FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

Feed the Future Mozambique Promoting Innovative and Resilient Agriculture Market Systems Activity (FTF Premier)

Cooperative Agreement No. 72065622CA00006

Food Processing Mapping

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TechnoServe
Business Solutions to Poverty

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List of Acronyms

AICAJU	Association of Cashew Industries
APIEX	Agência Para a Promoção de Investimento e Exportações (Export and Investment Promotion Agency)
CNSL	Cashew nut shell liquid
CPG	Consumer Packaged Goods
CSB	Corn soy blend
DOC	Day old chick
ETG	Export Trading Group
FMCG	Fast-moving consumer goods
GHP	Good Hygiene Practice
GMP	Good Manufacturing Practice
HACCP	Hazard Analysis Critical Control Point (certification)
HH	Household
HQCF	High quality cassava flour
INAE	National Inspectorate of Economic Activities
INE	Instituto Nacional de Estatística (National Institute of Statistics)
INNOQ	Instituto Nacional de Normalização e Qualidade" (National Institute of Standardization and Quality)
IPEME	Instituto para a Promoção das Pequenas e Médias Empresas (Institute for the promotion of SMEs)
MEF	Ministry of Economy and Finance
MIC	Ministry of Industry and Commerce
MNC	Multi-national company
PREMIER	Promoting Innovative and Resilient Agriculture Market Systems Activity
PRONAI	Programa Nacional Industrializar Moçambique (Government Industrial Strategy)
QMS	Quality Management System
RCN	Raw cashew nut
RSA	Republic of South Africa
SADC	Southern Africa Development Community
SEZ	Special Economic Zone
SHF	Smallholder Farmer
SME	Small and Medium Enterprises
SOPs	Standard Operating Procedures
TA	Technical Assistance
USAID	United States Agency for International Development
VAT	Value Added Tax
VC	Value chain

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1. Introduction and Executive Summary

Introduction

This Food Processing Mapping was carried out between October 2022 – January 2023 as part of a series of studies designed to provide background context and strategic recommendations to inform FTF Premier's strategy and workplan development. FTF Premier is a 5-year, USAID-supported agricultural markets program with a goal of supporting 90,000 SHFs in Mozambique's Nacala corridor. Focus districts for the program are Nacala, Nampula, Meconta, Malema, Gurue, Cuamba and Balama[1]. Focus value chains of this study were: cashew; maize; soybean; groundnut; sesame; beans; pigeon peas; cassava.

While all data presented in this report has been evaluated and triangulated by the team as far as possible, as this was a mapping excercise, there are necessarily data gaps and potential inaccuracies. As such, this mapping report should be seen as a guiding document for the FTF Premier team. FTF Premier can decide to continue to refine the analysis and recommendations when needed.

Overview of processing in key value chains

An assessment of 8 key value chains (cashew; maize; soybean; groundnut; sesame; beans; pigeon peas; cassava) in the Nacala corridor revealed that:

- Overall from the agricultural production in the Nacala corridor, a small percentage is actually locally processed. For only 2 of the 8 commodities – cashew and maize – more more than 5% of the total production is processed, approximately 45% and 40% respectively
- Over 70% of processing is at the primary processing level, with 30% or less at secondary processing level. Consumer Packaged Goods (CPG - branded, high quality, differentiated packaged goods[2]) is very small on average at <1%
- The number and size of processors differs by value chain. Maize accounts for the highest number of processors, especially small and medium-sized processors. The concentration of processing in the Nacala corridor vs. other regions of Mozambique differs across VCs: whereas the province of Nampula is the main processing hub for the country's cashew industry, maize and soy processing is concentrated in the south of the country
- Capacity utilization is currently around 60-70% in maize medium and small processors, and 50-70% in cashew due to a range of challenges including lack of available and affordable working capital to purchase raw material. In contrast, most large maize and soy processors are operating at high capacity utilization (at or close to 100%)

[1] Due to the security situation in Cabo Delgado, FTF Premier will replace Balama with Alto Molocue district in Zambezia province for the moment.
[2] See definition on p. 12

There is a range of opportunities to support expansion of processing in each value chain, both **expanding** existing levels of value-addition, and **upgrading** value chains to add more value to the crop through improving quality standards (at primary, secondary or CPG level) and/or adding additional levels of processing (i.e., either secondary or CPG). Expanding existing levels of value-addition can create new jobs and expand and stabilize markets for SHFs. Upgrading processing opens up opportunities to engage SHFs in inclusive business models (win-win structures adding value to both processor and SHFs through structured buying arrangements, premium pricing and/or agronomy support and input provision) which increase SHF incomes.

