market window among other benefits. Leverage international agricultural research centers and USAID partners' activities to partner with market actors working to strengthen the availability of quality seed, including linking farmers with buyers and input dealers to increase access to seeds and

markets. Leverage donor initiatives such as SNV that have worked with private sector players such as ETG and Olam to strengthen the pigeon pea value chains.

COWPEA

RELEVANCE TO USAID OBJECTIVES

Smallholders are extensively involved in cowpea production, largely as a crop for their own household consumption. Nearly half of the small- and medium-scale farmers in the USAID target provinces cultivate cowpea on a yearly basis. Cowpeas are a particularly important crop for women-headed households—54 percent of households planting cowpea are women-headed, despite the fact that only 24 percent of households are woman-headed nationally. Nationally, only about 9 percent of smallholders sell any of the cowpea that they produce (TIA 2012, 39). It is unclear, and merits investigation, as to what extent women-headed households sell or consume cowpeas or their leaves.

Cowpeas are important to nutrition and food security: the legumes provide protein, and their leaves are often harvested for fresh consumption during the growing season (in some locales, cowpeas are more valued for their greens than their legumes). Cowpeas are drought tolerant and nitrogen fixing. Furthermore, their short-duration production and early-maturing properties lend them well to integration in smallholder farmer intercropping systems as their production can be timed to when labor is less constrained and when vulnerability to climatic variation is reduced.

Market-driven interventions in the cowpea value chain have limited potential to promote USAID objectives. Overall, cowpeas are considered to be a "food security" or subsistence crop and are not perceived by either large private sector actors or industry expert key informants to have dynamic market demand. Although the market is expanding, there are no easily identifiable market players ready to exert a "demand pull" that could help to drive emergence of a more efficient market or uptake of productivity-improving inputs.

VALUE CHAIN STRUCTURE AND FUNCTIONS

Figure 8 (on page 30) shows a map of the pigeon pea value chain in Mozambique.

END MARKETS

There is a lack of data available on cowpea markets, and cowpea exports are not tracked separately from beans. However, major buyers report small volumes of exports to Asia (e.g., India, Indonesia, Philippines, Malaysia) as well as some recent sales to the World Food Programme for food aid programs in Angola and Sudan.

MARKETING AND VALUE ADDITION

Cowpeas are sold at the farm gate to small-scale market intermediaries. It then passes through informal market channels and is aggregated by medium- and large-scale buyers with buying centers and/or warehouses in rural areas, district centers, and urban areas. Cowpea is sold shelled, as grain, with little value added. Traders interviewed expressed the opinion that the quality of Mozambican cowpeas was inferior to that of neighboring countries as it is not uniform, exhibits pest damage, and contains contaminants. Major industrial buyers that have limited operations with cowpea include ETG, Olam, Sunsmile, V&M, and Dengo Commercial.

PRODUCTION

Cowpea production increased by about 30,000 MT (about 40 percent) between 2006 and 2014 (Walker 2016a). These increases have been attributed to improved productivity as the area cultivated has largely remained stable. Approximately half of small- and medium-scale farmers produce cowpea on an annual basis, though areas cultivated tend to be very low at only one-fifth of a hectare and yields are likewise low averaging only 275 kg/ha. The average household only produces about 56 kg of cowpea and only about 10 percent of

the product is marketed. (Table 3 in Appendix I presents data on cowpea production in Mozambique and the USAID target provinces.)

While cowpea production is widespread throughout Mozambique, Nampula province is responsible for about 25 percent of production and 33 percent of output and is also the location that has seen the most rapid productivity gains over the past decade; this is attributed to Nampula being the central location for cowpea research and extension (Walker 2016a). Cowpeas are mainly grown in sandy coastal areas and lowlands, and they do well on poor marginal soils such as seen in the northern coastal provinces. In 2009, only 11 percent of Mozambique's cowpea area was planted with improved varieties. IT 18, developed by IITA, was the leading variety responsible for 8 percent of area planted to cowpea (Walker 2016a). Meanwhile, only 15–20 percent of farmers receive extension services relating to cowpea (Walker 2015). Pests are a major issue affecting cowpea: it is more heavily attacked by pests than any other food crop in the country (Walker 2016a). Overall, yields are low, averaging only 275 kg/ha nationally, just over 300 kg/ha in USAID (AgriFUTURO and DFAP) intervention areas (Payongayong 2012) and barely surpassing 400 kg/ha in Nampula, the most productive cowpea-producing area of Mozambique (Walker 2016a). Low yields, combined with low prices (about 50 percent of common bean prices), imply relatively low profitability for cowpeas, with gross margins estimated at only about $90/ha (Payongayong 2012).

END MARKET PRIORITIES AND CONSTRAINTS

Overall, cowpea is not perceived as having dynamic market demand. "Arguably, the private sector is less interested in cowpea than in any other food crop in the USAID Feed the Future (FTF) portfolio," noted report authors Walker, Cunguara, and Donovan (Walker 2016). End markets include both domestic and export markets; however, there is a lack of dynamism in the market to motivate large-scale industrial buyers who could act as demand drivers.

From a markets/demand-driven perspective, the primary constraint to expanded production and trade in cowpea is the lack of private sector engagement due to weak overall demand, which limits incentives for farmers and other value chain players to invest in productivity-enhancing inputs and practices.

From a production standpoint, cowpea faces three primary constraints: lack of appropriate varieties, limited availability of quality planting material, and pest losses. Possible solutions to these constraints are discussed below.

UPGRADING STRATEGIES

While not a strong candidate for a market-driven development initiative, cowpea is an important subsistence crop with nutritional benefits as well as nitrogen-fixing properties. Cowpea may be considered as an integrated complementary crop to more commercially oriented ones.

Upgrading strategies for cowpeas could look to develop and expand existing investments in the value chain. For instance, IITA has led several donor-funded initiatives focused on the development of appropriate varieties and increasing the availability of quality seed. These include the Soybean and Cowpea project and the Tropical Legumes project, which targeted cowpeas (among other legumes) and led to the selection and release of several high-yielding, drought-tolerant varieties; multiplication and distribution of these varieties; and the development of alternative seed delivery models, such as village seed banks.

CASHEW

RELEVANCE TO USAID OBJECTIVES

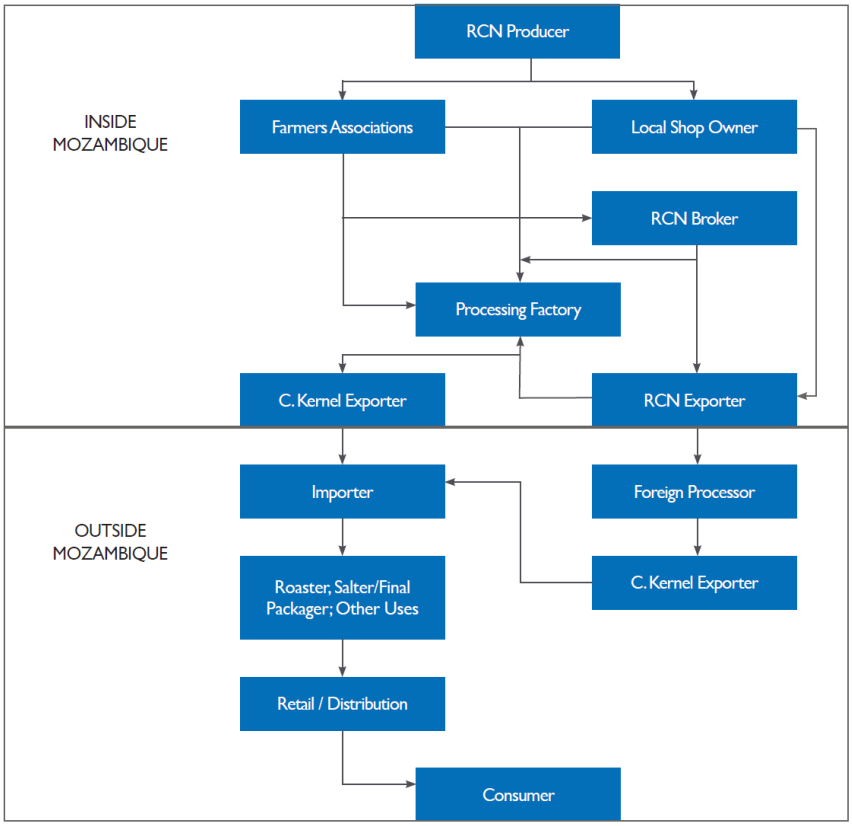
Cashew is a smallholder crop that is central to the economics of Nampula and Zambezia. Cashew is a significant contributor to agricultural output in these districts and plays a critical role in poor households' livelihood strategies. For example, in Nampula, the source of 60 percent of domestic output, cashews account for nearly one-fifth of total household income and approximately two-thirds of total cash income. Women constitute about 40 percent of labor employed in factories, making cashew an important source of income to women and their families.

Mozambique's cashew sales are constrained by inadequate production, and there are numerous opportunities to increase farmer incomes from cashew production by addressing key constraints along the value chain. However, there are significant financial and political challenges to realization of these potential gains. Several ongoing donor-supported initiatives are involved in the cashew value chain; coordination with these initiatives offers opportunities to create synergies and enhance each project's impact. Nonetheless, the level of political involvement in the cashew value chain, and the impact political involvement is recognized to have on incentives and value chain actors' behavior, bring into question the possibility of significantly improving the performance of the cashew value chain through a "market-driven" intervention.

VALUE CHAIN STRUCTURE AND FUNCTIONS

The cashew value chain is depicted in Figure 10.

Figure 10: Cashew Value Chain, Mozambique



END MARKETS

About 10 percent of cashew is processed for domestic consumption (as described above), and the remaining 90 percent is exported (Dalberg 2013). Three main types of cashew nut products are exported: whole (in-shell) kernels referred to as raw cashew nuts (RCN), shelled kernels, and broken kernels. Nearly all (95 percent) of Mozambique's cashew exports are in-shell (RCN). As shown in Table 4, India is by far the largest importer of Mozambique's RCN and is responsible for 83 percent of the value of exports from 2011–2015. In-shell exports have a ready market with no major quality problems, and the country benefits from being one of the first countries to have product available for export in the global cashew crop calendar when stocks in India have run low.

Table 4: Importers of Raw Cashew Nuts, 2011–2015 (U.S. dollar (USD), thousands)

Importer	2011	2012	2013	2014	2015	2011–2015 Average	Average share
World	53,382	3,930	6,370	9,585	713	14,796	100%
India	41,516	3,647	6,325	9,046	713	12,249	83%
Spain	6,136	-	-	-	-	1,227	8%
Singapore	1,840	72	-	63	-	395	3%
Vietnam	1,303	-	-	476	-	356	2%
UAE	1,398	-	45	-	-	289	2%
Turkey	469	-	-	-	-	94	1%
Hong Kong, China	323	94	-	-	-	83	1%

Source: ITC Trade Map.

In 2014, Mozambique exported about $9.51 million of kernels (shelled cashews) or 1,689 tons (ITC Trade Map 2015). Its top five markets were the United States (34.5 percent), Canada (18.8 percent), Norway (15.5 percent), South Africa (9.1 percent), and the UAE (6.9 percent).

For the Indian processing sector, Mozambique's in-shell nuts are in the midrange of quality relative to fellow African suppliers. Quality is measured in terms of the weight of kernels per bag, the count of nuts (kernels) per kilogram (an indicator of nut size), and the percentage of rejected kernels.

There is a limited market for broken kernels, which are a byproduct of cashew processing. Several processors interviewed reported that they have difficulty finding buyers for pieces. One South African buyer is able to take all grades, including broken nuts, for use in snacks, providing a convenient offtaker for processors' excess low-grade nuts. The potential of this market channel needs to be verified with the main high-quality processors, including Condor and ETG, who regularly supply the U.S. market.

MARKETING AND VALUE ADDITION

Mozambique's market for domestic consumption has two main channels: local roasters with poor-quality processes, packaging, and branding as well as high prices, which results in low consumer confidence and low demand; and informal, household-level or cottage-industry processors with lower prices and poor or no food safety or quality systems that sell mainly through street vendors. Consumer confidence is poor and demand weak, in part due to the relatively high price of the product compared to groundnuts, Mozambique's predominant snack food.

The three largest domestic processors, Condor Caju, Olam, and Ilha Caju, collectively account for 20,000 tons, which is about half of the nation's industrial processing capacity. Between five and 10 small- and medium-scale processors account for the remainder (Dahlberg 2013).

Domestic processors vary in terms of the quality of processed cashew that they produce, with implications for their access to more demanding export markets. Donor-funded initiatives (such as AgriFUTURO) have aimed to help cashew processors achieve export certifications that are required to access more demanding and profitable export markets. The top seven northern Mozambican processors have been able to adjust their processes to respond to quality, food safety, and certification (e.g., Hazard Analysis Critical Control Point (HACCP)) demands and are also aiming for organic certification.

Farmers harvest cashew over a three-month period, selling it to itinerant traders or bringing it to collection stations that serve as area processors.

PRODUCTION

Nearly 1.4 million farmers, 95 percent of whom are smallholders, produce cashews in Mozambique (TechnoServe 2013). Nampula and northern Zambezia are the two most important production areas: 60 percent of farmers living in Nampula produce cashews, accounting for 33 percent of the country's producers and 33 percent of the trees in production; while 35 percent of the farmers in Zambezia produce cashew and account for 21 percent of trees in production (MASA 2012, 2014). Nampula is the most productive province, accounting for half of sales of raw cashew nut recorded in the country and an even larger share of processed cashew nuts (Große-Rüschkamp et al. 2010).

Smallholders often intercrop low-density cashew stands with legume crops, including beans, sesame, and groundnuts, that return nitrogen and other nutrients to the soil. Domestic cashew output is well below its potential due to the predominance of orchards with low numbers of old and neglected trees that have poor yields and produce lower-quality output. The average productivity per tree is about 3 kg, with a median of only 1.6 kg/tree. This low productivity is the result of limited renewal (replanting or pruning) of trees and minimal use of fertilizer, spraying, or other yield-enhancing management options. Farmers that do apply fertilizer and spray their trees have average yields of 4.5 kg/tree.

The government cashew institution INCAJU is funded through a tax on exports of unprocessed cashew and is deeply involved in the provision of inputs and support services to cashew producers, including the production and distribution of seedlings and spraying services at no cost to farmers. Institutional capacity to meet demand for these services is limited, however, and only a small proportion of farmers actually receive them. Meanwhile, the subsidized nature of these services depresses farmers' willingness to pay for them on a commercial basis, inhibiting the commercial sector to supply these needs.

END MARKET PRIORITIES AND CONSTRAINTS

Efforts to strengthen the competitiveness of the cashew value chain should focus on increasing exports of quality RCN, as well as continuing to support the industrial processing industry's ability to meet international market requirements for shelled cashew.

There is strong and growing global demand for good-quality cashew in several markets, including the United States, Europe, Vietnam, and India. These markets are demanding in terms of product quality and hygiene, and they increasingly seek and are willing to pay a premium for product traceability. Large-scale exporters interviewed during fieldwork were largely aware of buyers' demands in these markets. They also perceived the United States to offer a more attractive market than the European Union, with better payment terms, slightly higher prices, and a pragmatic approach to business. In their opinion, European Union-based buyers tend to be very process oriented. Norway was cited as an exception to this rule and is an active and collaborative partner of a major processor in Nampula with a strong quality and compliance focus.

Red River Foods, the largest U.S. nut, dried fruit, and snack firm, as well as the largest U.S. importer of cashews, purchases kernels from Mozambique. They are seeking to source more from Africa as a result of buyer pressure from retailers such as Costco. Red River expects to increase their supplies from Mozambique as a result of new factories and improved processes at ETG and Condor, resting on several preconditions:

- Whole kernels only (no "brokens")
- Prices need to be competitive with Vietnam and India, currently their main suppliers
- Shipments need to be compliant with U.S. Food and Drug Administration requirements
- Shipments must be of the same quality as the samples sent by the supplier (this has not always been the case)

There are a number of important constraints in realizing these opportunities, chief among them being a policy environment that is unfavorable in many respects and inadequate production to meet demand. Other constraints include a lack of finance, particularly at the farm level; high costs along the value chain; and poor processing efficiency and quality.

Policy

- The cashew industry is heavily politicized, a factor that is perceived to have impeded some improvements in industry performance by inhibiting farmers' willingness to pay for productivity-enhancing inputs and services, raising costs, and depressing farm-level prices.
- Market distortions such as free cashew seedlings and subsidized spraying have reduced producers' inclination to invest in upgrades and hindered the success of private sector input providers.
- Government subsidies are funded by an 18 percent ad valorem levy on in-shell exports, representing an added burden on domestic producers upon sale. Increased domestic processing and decreased in-shell exports have reduced this revenue, creating a gap in input purchasing funds since farmers are currently not inclined to pay for them.
- The 18 percent tax on in-shell exports is sometimes cited as an example of a policy intervention that skews incentives in the cashew market and reduces overall sector performance.

Inadequate Production to Meet Demand

- Low yields and inadequate investment severely constrain national production of cashew: yields average 3kg/tree compared to a potential yield of up to 10–15 kg/tree during prime producing periods (Dalberg 2013).
- Subsidized provision of inputs (such as seedlings) and services (such as spraying) by INCAJU inhibits development of a commercial sector to supply these services. Meanwhile, INCAJU does not have the capacity to meet needs for these services, so that demand is underserved by available supply.
- Cashew farmers typically invest little in their cashew plantations and are more accurately referred to as "collectors" of cashew rather than "farmers." Most trees are large and overgrown as they are not pruned, and there is a large incidence of disease (34 percent of trees nationally are affected by the most severe tree disease, oidium), causing large yield losses. Few farmers—only 5 percent nationally and less than 10 percent in any one province—spray against oidium, a fungus that damages cashew flowers and reduces yields. This lack of investment is attributed to heavy government involvement in the industry, depressing farmers' willingness to pay commercial rates for these same inputs and services while failing to reach a significant proportion of farmers who need these services. The Mozacaju project (see TechnoServe and U.S. Department of Agriculture (USDA)), which works in

Nampula, Cabo Delgado, and Zambezia, estimates that farmers could double their net incomes through application of a basic technology package of fertilizer and spraying.

- Low output and yields are also referred to as a "socioeconomic" issue as high levels of poverty and food insecurity and low levels of literacy limit the effectiveness of interventions aimed at promoting production practices and inputs. These interventions have the potential to increase yields, while also inhibiting investments (such as replanting of trees, which takes five to seven years to produce) that offer longer-term payoffs in favor of more short term-oriented investments with more immediate (though lower over the life of the investment) payoffs.