The Nacala corridor's processing capacity is highest in cashew, maize and soy, compared to the other value chains explored; as such, these three sectors offer the strongest potential to further develop agro-processing in the corridor given the range of existing players and the variety of products currently being produced for both human consumption and animal feed. Maize and soy are very complementary, as they are often both used in key products including poultry feed and corn-soy blend (CSB). Maize processing is growing fast, and – despite the general shift towards exporting soybeans and processing imported soycake for poultry feed – there has also been growth in installed capacity for soy processing with the addition of 2 new soy oil factories in Cuamba. Maize and soy processing has the potential to be competitive in the Nacala corridor market and can compete with "imports" from elsewhere in Mozambique. The corridor's maize and soy processing industries are currently not able to compete in the central/southern Mozambique markets or export markets.

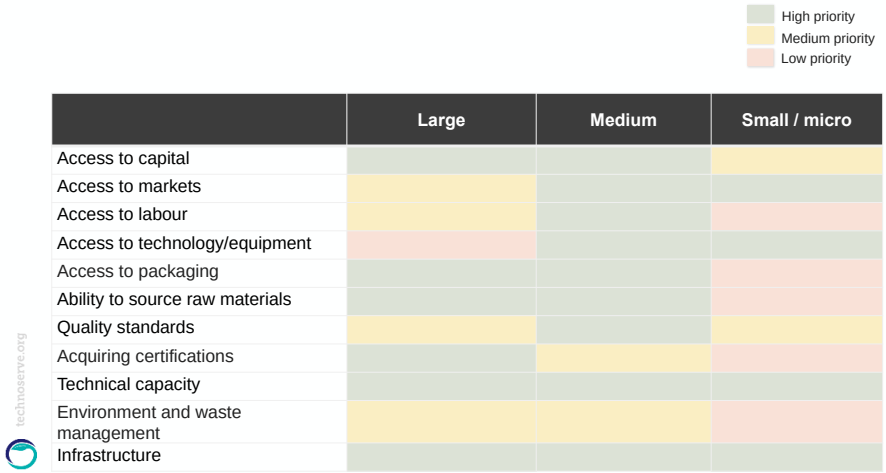
In contrast, the cashew processing sector has been declining overall, and in addition, the level of value addition has declined from processing 100% fully-processed kernels, to approximately 1/3 of the kernels being exported "skin-on". Many of the factories do not seem to be interested in upgrading their quality standards. As such, cashew represents a challenging opportunity, though we believe there is potential over the medium-term. The strongest strategic opportunity for Mozambique's cashew sector is to position itself as a supplier of high quality, traceable nuts with a "story"; however, interest from processors in uniting around this vision remains to be seen.

Groundnut, sesame and beans offer interesting, higher value processing opportunities to serve consumer markets. The consumer products are sold as branded consumable food products, and are considered higher quality products. In general, products with higher margins and higher quality standards offer the highest potential to engage SHFs in win-win business models that increase SHF income, although the number of farmers engaged may be relatively low. Opportunities in pigeon pea and cassava are limited.

Processor segmentation, challenges and opportunities

There are 3 major segments of processors in Mozambique, each with unique needs and opportunities and exist across value chains: large processors (typically 10,000MT+ capacity; medium processors (typically 1,000 – 10,000MT capacity) and small/microprocessors (typically <1000MT capacity). Key challenges per segment are illustrated in Figure 1 below.

Figure 1 Priority challenges by processor segment



Source: TechnoServe analysis

Many of the challenges faced by processors are connected to the enabling environment for food processing. Key issues include:

- Limited capacity of research institutes and labs
- Lack of trained talent to meet the labor needs of the food industry
- Unfavorable economics and quality of equipment and packaging
- Limited and unclear food processing regulations

Recommendations

Despite very low levels of processing today, the Nacala corridor has the potential to expand its agro-processing sector, which will create new job opportunities, improve opportunities for SHFs and stabilize the market. We recommend that FTF Premier supports 2 clusters of agro-processors:

- ***Nutritious foods for local consumption cluster*:** Key VCs for this cluster are maize and soy, linked also to poultry as a key source of animal protein (consuming maize/soy-based poultry feed). There could be potential also to include beans, groundnuts or other VCs depending on interest of processors (e.g., following East Africa growth in processing of beans products such as pre-cooked beans and flours for local

markets). There is scope to support medium and small-scale processors with a range of assistance tailored to their needs and including both business and technical elements, including upgrading quality standards. A particular focus may be placed on developing innovative, new nutritious foods including CSB and soy milk. Support to small-scale maize mills will be an important element of supporting this cluster, promoting localized food systems which deliver nutritious foods to the rural communities.

- ***High-value products cluster*:** A cluster of processors developing high-end branded products for sale to niche markets in Maputo, South Africa and other export markets should be supported to expand and upgrade their offerings. Key VCs for this cluster include cashew,[3] groundnut (aflatoxin free/ low aflatoxin) and sesame. TA could include: produce formulation support; marketing, branding and packaging design support; bringing processors together for peer learning support, exploration of joint branding and marketing initiatives, field study learning visits to other countries and relevant trade fairs. These products may be branded Made in Mozambique and linked to iconic images of northern Mozambique invoking its rich cultural history and beautiful landscapes; links with the local tourism sector may also be promoted.