High Costs along the Value Chain

- Processors face supply constraints, and available product may fall below installed capacity and demand for larger processors at times. This negatively impacts processors' economies of scale and bargaining power. The processing industry faces a shortage of raw material for processing.
- Low output at the farm level leads to high costs for harvesting, aggregation, bulking, and sorting.
- There is a lack of finance, particularly for investment in production at the smallholder level.

Processing Efficiency and Quality

- Low yields and continued exports of in-shell nuts have resulted in a chronic shortage of raw material for domestic processing, which limits economies of scale.
- Mozambique's cashew processors have mixed results in terms of quality of output. Recent initiatives, such as AgriFUTURO, have sought to address these issues by facilitating the upgrades needed to improve quality and obtain industrial practice certifications such as HACCP.

UPGRADING STRATEGIES

A strategy to strengthen the cashew value chain should be focused on improving the policy environment and increasing farm production of cashew by increasing smallholder access and utilization of inputs and services and promoting medium-scale, block-style plantations. Complementary activities can be used to improve the availability of finance and upgrade industrial processors' ability to comply with importing market requirements.

Policy – Support should focus on privatization of cashew inputs and support services; the development of policy; and capacity-supporting, market-based provision of these inputs and services. These initiatives could build on the recent experiences of NGOs and donor programs in developing private sector provision of insecticide spraying services, an industry which has relatively low entry costs and high potential returns (see MEDA 2011).

Production

- Investigate options and the feasibility of medium-scale plantation schemes such as block-style plantations (30 hectares minimum). These plantations, proposed by MEDA, can incorporate multiple smallholder plots while improving the efficiency of service delivery and coordination with buyers and other value chain players. Results of an African Cashew Initiative (ACI) analysis (Große-Rüschkamp et al. 2010) demonstrated that new plantations have a high rate of return for smallholders (68 percent).

- Evaluate the financial profitability of basic input and service packages for smallholders compared to alternative investments. An ACI analysis (Große-Rüschkamp et al. 2010) posits that a basic input and

service package could increase productivity from 3 kg/tree to 8 kg/tree. This would increase production by about 150 kg for a farmer with 30 trees. The financial returns of such an activity should be compared to alternative agricultural options for similar farmers, such as investment in sesame.

Finance – Investigate the potential for savings and credit groups to enhance financial literacy and access among smallholder cashew producers, as promoted by MEDA. These groups, successful examples of which exist throughout Mozambique, can be leveraged to help smallholders understand the basics of finance as well as specific financial aspects of investment in cashew production.

Processing – Support for upgrading of processing facilities, particularly certifications and traceability, will enable access to more lucrative markets.

BANANA

RELEVANCE TO USAID OBJECTIVES

Banana is a crop frequently produced by smallholders throughout Mozambique for home consumption or sale in local markets. Although it is not a staple food, as it is in other southern and East African countries, it does provide important nutrients and micronutrients. Continuous production throughout the year makes banana important to food security as they can grow when other crops are not in season.

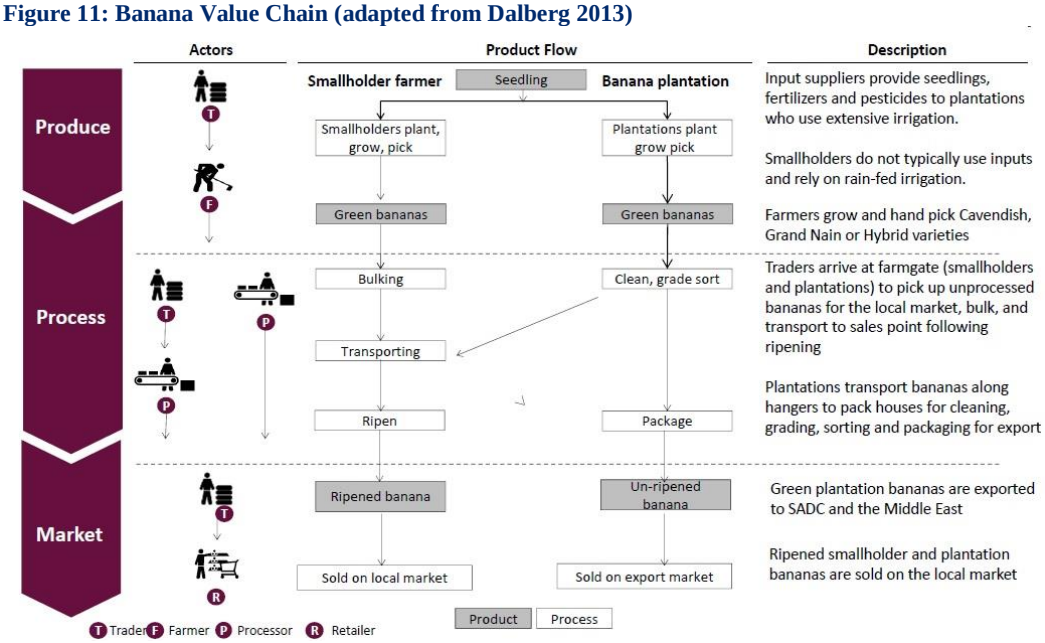
Commercial activity in banana markets offers limited income potential for smallholder farmers and is not recommended as a priority value chain for a smallholder-oriented development intervention. Domestic markets are easily glutted and have high price variability given the high perishability of bananas. Smallholder banana farmers are concentrated in Zambezia and Nampula where there is little irrigation, and soils tend to be infertile. Banana plants extract high volumes of nutrients from the soil, making fertilization critical. Export markets—both regional and overseas—have quality standards that smallholders would have difficulty meeting without extensive and costly technology transfer including irrigation, improved planting materials, and fertilizer (particularly in areas where soils are at risk of or are already exhausted). Minimum commercial scale of production for bananas is estimated at 5 ha, and the industry is afflicted with diseases such as Fusarium wilt, black Sigatoka, and Panama disease.

There is a common consensus that smallholders do not have high potential to benefit from investment in banana markets. In addition to production-side constraints, the market themselves are not attractive. Local domestic markets are relatively low value, and the high perishability of banana can lead to large price movements when there are supply gluts. Export markets are better able to absorb large volumes of bananas, but smallholders are poorly equipped to meet their quality standards in a cost-effective manner. "Mozambique is building a commercial scale sector oriented at export markets, but this presents little short-medium term opportunity for smallholder farmers." (BMGF 2007, 8)

VALUE CHAIN STRUCTURE AND FUNCTIONS

Figure 11 depicts the banana value chain.

Figure 11: Banana Value Chain (adapted from Dalberg 2013)



END MARKETS

Mozambique's most important export markets are South Africa (69 percent of export value), followed by the Middle East: Saudi Arabia with 17 percent of export value while the UAE, Iran, Kuwait, and Qatar also importing Mozambican bananas, as shown in Table 5.

Table 5: Mozambican Exports of Banana and Plantain, 2012–2015

Importers	Average value 2012-2015	Average export share
World	29,764	100%
South Africa	20,526	69%
Saudi Arabia	5,185	17%
UAE	1,294	4%
Iran	1,285	4%
Kuwait	784	3%
Qatar	279	1%

Source: ITC Trade Map.

MARKETING AND VALUE ADDITION

Traders collect bananas from smallholders at the farm and handle storage, ripening, and packing for sale. Banana ripening is the main post-farm-gate value-added activity. While small-scale producers can provide outgrower services to large plantations, only a few large firms are developing contract farming initiatives. These initiatives typically facilitate smallholder access to inputs, aggregation, and transport costs, and accruing attendant economics of scale as a result (Dalberg 2013). Larger farms market directly for export and retail.

PRODUCTION

The commercial banana industry is anchored around large-scale plantations in Nampula, Metuchira, and southern Mozambique, the largest of which is Matanuska in Nampula. Other large banana companies include

Jacaranda in Nampula and ENICA. These plantations average 100 ha but can be as large as 6,000 ha (BMGF 2007). They are situated for easy access to ports and rely on input-intensive production methods, including irrigation, yielding 40–60 MT/ha of export-quality bananas. Plantations expand into fertile, level land that is uncultivated.

In contrast to large-scale plantations, smallholder banana production is labor intensive, uses few inputs, and is often intercropped with other crops. Yields are only about 20–30 percent of their potential (11 MT/ha versus a potential of 30–50 MT/ha).

In addition to their low productivity, smallholder-produced bananas do not typically meet export standards. For smallholders, the current cost of post-harvest methods required to meet such standards is prohibitive. Start-up costs are also high, representing a barrier to entry. As such, many smallholders cannot access higher-value markets. Large commercial farms have realized more competitive prices and can invest in quality upgrades, helping them sell into high-value markets.

ENDMARKET PRIORITIES AND CONSTRAINTS

While smallholders are not considered to have high potential to compete or thrive in mainstream export markets for banana, they may have some potential to participate in domestic and global niche markets, such as small finger bananas and plantains (Harris 2010). Supporting farmer group investments in packhouses, storage, ripening, and marketing also stands to improve smallholder returns, as the majority of value addition occurs past the farm (Global Development Solutions 2005).

The following issues constrain smallholder participation:

Inappropriate production systems to support low-cost production of high-quality banana – Smallholder banana farmers are concentrated in Zambezia and Nampula where there is little irrigation, and soils tend to be infertile. Banana plants extract high volumes of nutrients from the soil, making fertilization critical. Export markets—both regional and overseas—have quality standards that smallholders would have difficulty meeting without extensive and costly technology transfer including irrigation, improved planting materials, and fertilizer (particularly in areas where soils are at risk of or are already exhausted). Minimum commercial scale of production for bananas is estimated at 5 ha.

Disease and consequent high risk of financial loss – The most common diseases include Panama disease, Fusarium wilt, and black Sigatoka.

Low yields and inconsistent quality

- Need for improved varieties, irrigation, fertilizer
- Poor post-harvest management in bananas leads to low quality and low market prices. Proper infrastructure has a high cost and is prohibitive for smallholders.

Weak infrastructure increases costs and reduces competitiveness of Mozambican banana sector – Port inefficiencies lead to delays and increase the costs of banana exports. For example, Matanuska exports 5,000 containers of bananas a year through the Nacala port; however, the port lacks refrigeration so they have to send refrigerated containers to the farms where they sit loaded until it is time to ship. This entails an extra round trip for the refrigerated containers, substantially increasing costs.

UPGRADING STRATEGIES

Although some USAID-funded initiatives, such as AgriFUTURO, have worked to incorporate smallholder farmers into the banana value chain, the multitude of issues constraining their entry into and competitiveness in export markets for banana, as well as the low-value and highly variable nature of the domestic market, argue for exclusion of banana as a priority USAID value chain.

VEGETABLES

RELEVANCE TO USAID OBJECTIVES

Vegetables are produced by a significant share of Mozambican farmers, though they typically (and with some exceptions) sell relatively small shares of what they produce. Vegetables offer significant income potential to smallholder farmers, with gross margins of MZN 85,000 per hectare reported by ACDI/VOCA (2016), particularly for those that can access more demanding markets. However, barriers to entry to those markets tend to be high. Vegetables also offer a rich array of major and micronutrients and thus have potential to help mitigate the high incidence of malnutrition in Mozambique.

Mozambique imports more than $1 million in vegetables monthly, largely from South Africa, and domestic demand for vegetables is expected to grow from four- to six fold between 2000 and 2030 (Cairn 2012), offering a significant market opportunity. Smallholders can benefit economically from participating in vegetable markets, although their engagement in these markets must be carefully structured and coordinated if these potential gains are to be realized. There are opportunities to leverage recent and current development initiatives to develop smallholder-inclusive vegetable value chains, specifically targeting higher-value domestic markets. Women are under-represented in the vegetable value chain, particularly from a marketing standpoint: while women head 24 percent of households nationally and 25 percent of households producing vegetables, only 16 percent of vegetable-selling households are female-headed (Cairns 2012). Tete and Manica are among the most important vegetable-producing provinces in Mozambique.

VALUE CHAIN STRUCTURE AND FUNCTIONS

The Mozambican vegetable value chain comprises two largely distinct market segments: the domestic traditional vegetable market driven by localized production and consumption of mostly amaranth, cowpea, kale, pumpkin, and cabbage; and the high-value "exotic" vegetable market (including tomato, onion, potato, green beans, and others), which is focused on production for domestic high-value markets such as restaurants, tourist establishments, and supermarkets. The value chains for these two segments have different market preferences and requirements, operate on different spatial scales, and have different potential advantages for smallholder producers.

Nationally, 36 percent of farmers produce vegetables and 8 percent of farmers sell vegetables (Cairns 2012) but only 16 percent of producers grow fresh produce crops exclusively. Smallholders constitute 83 percent of vegetable producers. "Emerging commercial," medium-scale farmers are responsible for only 3 percent of vegetable areas, while large-scale farmers are responsible for the remainder.

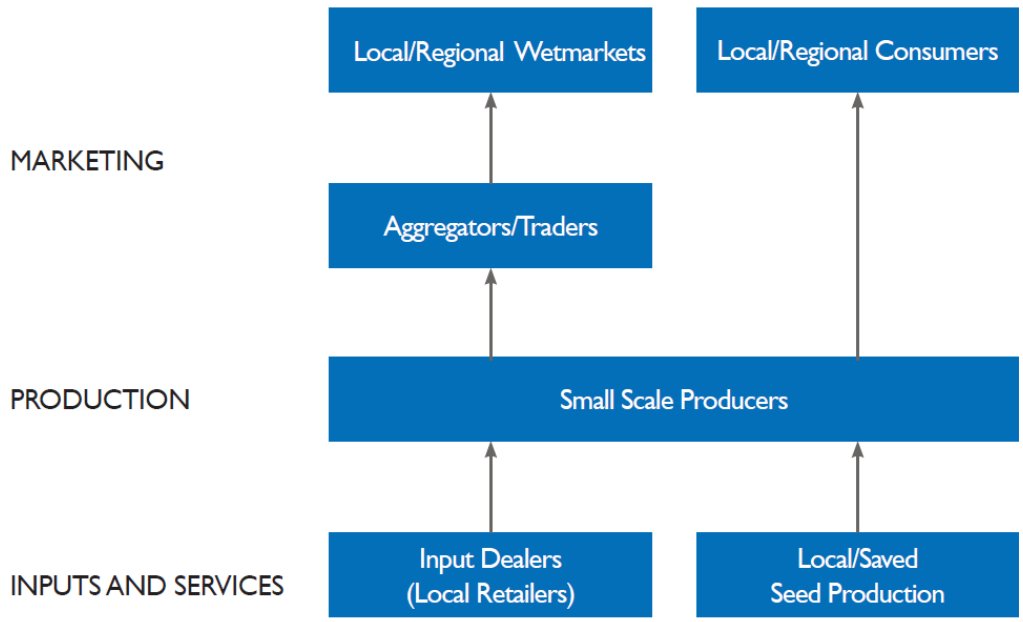
Most vegetables are produced alongside maize crops either as an intercrop, perimeter crop, or short season crop. The vast majority of producers cultivate .25 ha of vegetables and water it by hand or use manually-managed flood irrigation. Land is tilled manually with a hoe, leading to significant soil depletion and erosion. Most growers use limited or no organic or synthetic fertilizers or crop protection products, although commercially oriented producers, in contrast, sometimes apply excessive amounts of pesticides to the point of raising concerns about the environmental and human health impacts (Cairns 2012). Tete and Manica are among the most important vegetable-producing provinces in Mozambique, with 26 percent and 21 percent of land under vegetable production, respectively (ACDI/VOCA).

It is notable that vegetable-producing and -selling households tend to be more educated and have more land than households that do not produce vegetables. Heads of vegetable-producing and -selling households are better educated (3.4 years of education on average versus 2.9 years for nonproducers) and have larger land-holdings (2.4 ha versus 1.5 ha) (MASA 2008).

Domestic Traditional Vegetable Value Chain

Figure 12 depicts the domestic traditional vegetable value chain.

Figure 12: Local/Traditional Value Chain Map



The full value chain for this market segment tends to be very geographically constrained, with final retail transactions taking place no further than provincial primary urban areas. The quality of produce in these markets varies widely, but losses from the farm gate to the market average 20 percent (Chagomoka et al. 2014).

END MARKETS -TRADITIONAL VEGETABLES

Most retailers sell at informal spot market locations, ranging from small, roadside locations to medium-sized crossroad retail clusters to village-based informal markets. The retailers at smaller locations will often be farmers themselves or small-scale traders, while produce in village green markets will often change hands at least twice before arriving.

MARKETING AND VALUE ADDITION

Traditional vegetable farmers typically sell their vegetables directly to consumers at local markets or to local traders or semi-commercial farmers who aggregate produce for transport to urban markets. There is little processing or value addition to vegetables as they pass through the value chain.

Women are active along the trading chain, from farm-gate purchases to running larger wholesale operations in town centers. Local vegetables are core aspects of trader, wholesaler, and retailer businesses in target districts, comprising at least 50 percent of trader, wholesaler, and retailer revenues in wet markets (Chagomoka 2014). Prices in wholesale markets are extremely volatile with supply peaks and price lows in July/August, and

supply lows and price peaks in December (Chagomoka 2014). Intra-day price swings of 50 percent or more are common at these markets.