The first cluster is likely to engage more SHFs and has the potential to create more jobs, stabilize local markets and improve nutritional status of people living within the Nacala corridor. The second cluster is likely to engage lower numbers of SHFs and support fewer jobs but has potential to deliver higher per SHF impact (incremental revenue).

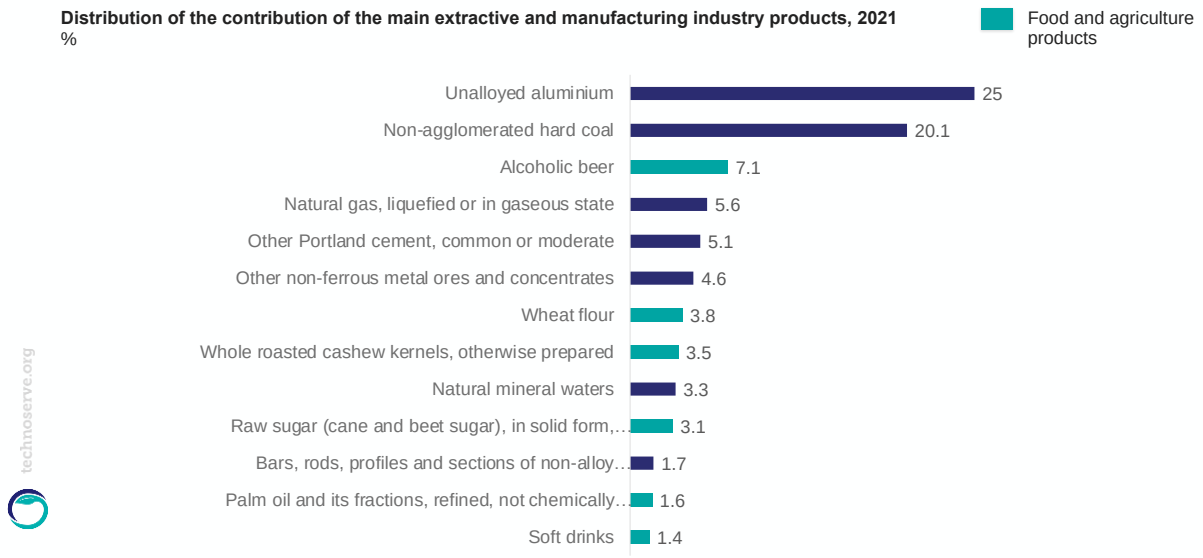
Both core business TA (e.g., access to finance, marketing support) and "inclusive" TA (TA to support processors to develop win-win sourcing models that deliver value both to the processor and to the SHFs) are important. Many small and medium-scale processors in the Nacala corridor need to focus first on stabilizing and expanding their own businesses. In general, it is only the larger processors – especially those processing higher value products – who can absorb inclusive TA. Provision of inclusive TA should begin with the development of an Inclusive Business Plan, which assesses the business case for the proposed improved sourcing model from the perspective of the processor and the SHFs. Only models that offer significant benefits to both processor and SHFs, under a range of likely scenarios, should be supported.

[3] We have not identified through this study a widespread interest in developing high-end, branded nuts; however, it could be worth exploring with the industry whether there would be broad industry appetite to invest in this kind of vision. If so, there could be opportunities for shared branding and marketing of cashew only, e.g., resurrecting Zambique brand or developing a similar brand and arrangement to the Zambique collaboration

2. Overview of Nacala Corridor's Processing Landscape

Mozambique's food sector contributes approximately 20% of total manufacturing[4] based on contributions from sugar, cashew, milling and beer, as illustrated in Figure 2 below.

Figure 2 Main extractive and manufacturing industry products in 2021



Source: *INE, Inquérito mensal a produção industrial*

While Mozambique has grown exports in key agricultural industries including edible fruit and nuts, oilseeds, sugars/sugar confectionaries and cotton in the last 5 years,[5] domestic food consumption remains highly dependent on imports of both raw materials and processed products. This is especially true in high-end formal food outlets. For example, SPAR, a South African supermarket chain with a number of supermarkets in Mozambique, only sources 25% of its food sales category locally in Mozambique, while 25% is sourced from South Africa and the remaining 50% is sourced from 16 other countries.[6]

Mozambique's food processors – especially the larger processors – are concentrated in the south of the country, while agricultural production is concentrated in the north. Infrastructure challenges and economics of transporting produce from north to south lead to southern processors importing raw materials from South Africa or other countries, while produce from

[4] Developing Capabilities in Mozambique's Food Processing Sector - The Role of South African Food Processing Firms and Supermarket Chains, 2018
[5] Trademap Mozambique exports 2017-2021
[6] Developing Capabilities in Mozambique's Food Processing Sector - The Role of South African Food Processing Firms and Supermarket Chains, 2018

the north is often exported raw, with little or no value addition in country. For example, maize and soy from the north cannot competitively supply the south (e.g., maize from northern Mozambique would arrive at Maputo feed-miller gate at MZN21/kg compared to MZN17/kg for imported grain from south Africa).[7] At the same time, over 90% of the soy, sesame and pigeon pea produced in the Nacala corridor is exported raw out of Mozambique each year. While multi-national fast-moving consumer goods (FMCG) companies such as AB InBev have entered Mozambique in recent years, there is no direct representation of these FMCG MNCs in the Nacala corridor, though there have been intermediary firms feeding into the sector e.g., for maize and cassava beer.