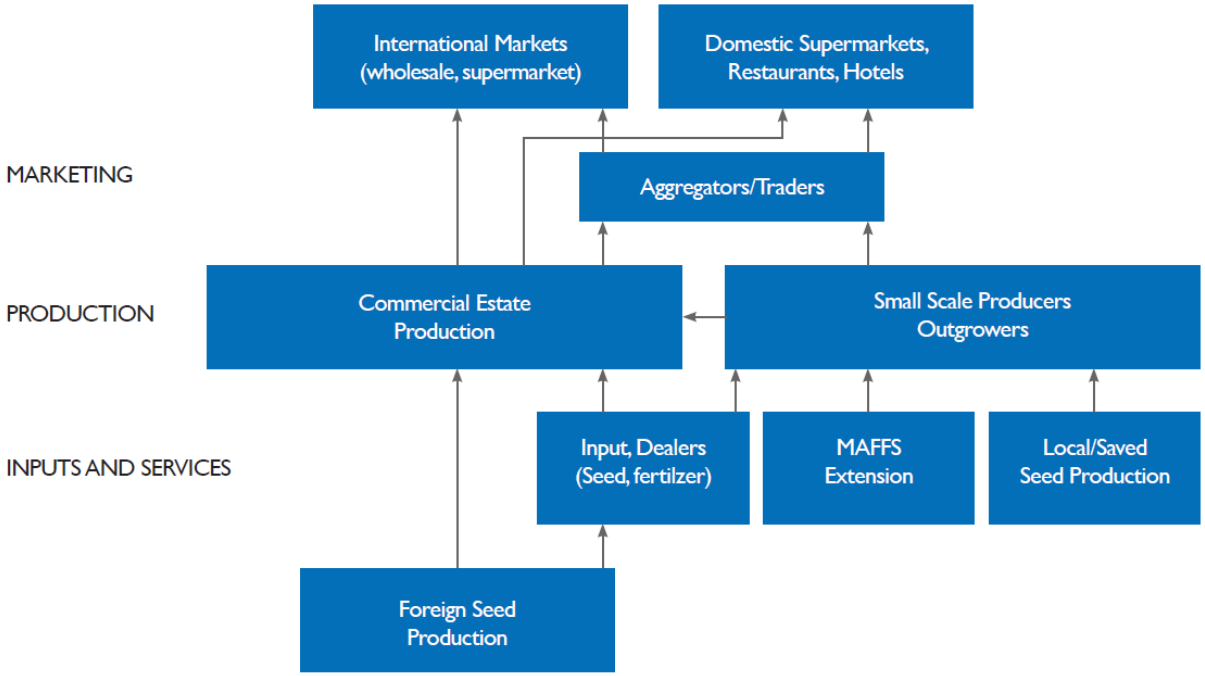
PRODUCTION

Farmers producing for the local market source seed primarily from their own stock or local seed savers. Other inputs, including pesticides and fertilizer, are not widely available, and less than 5 percent of farmers utilize these inputs. Examples of traditional vegetables that are locally produced and consumed include amaranth, cowpea leaves, kale, pumpkin, and cabbage.

DOMESTIC HIGH-VALUE VEGETABLE VALUE CHAIN

The domestic high-value vegetable value chain is depicted in Figure 13.

Figure 13: High-Value Vegetable Value Chain



END MARKETS - HIGH VALUE VEGETABLES

Mozambique's grocery retail industry is largely underdeveloped (Business Monitor International 2013), and it is estimated that 98 percent of food retail sales are accounted for by the informal sector, for example kiosks and open-air markets (AGRIX 2014). One major supermarket chain, South Africa-based Shoprite, has seven stores in Mozambique located in Maputo (3), Chimoio, Beira, Nampula, and Xai Xai, and is in the process of opening an eighth store in Tete. Pick N Pay, the second largest retailer in South Africa, closed its Maputo store in 2015.

There are also limited exports of high-value produce. The major company working in high-value vegetable exports is Companhia de Vanduzia, a subsidiary of MozFoods. Vanduzia is the largest exporter of fresh produce in the country and has British Retail Consortium and European Good Agricultural Practice (EuroGAP) certifications, which allow it to access demanding European markets to complement its sales to South Africa. Produce destined for the export market is negotiated on a contract basis before shipment, and logistics tend to be coordinated by the estate or outgrower producing company.

MARKETING AND VALUE ADDITION

High-value vegetable producers vary in size, but they tend to have access to irrigation systems that allow them to produce a more consistent-quality product and target higher-value seasonal price windows. The high-value vegetable chain tends to operate on formal contracts, with most production on estate commercial farms or through outgrower schemes of relatively high-capacity smallholders. This production is then sold onward through traders or directly by commercial estate growers to pre-identified buyers in high-end domestic or international markets. The high-value segment accounts for an extremely small percentage of the total horticulture production chain.

High-value vegetables consumed in Mozambique are primarily imported. In 2012, Mozambique imported $12.1 million of vegetables, including tomatoes, onions, cabbage, green beans, peppers, and potatoes, which satisfied 90 percent of domestic high-value demand. Table 6 shows the values of vegetable imports to Mozambique for 2014 and 2015 as well as average values for 2011–2015. It also shows the relative share of each vegetable out of the total value of vegetable imports. As shown, potatoes account for just over half of imports. With the exception of garlic, which is imported almost entirely from China, South Africa is a major source for vegetable imports to Mozambique.

Table 6: Vegetable Imports to Mozambique, 2011–2015 (USD, thousands)

	Average value 2011–2015	Average share of imports
Total	19,493	102.0%
Potatoes	9,942	51.0%
Onions and shallots	4,031	20.7%
Tomatoes	1,942	10.0%
Garlic	1,759	9.0%
Vegetables, fresh or chilled	1,153	5.9%
Carrotts, Turnips, & Salad beetroot	455	2.3%
Cabbages & Cauliflower	211	1.1%
Peppers and capsicum	130	0.7%
Leguminous Vegetables	121	0.6%
Lettuce	77	0.4%
Cucumbers & Gherkins	64	0.3%

Source: ITC Trade Map, 2016.

Production

High-value vegetable production often relies on commercial seed imported from countries such as South Africa, Zimbabwe, Brazil, China, and France. Commercial input suppliers are limited in reach, but some certified vegetable seed is available in local retail shops.

END MARKET PRIORITIES AND CONSTRAINTS

The most promising end-market opportunities involve producing high-value fresh vegetables to substitute for imports in domestic markets. Target markets include supermarkets, tourist establishments, and restaurants, as well as urban markets that are frequented by middle-class urban consumers.

Another promising market opportunity to pursue is that of traditional vegetables in mainstream urban markets. It is critical that these market opportunities are demand driven and that production increases tightly respond to demand; otherwise, increases in production that are not marketed may create local gluts that depress

prices and exacerbate price fluctuations. This production should be targeted to off-season windows (peak production and price troughs occur in July/August and December), which implies the need for irrigation among these producers as well.

There are a number of constraints that will influence the ability of producers to reach these target end markets:

Proximity to market – Given the highly perishable nature of fresh vegetables and Mozambique's weak transport infrastructure and limited cold chain, high-value vegetable production will need to be proximate to the markets where it will be sold and consumed. Analysis by Cairns demonstrated that the closer producers were to cities with populations of 10,000 or more, the more likely they were to produce vegetables for market.

Water access – Access to water, including irrigation, is critical to reducing production risks, ensuring a high quality product, and timing production to take advantage of off-season market windows. As opposed to shelf-stabilized crops, the water intensiveness and high perishability of vegetables make proximity to a water source and to a profitable end market the biggest limiting geographic factor for production. Irrigation infrastructure is also severely underdeveloped. Most irrigation is manual or manually managed flooding.

Capital and liquidity constraints – Commercial production of vegetables is a relatively capital-intensive endeavor. It requires that farmers have adequate liquidity to access inputs, as well as capital resources so that they can invest in critical equipment such as irrigation infrastructure. Given the substantial financial investments that are involved in vegetable production, producers also need to have the capacity to manage financial risks—a factor that can exclude poorer and more risk-averse producers.

Seed quality – High-quality commercial seed is of limited availability; landrace seed stocks for local vegetables are undifferentiated and range in quality, vigor, yield, and disease resistance. For potato, farmers are holding back the smallest potatoes as seed for the subsequent season, in effect selecting for inferior size characteristics. Imported seed is extremely expensive and hard to find.

Technical and management capacity – Vegetable production requires more skilled labor and management than other crops, like maize (Cairns 2012). In addition to affecting economic outcomes, a lack of technical knowledge is associated with problems such as excessive application of pesticides by commercial vegetable producers and the environmental and human health consequences associated with this (ACDI/VOCA 2014 and Cairns 2012). ACDI/VOCA reports that less sophisticated producers use twice the rate of active ingredients than more sophisticated producers.

Lack of post-harvest facilities – Post-harvest facilities for cooling, cleaning, sorting, and packing produce are limited, and there is no cold chain infrastructure for domestic markets (ACDI/VOCA).

Food safety – Lack of food safety knowledge leads to current harvest, post-harvest handling, and food preparation practices that make vegetables a vector for food-borne illness. Food safety is likely to become an increasingly important issue for urban consumers, and the ability to respond to these concerns may become an important factor affecting market access.

UPGRADING STRATEGIES

Target higher-value domestic vegetable markets for import substitution and off-season production of local/traditional vegetables.

Identify and coordinate with large-scale buyers of vegetables for the target markets. Local demand for specific vegetables should be analyzed to address varieties, volumes, price movements, and product attributes; this analysis should be used in the development of a strategy to serve specific vegetable markets. Coordinate supply for these market opportunities by working with farmers through producer associations to facilitate delivery of training and technical assistance, and enable greater coordination of supply to avoid losses associated with excessive production for local markets.

Investments in developing the high-value and off-season traditional vegetable value chain should be directed to higher-capacity farmers who are located in proximity to their target markets and access to water; these farmers should have the capacity to bear significant financial risk and meet the investment requirements entailed in producing for these markets.

CITATIONS

Abt Associates. "USAID AgriFUTURO Project End of Project Report: 1 May 2009 – 28 February 2015." Contract/Program NO.: EDH-1-00-05-00005-00 Task Order No.: 10. 2015.

AGRIX. "Investment Opportunities for Dutch Agrifood Companies in Mozambique: A Challenge for Patient Money." The Netherlands: Deventer, 2014.

Cachomba, I. and C. Donovan. "Value Chain Analysis of Common Beans In Mozambique." Mozambique: Agricultural Research Institute of Mozambique.

Cairns, J.E. "Does Selling Fruits or Vegetables Provide a Strategic Advantage to Selling Maize for Small-Holders in Mozambique? A Double-Hurdle Correlated Random Effects Approach to Evaluating Farmer Market Decisions." Mozambique: Agricultural Research Institute of Mozambique, 2012.

Chagomoka, T. "Value Chain Analysis of Traditional Vegetables from Malawi and Mozambique." *International Food and Agribusiness Management Review* (IFAMA)17, 4 (2014): 59-85.