The Government's commitment to industrial growth is captured in its new strategic plan, PRONAI - Programa Nacional Industrializar Moçambique, which has a focus on increasing agro-processing in rural areas, including through Special Economic Zones such as the Pemba-Lichinga Special Agro-Industrial Processing Zone in Cuamba.

2.1 Processing Comparison by Value Chain

We compared the agro-processing sector in the Nacala corridor in the 8 focus value chains to highlight key differences and common trends.

Volume of Processing

Overall, the volume of processing is extremely low. Only 2 value chains – cashew and maize - process more than 5% production volumes, at approximately 45 % and 40% respectively. The volume of processing per value chain is laid out below and illustrated in Figure 3:

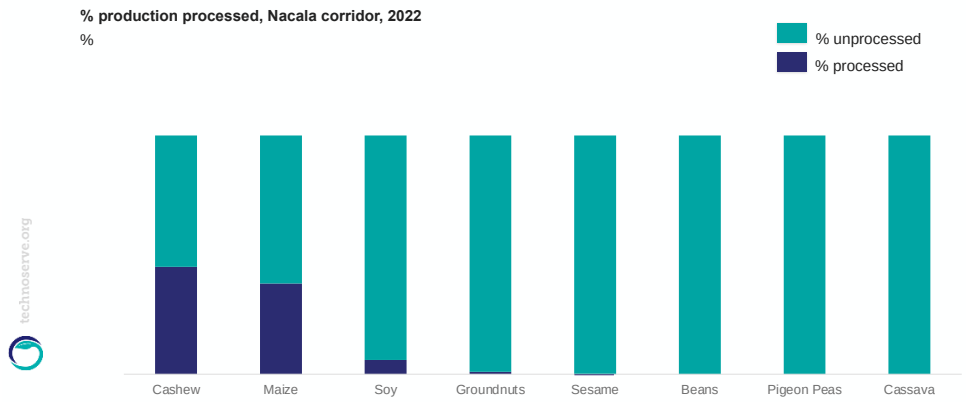
- ***Cashew:*** Approximately 45% is processed while the remainder is exported or consumed raw. Processing is mainly basic processing into range of cashew kernels as well as informal processing of roasted nuts
- ***Maize:*** Approximately 40% is processed of which a majority is basic processing into flour; minimal sales to animal feed and beer
- ***Soy:*** North/central Mozambique has the processing capacity to process all of the soy that is locally produced;[8] however, the facilities are currently largely processing imported soy. Today, less than 5% of soybeans produced in northern Mozambique are processed and the rest are exported
- ***Groundnuts:*** There is minimal formal processing via two Maputo-based companies processing peanut butter. Small companies as well as individuals grind up groundnuts and package for sale in supermarkets unbranded. Some groundnuts are cleaned/graded[9]

[7] TNS analysis
[8] See Figure 13 on p. 21 for details
[9] Not considered "food processing" here as it does not transform the product

by the big traders for the domestic market. A small amount of groundnuts is boiled or roasted at the household level and commercialized in the informal market with or without unlabeled packages.

- ***Sesame:*** A very small amount – approximately 0.02% - of sesame production is processed into sesame oil and flour for high end domestic markets. All sesame is cleaned/graded by large exporters prior to export and in some cases colour-sorting is carried out
- ***Beans:*** There is no processing. Beans are dried at household level[10] and some beans are also cleaned/graded by the big traders for the domestic market
- ***Pigeon peas:*** There is a very high level of cleaning/grading/bulk packaging by large exporters prior to export, but there is no further processing; the only dahl factory is currently closed
- ***Cassava:*** Formal processing in the Nacala corridor is estimated at <1%; there are limited prospects of kick-starting new processing within a 5-year timeframe, with the exception of a potential opportunity to supply cassava wet cake to the beer sector

Figure 3 Breakdown of volumes processed by sector



Source: TechnoServe analysis

Level of Value Addition

We assessed the degree of value addition which is taking place, considering 3 categories:

- ***Primary processing*****:** First level processing of crop e.g., maize flour, cashew kernels, cooking oil. Main opportunities at this level relate to increasing volumes and increasing efficiencies in supply chains as processors are primarily competing on price
- ***Secondary processing*****:** Second level value addition, using as raw material an already processed product such as maize flour or cashew kernels. Examples are roasted nuts