Dalberg. "Ghana, Burkina Faso, Tanzania and Mozambique Value Chain Assessments: Banana and Cashew." Washington, D.C.: International Finance Corporation, 2013.

Easterling, T., T. Mata, T. Camba, C. Creva, and J. Tinga. "Performance Evaluation of the USAID/Mozambique Agriculture Portfolio." Bethesda, MD: Mendez England & Associates, 2013. Prepared under Task Order No: AID-656-TO-12-00003.

FEWS NET. *Southern Africa Informal Cross-Border Food Trade Bulletin* 78 (2012).

Folmer, E.C.R., P.M.H. Guerts, and J.R. Francisco. "Assessment of soil fertility depletion in Mozambique." *Agriculture, Ecosystems and Environment* 71 (1998): 159–167.

Food and Agriculture Organization of the United Nations (FAO). "Nutrition Country Profile: Republic of Mozambique." Rome, Italy: FAO, 2011.

Große-Rüschkamp, A. and K. Seelige. *Analysis of the Cashew Value Chain in Mozambique. African Cashew Initiative (ACI).* Mozambique: GTZ, 2010.

Gungulo, A.L. "Expanding Pulse Production in Mozambique: Identifying Constraints and New Strategies." Unpublished master's dissertation. South Africa: University of Pretoria, 2013.

Hackenberg, I., R. Majumdar, and H. Zefanias. "AgriFUTURO Gender Assessment." Mozambique: USAID, 2013.

Hanlon, J. and T. Smart. "Small Farmers or Big Investors? The Choice for Mozambique." Research report, updated in 2013.

Harris, S. "Revisiting the Fruit Industry Development Strategy for Mozambique." Washington, D.C.: USAID, 2010.

USAID AIMS III Project. "Impact Assessment of the Effectiveness of Agro-Dealer Development Activities." Mozambique: USAID, 2015.

International Food Policy Research Institute (IFPRI). *Southern Africa and Climate Change: A Comprehensive Analysis: Mozambique*. Washington, D.C.: IFPRI, 2012.

Jasse, A. "Cadeias de Valor de Cerais e Oleaginosas." *Promoção do Desenvolvimento das Fieiras de Cereais e Oleaginosas Distrito de Nhamatanda.* Mozambique: 2013.

Kleijn, W., W. Heemskerk, and M. Wongtschowski. "Pluralistic service systems: Sesame in Nampula, Mozambique." KIT Case Study. The Netherlands: Royal Tropical Institute.

Mennonite Economic Development Associates (MEDA). "Value Chain Finance Assessment of the Cashew Nuts Sector in the Province of Nampula, Mozambique." Canada: GIZ and African Cashew initiative, 2011.

Ministério da Agricultura e Segurança Alimentar (MASA). *Anuário de Estatísticas Agrárias 2002–2011*. Mozambique: MASA, 2012.

Payongayong, E. "Report on the Implementation of the Gross Margins Survey of 2012." Mozambique: Michigan State University, 2012.

Perreira, L. "Field Situation for Soy in Mozambique." Washington, D.C.: TechnoServe, 2015.

TechnoServe ISP. "Soybeans in Mozambique." Mozambique: TechnoServe, 2009.

Tropical Legumes II. *Bulletin of Tropical Legumes* 18 (2013).

Tvetden, I. "Mozambique Case Study: Gender Equality and Development." Washington, D.C.: World Bank, 2011.

USAID AIMS III Project. "Impact Assessment of the Effectiveness of Agro-Dealer Development Activities." Mozambique: USAID, 2015.

Walker, T. and B. Cunguara. "Taking Stock of Soybean R&D and USAID's Feed the Future Program in Mozambique." Washington, D.C.: MEAS and USAID, 2016b.

Walker, T., S. Silim, B. Cunguara, C. Donovan, P. P. Rao, and M. Amane. "Pigeon pea in Mozambique: An Emerging Success Story of Crop Expansion in Smallholder Agriculture." Washington, D.C.: USAID, 2015.

Walker, T., B. Cunguara, and C. Donovan. "Assessing Directions for Cowpea R&D in USAID's Feed the Future Program in Mozambique." Washington, D.C.: MEAS and USAID, 2016a.

World Bank. *Climate Change Portal.* Accessed at sdwebx.worldbank.org/climateportal.

APPENDIX 1: VALUE CHAIN COMMODITY PRODUCTION STATISTICS

TABLE 1: COMMON BEAN PRODUCTION IN MOZAMBIQUE

	Area (ha, thousands)	Area (%)	% producers	# holdings (thousands)	Holdings (%)	Production (MT)	Production (%)	Avg Ha	Avg Production (kg)	Avg Yield (kg)	Received improved seed
Data year	2014		2014	(2008*2014)		2014					2012
Niassa	30.4	32%	35.6	83	25%	22,028	43%	0.37	267	725	3.7
Cabo Delgado	0.1	0%	0.1	0	0%	70	0%	0.28	193	700	2
Nampula	**1.2**	1%	**0.8**	**6**	2%	**467**	1%	**0.20**	**77**	**389**	**7**
Zambezia	**13.6**	14%	**6.6**	**54**	17%	**7,065**	14%	**0.25**	**130**	**519**	**-**
Tete	**34.9**	36%	**31.1**	**115**	35%	**15,179**	29%	**0.30**	**132**	**435**	**26.6**
Manica	**8.6**	9%	**13.8**	**38**	12%	**4,712**	9%	**0.23**	**125**	**548**	**13.3**
Sofala	2.1	2%	6.4	17	5%	1,083	2%	0.13	65	516	5.3
Inhambane	.		.	.		.		.	.	.	-
Gaza	3.3	3%	13.9	35	11%	599	1%	0.10	17	182	11.8
Maputo	2.3	2%	3.3	4	1%	381	1%	0.61	101	166	9.8
NATIONAL	96.5	100%	9	326	100%	51,583	100%	0.30	158	535	12.5
Sum FTF ZOI provinces	58	0.60		213	0.65	27,423	0.53				
Avg FTF ZOI provinces	15	0.15	13	53	0.16	6,856	0.13	0.24	116	473	16
% FTF ZOI provinces	60%	60%	145%	65%	65%	53%	53%	83%	73%	88%	125%

Sources: MASA 2012, MASA 2014.

TABLE 2: PIGEON PEA PRODUCTION IN MOZAMBIQUE

	Area (ha, thou-sands)	Area (%)	% produc-ers	# holdings (thou-sands)	Holdings (%)	Production (MT)	Production (%)	Avg Ha	Avg Pro-duction (kg)	Avg Yield (kg)
Data year	2014		2014	(2008*2014)		2014				
Niassa	10.3	4%	29.5	68	6%	4,800	4%	0.15	70	466
Cabo Delgado	22.8	8%	32.1	116	11%	5,992	5%	0.20	52	263
Nampula	**42.4**	15%	**38.6**	**293**	27%	**16,774**	15%	**0.14**	**57**	**396**
Zambezia	**191**	67%	**59.3**	**489**	45%	**77,657**	70%	**0.39**	**159**	**407**
Tete	**5.3**	2%	**8**	**30**	3%	**1,615**	1%	**0.18**	**55**	**305**
Manica	**5.6**	2%	**15.1**	**41**	4%	**1,636**	1%	**0.14**	**40**	**292**
Sofala	8.1	3%	17.7	46	4%	1,874	2%	0.18	41	231
Inhambane	0.3	0%	1.1	.		15	0%	.	.	.
Gaza	1.2	0%	5.3	13	1%	196	0%	0.09	15	163
Maputo	0	0%	0.8	1	0%	20	0%	-	22	
NATIONAL	287.1	100%	30.3	1,097	100%	110,580	100%	0.26	101	385
Sum FTF ZOI provinces	244	0.85		853	0.78	97,682	0.88			
Avg FTF ZOI provinces	61	0.21	30	213	0.19	24,421	0.22	0.21	78	350
% FTF ZOI provinces	85%	85%	100%	78%	78%	88%	88%	81%	77%	91%

Sources: MASA 2012, MASA 2014.

TABLE 3: COWPEA PRODUCTION IN MOZAMBIQUE

	Area (ha, thousands)	Area (%)	% producers	# holdings (thousands)	Holdings (%)	Production (MT)	Production (%)	Avg Ha	Avg Production (kg)	Avg Yield (kg)	Received improved seed
Data year	2014		2014	(2008*2014)		2014					2012
Niassa	9.5	3%	27.5	64	4%	4,463	4%	0.15	70	470	0
Cabo Delgado	36.5	10%	53.3	193	11%	12,913	12%	0.19	67	354	4.8
Nampula	**89.1**	24%	**62.8**	**477**	28%	**34,964**	34%	**0.19**	**73**	**392**	**1.3**
Zambezia	**44.1**	12%	**30**	**248**	14%	**13,461**	13%	**0.18**	**54**	**305**	**0.8**
Tete	**38.6**	10%	**51.2**	**189**	11%	**9,638**	9%	**0.20**	**51**	**250**	**9.1**
Manica	**29.2**	8%	**47**	**128**	7%	**5,947**	6%	**0.23**	**46**	**204**	**5.4**
Sofala	17.4	5%	40.5	105	6%	3,480	3%	0.17	33	200	3
Inhambane	36.7	10%	73.8	.		9,406	9%	.	.	.	1.4
Gaza	35.9	9%	66.4	165	10%	4,955	5%	0.22	30	138	1.8
Maputo	41	11%	47.1	54	3%	4,609	4%	0.76	86	112	4.9
NATIONAL	377.9	100%	47.3	1,712	100%	103,837	100%	0.22	61	275	2.9
Sum FTF ZOI provinces	201	0.53		1,042	0.61	64,010	0.62				
Avg FTF ZOI provinces	50	0.13	48	260	0.15	16,003	0.15	0.20	56	288	4
% FTF ZOI provinces	53%	53%	101%	61%	61%	62%	62%	90%	93%	105%	143%

Sources: MASA 2012, MASA 2014.

TABLE 4: SOY PRODUCTION IN MOZAMBIQUE (2014/15)

	No. of farmers	Area (ha)	Production (MT)	% area	Ha/farmer	Yield (MT/ha)
By farm type						
Commercial (own farming)	6	4,262	7,700	16%	710.3	1.81
Small Commercial Farmers ("farmer-dealers")	177	1,282	1,822	5%	7.2	1.42
Small farmers	18,242	20,610	23,264	79%	1.1	1.13
By province	No. of farmers	Area (ha)	Production (MT)	% area	Ha/farmer	Yield (MT/ha)
Niassa	228	1,212	1,995	5%	5.3	1.65
Nampula	410	668	1,010	3%	1.6	1.51
Zambézia	9,861	16,013	20,520	61%	1.6	1.28
Manica	2,421	1,900	2,000	7%	0.8	1.05
Tete	5,506	6,361	7,261	24%	1.2	1.14

Sources: Perreira 2016.

TABLE 5: SESAME PRODUCTION IN MOZAMBIQUE

	Area (ha, thousands)	Area (%)	% producers	# holdings (thou-sands)	Avg Ha
Data year	2014		2014	(2008*2014)	
Niassa	1	1%	4.5	10	0.10
Cabo Delgado	23.9	17%	22.3	81	0.30
Nampula	**32.2**	23%	**11.8**	**90**	**0.36**
Zambezia	**20.7**	15%	**7.9**	**65**	**0.32**
Tete	**7.2**	5%	**5.5**	**20**	**0.35**
Manica	**14.7**	11%	**10.2**	**28**	**0.53**
Sofala	39.5	28%	30	78	0.51
Inhambane	.		.	.	.
Gaza	.		0	-	
Maputo	0.5	0%	1.2	1	0.37
NATIONAL	140	100%	10.38	373	0.35
Sum FTF ZOI provinces	75	0.54		203	
Avg FTF ZOI provinces	19	0.13	9	51	0.39
% FTF ZOI provinces	54%	54%	85%	54%	110%

Sources: MASA 2012, MASA 2014.

TABLE 6: GROUNDNUT PRODUCTION IN MOZAMBIQUE

	Large groundnuts									
	Area (ha, thousands)	**Area (%)**	**% produc-ers**	**# holdings (thousands)**	**Holdings (%)**	**Production (MT)**	**Production (%)**	**Avg Ha**	**Avg Production (kg)**	**Avg Yield (kg)**
	2014		2014	(2008*2014)		2014				
Niassa	6.5	6%	18	42	10%	1,815	5%	0.16	43	279
Cabo Delgado	39.5	37%	39.3	142	35%	20,215	53%	0.28	142	512
Nampula	**25.4**	**24%**	**16.3**	**124**	**30%**	**9,317**	**25%**	**0.21**	**75**	**367**
Zambezia	**9.6**	**9%**	**4.6**	**38**	**9%**	**1,863**	**5%**	**0.25**	**49**	**194**
Tete	**16.5**	**15%**	**14.8**	**55**	**13%**	**3,447**	**9%**	**0.30**	**63**	**209**
Manica	**1.8**	**2%**	**4.6**	**13**	**3%**	**294**	**1%**	**0.14**	**23**	**163**
Sofala	3.1	3%	4.6	12	3%	343	1%	0.26	29	111
Inhambane	2.5	2%	3.3	.		178	0%	.	.	.
Gaza	1.8	2%	3.3	8	2%	218	1%	0.22	27	121
Maputo	1.2	1%	2.6	3	1%	302	1%	0.40	102	
NATIONAL	107.9	100%	11.3	409	100%	37,991	100%	0.26	93	352
Sum FTF ZOI provinces	53	0.49		229	0.56	14,921	0.39			
Avg FTF ZOI provinces	13	0.12	10	57	0.14	3,730	0.10	0.23	53	233
% FTF ZOI provinces	49%	49%	89%	56%	56%	39%	39%	86%	57%	66%

Sources: MASA 2012, MASA 2014.

	Small groundnuts									
	Area (ha, thousands)	**Area (%)**	**% producers**	**# holdings (thousands)**	**Holdings (%)**	**Production (MT)**	**Production (%)**	**Avg Ha**	**Avg Production (kg)**	**Avg Yield (kg)**
	2014		2014	(2008*2014)		2014				
Niassa	2.3	1%	6.1	14	1%	558	1%	0.16	39	243
Cabo Delgado	10.5	3%	10.5	38	4%	6,212	6%	0.28	163	592
Nampula	**107.2**	**35%**	**56.4**	**428**	**41%**	**50,448**	**49%**	**0.25**	**118**	**471**
Zambezia	**50.6**	**16%**	**17.2**	**142**	**14%**	**13,046**	**13%**	**0.36**	**92**	**258**
Tete	**18**	**6%**	**24**	**89**	**9%**	**4,927**	**5%**	**0.20**	**55**	**274**
Manica	**13.5**	**4%**	**18.4**	**50**	**5%**	**2,839**	**3%**	**0.27**	**57**	**210**
Sofala	7.4	2%	10.6	28	3%	1,981	2%	0.27	72	268
Inhambane	34.3	11%	57.4	.		6,689	7%	.	.	.
Gaza	28.9	9%	55.4	138	13%	6,945	7%	0.21	50	240
Maputo	35.8	12%	37.2	42	4%	8,488	8%	0.84	200	
NATIONAL	308.6	100%	28.7	1,039	100%	102,133	100%	0.30	98	331

Sum FTF ZOI provinces	189	0.61		709	0.68	71,260	0.70			
Avg FTF ZOI provinces	47	0.15	29	177	0.17	17,815	0.17	0.27	80	303
% FTF ZOI provinces	61%	61%	101%	68%	68%	70%	70%	91%	82%	92%

Sources: MASA 2012, MASA 2014.

TABLE 7: CASHEW PRODUCTION IN MOZAMBIQUE

	% farmers with trees	# plantations (thousands)	% national plantations	# trees (thousands)	# trees in production (thousands)	Avg # trees in production	% trees in production	# trees planted in past 12 months	% renewed trees	% disease-affected holdings	% of holdings that spray against oidium
	2014	2008*2014	2008*2014	2014	2014		2014	2014	2014	2014	2014
Niassa	3.3	8	1%	22	6	0.78	27%	7	32%	34.1	0
Cabo Delgado	40	145	11%	7,655	6,297	43.49	82%	161	2%	32.8	9.9
Nampula	**59.5**	**452**	33%	**13,096**	**8,062**	17.85	**62%**	**450**	**3%**	**32.9**	**8.7**
Zambezia	**34.6**	**285**	21%	**4,115**	**2,210**	7.74	**54%**	**769**	**19%**	**23.3**	**1.8**
Tete	**0.4**	**1**	0%	**3**	**3**	2.03	**100%**	**0**	**0%**	**100**	**3.7**
Manica	**9.9**	**27**	2%	**1,546**	**961**	35.56	**62%**	**59**	**4%**	**32**	**0.1**
Sofala	23.5	61	4%	1,254	727	11.90	58%	75	6%	23.4	2.3
Inhambane	82.4	232	17%	4,419	1,862	8.04	42%	107	2%	55.5	4.6
Gaza	55.5	138	10%	2,369	1,306	9.45	55%	36	2%	48	0.6
Maputo	18.4	21	2%	392	185	8.82	47%	12	3%	33.3	7.9
NATIONAL		1,370	100%	34,853	21,600	15.77	62%	1,676	5%	33.8	5.3

Source: MASA/DPCI. Inquérito Agrário Integrado, 2012-2014.

Table 8: Vegetable production in Mozambique

	Potato			Squash			Onion			Kale		
	% farmers producing	% farmers selling	% farmers producing	% farmers producing	% farmers selling	% farmers producing	% farmers producing	% farmers selling	% farmers producing	% farmers producing	% farmers selling	% farmers producing
Year	2008	2008	2014	2008	2008	2014	2008	2008	2014	2008	2008	2014
Niassa	7	36.9	7.2	27.6	3	17.2	2.1	25.4	3	2.5	54.2	4.4
Cabo Delgado	0	.	0	23.2	8.9	21.8	1.1	66.6	1.2	1.3	64.3	0.4
Nampula	0	.	0.1	5.4	10.2	14.8	3.1	45.6	2.2	1.3	39.4	0.6
Zambezia	0.8	10.3	0.9	13.8	10.4	12.2	2.7	46	0.9	2.5	44.4	3
Tete	13.1	63.5	10.4	66.1	.	40.3	5.9	32.6	5	10.3	45.1	6.4
Manica	1.5	5.9	0.5	46.1	4	55.9	5.5	41.9	3.2	9.5	56.5	9.8
Sofala	0.5	26	0.4	29.6	2.8	25.7	8.9	27.8	3.5	9.4	30.3	5.5
Inhambane	0.7	13.7	0.1	24.8	1.6	14.6	15.5	21.8	7.3	21.7	22.1	10
Gaza	0	0	0.9	51.2	4.8	57.9	11.3	18.8	10.4	12.2	27.2	14.4
Maputo	0.7	46.6	1.3	39.1	4.1	36.8	13	29.5	14.5	12.8	30.4	20.6
NATIONAL	2.1	48.7	1.8	26.6	4.4	25	5.4	31.7	3.9	6.3	36	5.7

Sources: Trabalho de Inquérito Agrícola, 2002-2008; Trabalho de Inquérito Agrícola, 2014.