[10] HH level activities e.g., where each individual farming family is drying beans, are not considered processing in this analysis

and animal feed. At this level, processors are interested in improving both quality and efficiency

- ***Consumer Packaged Goods (CPG):*** Branded, high quality, differentiated packaged goods usually found in formal food outlets, where the brand has a value the consumer is willing to pay for e.g., beer, baby food, soy chunks. These products compete on attributes other than price, and may have premium brands; the opportunities to pay premium prices to SHFs for improved quality are therefore typically highest at this level

Even within primary processing, there is a range of processing stages/sophistication. For example, maize flour can be low quality flour from a small-scale processor, or it can be a higher quality flour without bran mixed in that is fortified in a large facility and packaged in a branded pack for sale in formal outlets. In the cashew sector, there are semi-processed kernels (i.e., with skin left on) and then a range of grades of kernels from broken pieces to the larger whole kernels. These all serve as inputs into further secondary processing. *Note that neither household level processing by individual families for their own use, nor cleaning/grading by larger companies are considered processing in this analysis.*

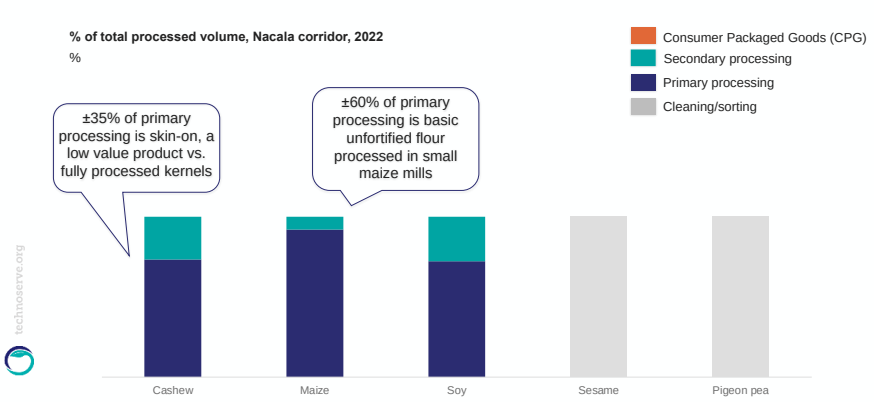
In general, higher value-addition categories (secondary and CPG) typically offer better incentives for processors to engage in win-win inclusive buying arrangements which increase SHF incomes (inclusive business models are win-win sourcing arrangements in which the buyer invests in its SHF suppliers through structured buying contracts, premium pricing, agronomy support and/or inputs on credit).

Overall, even where processing is taking place, over 70% of the processing is primary processing, with 30% or less at the secondary processing level. CPG is very small on average at <1%. The level of processing per value chain is laid out below and illustrated in Figure 3:

- ***Cashew*:** Almost 75% of the processing is primary processing (cashew kernels); of this, approximately 35% is "skin-on" kernels while the rest is fully processed kernels. The remaining 25% is secondary processing – primarily informal roasting and a very small amount of formal secondary processing into consumer packs of flavoured nuts) – and niche CPG (cashew nut butter and branded packs of cashews) through Maputo-based processors
- ***Maize*:** 91% of maize is processed at the primary processing level, into flour; of this about 40% is fortified maize processed in medium-large mills while 60% is processed in small-scale mills and <1% is maize grits which is sold to the beer sector. The remaining 9% is secondary processing (animal feed) and a small amount (<1%) of CPG (CSB)
- ***Soy*:** Majority of processing (75%) is primary processing (soy oil) with approximately 25% of processing currently at secondary processing level (animal feed, soy milk). Historically much higher levels of secondary processing for animal feed
- ***Sesame*:** Very small amount of CPG (niche branded sesame oil and flour)

- ***Groundnuts*:** Very small amount of CPG (niche branded groundnuts products like roasted nuts and peanut butter); informal primary processing (crushed groundnuts)
- ***Beans*:** There is no primary or secondary processing. There is a small amount of grading sorting and packaging into smaller bags for sale and export. A Maputo-based retailer of canned beans products is just importing and re-selling.
- ***Pigeon pea*:** There is no primary or secondary processing. The closed dahl processing plant did process at primary processing level
- ***Cassava*:** There is no primary and secondary processing. Previously small amount of primary processing into wet cake (which is later processed into beer); household level processing e.g., for animal feed

Figure 4 Breakdown of level of value addition by sector, 2022



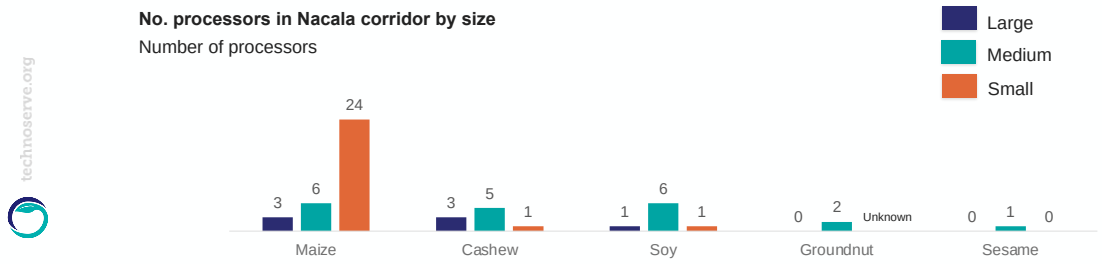
Source: TechnoServe analysis

Number and Concentration of Processors

The number and size of processors varies by value chain, as illustrated in Figure 5 below. Maize has the highest number of processors, especially small and medium processors. There is a proliferation of SME maize millers in the north which are able to process and sell maize flour very competitively vs. the larger-scale millers (who are required to fortify the maize) outside the area. There are also many small-scale mills which provide a "toll processing" service to nieghbouring farming families, processing their maize into flour for them (rather than into packets of flour to sell in the shops).

In contrast, soy processing has significant economies of scale and is dominated by medium-scale processors who have the technology to process soy oil. Cashew is dominated by medium-large factories after the closure of many factories processing 1000 – 5000MT p.a., though there are still a few small factories processing <500 MT p.a. Further details are provided in the processor lists by value chain in the following section.

Figure 5 Number of processors in Nacala corridor by size and value



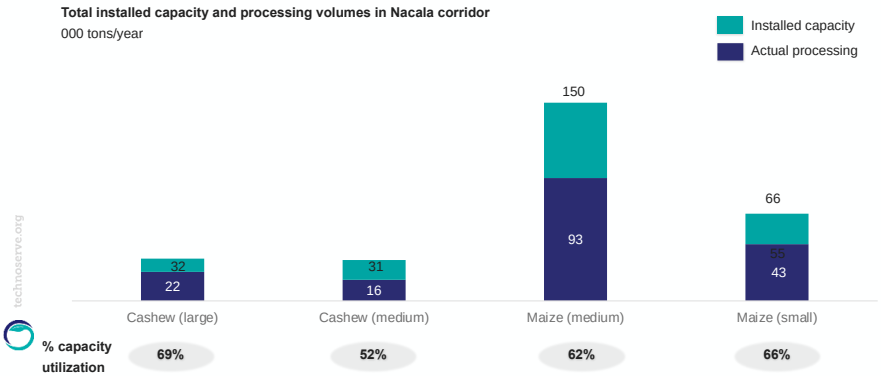
Notes: Definition of large/med/small differs by sector – see Figure 17 below for bands. Large exporters have cleaning/packing facilities (2 sesame, 2 pigeon pea) and there is 1 medium pigeon pea cleaning facility – not included as not defined as processors
Source: TechnoServe analysis

The concentration of processing in the Nacala corridor – versus other parts of the country – also varies by value chain. While 8 out of 9 medium-large cashew factories in the country are based in Nampula, Mozambique's largest maize processors (±240T/day) are based in Maputo. Similarly, only 1 medium feed company is based in the Nacala corridor (and 1 planned investment) versus 3 medium-large feed processors in Maputo/Chimoio.

Capacity Utilization

Capacity utilization is currently around 60-70% among maize medium and small processors, and 50-70% in cashew. In contrast, most large maize processors and soy processors are operating at high capacity utilization (at or close to 100%). Further details are provided in the processor lists by value chain in the following section.

Figure 6 Capacity utilization in the Nacala corridor in key value chains



Source: TechnoServe analysis

2.2 Overview of Processing Sector by Value Chain

Cashew

The cashew nut sector has always been considered important for Mozambique because it provides employment for many people in rural areas: the sector directly employs 20,000 workers and supports about 1.4 million families[11] that are linked to the cashew production sector. Almost all of Nampula province's[12] 19 districts produce cashew nuts, including Meconta and Nampula. The province accounts for 50% of Mozambique's raw cashew nut (RCN) production and 80% of its installed cashew processing capacity with the largest concentration of cashew processing plants in the country.

In the 2021/2022 campaign, the cashew sector had a gross income of USD87M.[13] In Q1 2022, RCN were exported to India[14], Vietnam[15], China and RSA. 2022/2023 production is estimated to be about 150,000 MT of RCN[16], but prices are being influenced by weak demand in the international market, where it is said that there are high quantities of last year's RCN still on the global market, estimated at more than one million tons[17]. Additional factors influencing the slowdown are the presence of other competitors (e.g., Ivory Coast, Guinea Bissau, etc.) and the war in Europe (Russia-Ukraine).