	Cucumber			Okra			Tomato			Green bean	Lettuce
	% farmers producing	% farmers selling	% farmers producing	% farmers producing	% farmers selling	% farmers producing	% farmers producing	% farmers selling	% farmers producing	% farmers producing	% farmers producing
Year	2008	2008	2014	2008	2008	2014	2008	2008	2014	2014	2014
Niassa	2.2	17.8	1	5.3	10.4	4.1	6.1	42.7	8.9	0.2	2.7

	Cucumber			Okra			Tomato			Green bean	Lettuce
	% farmers producing	% farmers selling	% farmers producing	% farmers producing	% farmers selling	% farmers producing	% farmers producing	% farmers selling	% farmers producing	% farmers producing	% farmers producing
Cabo Delgado	13.3	9	6.2	3.7	9.6	4	5.6	52.5	9.7	0.3	0.7
Nampula	4.6	6.4	9.7	0.4	0	4.3	3.7	60.1	7.4	0.1	0.4
Zambezia	4.7	8.4	5.6	7.4	11.2	7.2	11.2	31	9.7	0.3	1.1
Tete	44	2.4	29.7	40.4	2.8	19.4	16.1	39.6	12.1	0.2	2
Manica	12.5	4.4	23.9	11.9	11.3	17.5	12.5	45.4	8.6	0.8	1.5
Sofala	19.2	3.5	16.9	14.4	4.2	7.7	18.2	41.3	9.4	0.6	2
Inhambane	0.1	0	0.2	0.3	0	0.3	15.4	20.4	7.2	0.2	10.2
Gaza	0.9	27.6	0.9	1.8	0.7	4.9	10.4	27.1	11.5	0.8	12.3
Maputo	1.9	33.8	2.1	1.6	54.2	5.3	9.7	35.2	7.8	3.5	18.8
NATIONAL	10.2	5.1	9.8	8.5	6.3	7.5	10.1	37.3	9.2	0.6	3.6

Source: Trabalho de Inquérito Agrícola, 2002-2008; Trabalho de Inquérito Agrícola, 2014.

APPENDIX II MEETING LIST

Organization	Entity Type	Place	Contact
Aga Khan Foundation	NGO	Maputo	Alfredo Aldino Chamusso
ACDI/VOCA	NGO	Maputo	Cristobal Aguilar
AC-Lioma	Private Company	Lioma	Sergio Gouveia
AgDevCo	Private Company	Beira	Rui Afonso
Agri-Focus	Private Company	Maputo	Fernando Ricardo Sequeira
Agri-Focus	Private Company	Maputo	Antonio Pignatolli Vasconceles
AgriFUTURO	Project	Remote	Randy Fleming
AgriFUTURO	Project	Remote	Alex Rivera
Agrimerc - ODS	Private Company	Chimoio	Gil Mucave
Agromoz	Private Company	Lioma	Justiniano Gomes
AgroNegocio para o Desenvolvimento de Mocambique, Lda	Private Company		Misaki Seki
AICAJU	Private Company	Nampula	Gani
Alif Quimica	Private Company	Quelimane	Mahomed Faruk
Associacao Samora Machel	Association	Barue	Simiao
Cargill	Private Company	Beira	Pieter
CB Fresh Farm	Private Company	Tete	Martinus
Centro de Promoção da Agricultura (CEPAGRI)	Government Agribusiness Center	Chimoio	Luis Tome
CEPAGRI	Government Agribusiness Center		CEPAGRI
Namialo Fruit Training Centre (CFF)		Namialo	Hussene M Bay
CFF			Virgilio Villancio, Team Leader
Chief of Provincial Agricultural Services	Government		Joaquim Tomas
Chiguirizano		Domue	
Companhia do Zembe	Private Company	Chimoio	Manjate
CONDOR	Private Company	Nametil	Anibal Muquera, Production Manager
CONDOR Factory	Private Company	Nametil	Manager
Culima Cuacanaca		Barue	

Organization	Entity Type	Place	Contact
Dengo Commercial	Private Company	Chimoio	Mauricio Dengo
Empresa de Comercializacao de Agricola		Catandica	Grant Taylor
Emerging Farmer	Farmer	Domue	Abdul
Emerging Farmer	Farmer	Lioma	Caxtava
Emerging Farmer	Farmer	Magige	Muchenguete
ETG	Private Company	Nampula	Shrikantha Nalik, Country Head
ETG	Private Company	Maputo	Guilhermo Machado
European Union	Intergovernmental Organization	Maputo	Illona Gruenewald
FA Gurue		Magige	
FINAGRO	Private Company	Chimoio	Lorena
FONPA			
Fonte Boa Mission		Tsangano	Padres
Gasparre Trader	Trader	Angonia	Gasparre
Gerente da African Century em Lioma	Private Company		Estevao Chico
Government of Nampula Province – Provincial Direction of Agriculture	Government Agriculture Department	Nampula	Pedro Dzucule
Green Belt	Private Company	Beira	Porky Smith
Groundnuts	Farmer	Nametil	Producer
Grupo Madal	Private Company	Quelimane	Manuel Barbosa, Managing Director
Higest	Private Company	Maputo	Américo Marques
Hoyo	Private Company		Rito Muaquiua, Production Manager
Hoyo-Hoyo	Private Company	Ruace	Rito Muaquiua
IITA	Research Institute		Steve K Boahen
Ikuru	Private Company	Nampula	Dinesh Singh
IKURU	Private Company		Mario Santos, Inputs Manager
IKURU SARL	Private Company		Dinesh Singh, Executive Director
INOVAGRO	NGO	Nampula	Celso Ruface
INOVAGRO	NGO	Zambezia	Carlos Malita
INOVAGRO	NGO		Nephas Munyeche, Project Manager
Intertek	Private Company	Beira	Danie de Plessis

Organization	Entity Type	Place	Contact
Intertek Lab	Private Company	Beira	David Du Plessis
iTC		Chimoio	Joaquim Langa
Legume Innovation Lab	Research Organization	Washington, D.C.	Cynthia Donovan
Lozane	Private Company	Molocue	Bakir Lozane
Michigan State University	University	Maputo	Rafael Uaiene
Michigan State University	University	Maputo	Benedito Cunguara
MBFI	Private Company	Mocuba	Altie Steenkamp
MIRUKU	Consulting Firm		Chissungue Haje António
MIRUKU	Cooperative		Atumane Muquissirima, Cooperative Member
MIRUKU	Cooperative		Joao Soares Guedes, Agribusiness Officer
MLT	Private Company	Angonia	Kanhandula
Mozfert	Private Company	Beira	Joao Pereira
Murrimo Estate	Estate		Tjaart van Nieuwenhuizen, Estate Manager
Murrino Macadamia	Private Company	Gurue	Tjaart Van Nieuwenhuizen
Murrupula District Farmers Forum	Association	Murrupula	
Murrupula District Farmers Forum	Association	Murrupula	Horticulture Plot Worker
NCBA CLUSA	NGO	Nampula	Carolina Reynosa
NCBA CLUSA	NGO	Nampula	Pippy Gardner
NCBA CLUSA: PROMAC	NGO	Chimoio	Sergio Ye
Nsuzumire - Emerging Farmer	Farmer	Mulanguene	Palusso
Nzara Ya Pera		Barue	Peter Wasuwei
OPTIMA Industrial	Private Company	Chimoio	Pine Pienaar
Philippines Counterpart at Namialo Fruit Center	Government partnership	Namialo	Virgilio
Phoenix Seeds	Private Company	Vanduzi	Kevin Gifford
Pineapple Association	Association	Nicoadala	
Portucel (IFC)	Private Company	Gurue	Jonnhy Colon
PROMER	NGO	Molocue	Edson Natha
Rei do Agro	Private Company	Ruace	Edward Muswerakuenda

Organization	Entity Type	Place	Contact
District Services for Economic Activities (SDAE)	Agricultural District Representative	Meconta	Gastao
SDAE	Agriculture District Representative	Meconta	Chefe de Rede de Extensao
SDAE	Agriculture District Representative	Murrupula	Manuel Horta, Director
SDAE	Agriculture District Representative	Monapo	Mariamo Jamal, Chief of Planning
SDAE	Agriculture District Representative	Monapo	Adelino Manuel, Director
SNV	NGO		Moises Raposo
SOSoja	Private Company	Chimoio	Lucas
Support Program for Economic and Enterprise Development (SPEED)	NGO		Carrie Davis
SPEED	NGO		Horonata Chipepo, Project Manager
TechnoServe	NGO	Quelimane	Luis Perreira
Track Auto (John Deere)	Private Company	Beira, Maputo	Brent Quincey
Unidade de Coordenação do Desenvolvimento Integrado de Nampula (UCODIN)	Government	Nampula	Felicidade Muixora
USAID	Donor	Maputo	Maria Cox
Westfalia Fruit Mozambique	Private Company	Chimoio	Michael Jahme