Figure 1 Evolution of Mozambique's cashew processing industry

	2003	2011	2022
Number of processors	17 processors	20 in north + 9 in south	9 north + 1 in south
Installed capacity	15,750 MT/year	55,550 MT/year (N) + 22,550 MT/year (S)	63,600 MT/year (N) + 5,000 MT/year (S)
Actual processing	13,850MT/year	78,100 MT/year	42,700 MT/year
Employment	±5,000 workers	15,000 workers	7,800 workers

Source: TechnoServe analysis

[11] BM, 2021. "Challenges and Opportunities in the Commercialization and Processing of Cashew Nuts".
[12] BM, 2021. "Challenges and Opportunities in the Commercialization and Processing of Cashew Nuts". Interventions Booklet and Debates.
[13] INE
[14] World's leading consumer: in 2020 the consumption of the kernel in India was 132,367 metric tons.. Source: Mordor Intelligence, 2022.
[15] World leader in cashew nut production
[16] INCAJU, 2022.
[17] Club of Mozambique, Out. 2022

Mozambique's cashew sector has experienced a process of consolidation and decline, with recent factory closures including the withdrawal of OLAM from cashew processing. Key to the closures were difficulties accessing working capital and managing cash flow through a challenging period. In some cases when the factories were unable to pay their debts to the bank, they could no longer borrow money in the following year for the purchase of raw materials, which led to the seizure of the assets by the bank and their closure. Whereas in the past, cashew factories with annual processing capacity of 1000 – 5000 MT were common, today there are no factories of this size – only larger factories from 5000 – 12,000MT and a few small factories <500 MT capacity. Factories currently operating in the north are listed in Figure 8 below and shown on the map in Figure 9.

Figure 8 Cashew processors in the Nacala corridor

Factory	Location	Installed capacity (ton/year)	Actual (ton/year)	Manual	Automatic (cutting)	Automatic (peeling)	Automatic (selection)	Certification
CN Cajú	Nacala	12,000	10,000		X		X	
ETG Rex	Nampula	10,000	6,000		X	X	X	BRC; Kosher; Halal
Sunny M. Internac.	Nampula	10,000	6,000		X	X	X	
Cajú Angoche	Angoche	7,500	3,000	X	X			
Cajú Ilha	Lumbo	7,500	3,000	X	X			
ETG -Chiúre	Chiúre	6,000	4,000		X	X	X	BRC; Kosher; Halal
Indo África	Mecua	5,000	3,000	X	X			
Agrico Marketing	Namialo	5,000	3,000		X		X	
ADPP	Itoculo	300	200	X				
Condor Anacardium	Macia, Gaza	5,000	4,500	X	X	X	X	HACCP

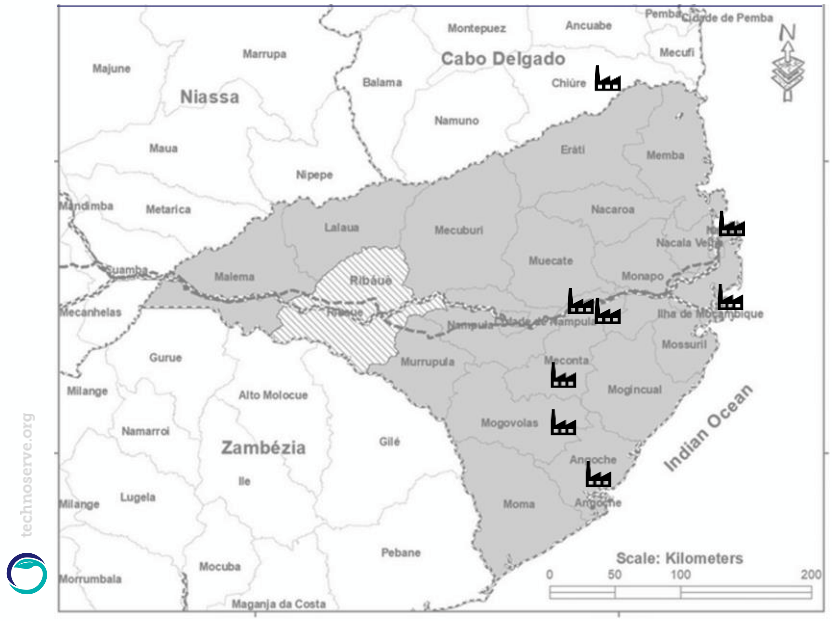
Note: *Condor Nuts and Condor Cajú have both closed
Source: Processor visits and interviews; TechnoServe analysis

Some factories have manual processing while others have automatic/semi-automatic machines, or a mix of manual and semi-automatic/automatic processing.[18] Technological innovations in processing have enabled better efficiency driving many factories to opt for automatic systems. At the same time, there was a requirement to upgrade given changing labor laws from end markets like Europe that are banning sources of nuts that use child labor. The innovations with the greatest impact so far have happened in the peeling and dehulling processes. These areas are considered "stepping stones" towards automated processing, offering the highest return to processors because they address the low productivity of the workforce and associated challenges in managing large numbers of staff operating manual equipment (however reduce employment

[18] The reason for choosing manual machines for one sector (e.g., peeling) and semi- or automatic machines for others (e.g., selection) is related to the yields of whole nuts, of the machines themselves (mechanical problems) and the productivity man-hour. For example, with a manual shelling machine the damage caused to kernel reaches 5% and the content (in 35kg) is between 25.5% to 27.5%; while in large semi-automatic machines the average content can reach 45%. In both situations the average yield is around 85%. In selection, "shaving" decreases the quality of processed cashew kernels and causes more broken kernels to appear (industry limits are set (by the processors) between 19% - 21%).

opportunities for rural communities With the introduction of automated cutting and peeling processes, there have been notable reductions in operating costs in these two areas and achievement of quality production with less waste.

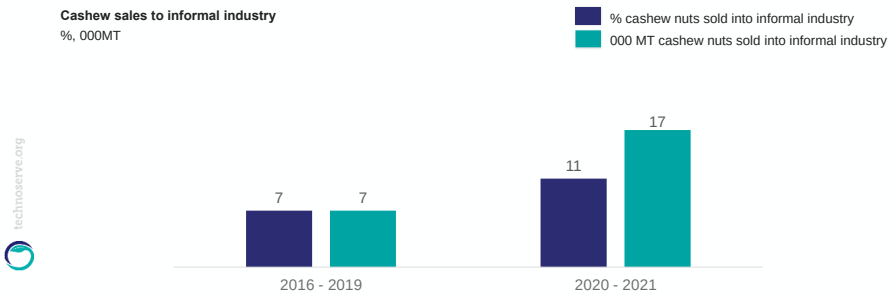
Figure 9 Map of large and medium cashew processors in the Nacala corridor



Source: TechnoServe analysis

At the same time, the informal/domestic street market seems to be flourishing with the sale of roasted kernels, especially along the main highway (EN1) and in popular markets. This growth is illustrated below in Figure 10. This sector can be considered secondary processing as it is characterized by roasting the cashew nuts and selling both with and without skin. These informal processors do not follow any standards, hygiene measures or certifications; however, they are growing implying that the local consumer is price sensitive. In fact, 1kg of kernel might cost around 500MZN/kg compared to 200g for around 380MZN in the supermarkets.

Figure 10 Growth of Mozambique's informal cashew market



Source: IAM

Maize

Mozambique's maize flour market is made up of approximately 10% corn that is locally processed into flour; 30% from the small producers who buy corn and take it to local mills, 10% from small consumers who buy corn and take it to local mills, and 40-60% of imported maize flour and flour processed by Maputo's processing sector. Mozambique has the capacity to process a little over 1,270 tons of corn per day.[19] The corn passes through a series of mills and sieves, which then give flour according to size. This is known as 'wet milling' or 'dry milling,' which produces flour which is then sent for further refining to remove the husks. Additional mechanised processing equipment is used for threshing, sieving, drying, storage and transport.

MUTHOZANE: Small-scale maize/cassava processor, Quelimane

Muthozane is a small corn flour processor in Quelimane city, established for about 20 years, providing corn and cassava milling services to customers. Muthozane also owns two brands of packaged maize flour: "Zana" and "Muthozane". He has an electric mill with capacity of 20 tons/day and 4 production machines (2 for husking and 2 for flour). He does not know Mozambique's national standards and does not have a dosing device or premix for fortification. His ambition is to modernise and expand his facilities and to acquire larger machines with better production volumes.

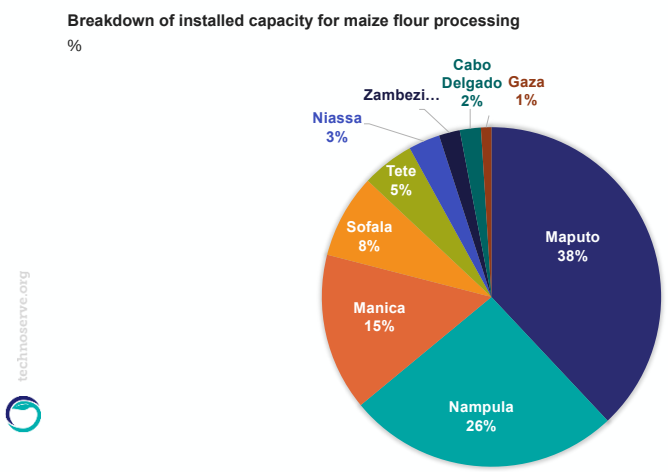
Maputo is the major consumer of excess maize and major wholesale markets for maize are located in Maputo and Nampula, while the main producers are in Nampula, Manica and Tete. Maize milling in the north has been increasing steadily over time; Nampula province accounts for 25% of Mozambique's installed flour processing capacity, with Niassa, Tete and Zambezia contributing an additional 13%. The southern region, which accounts for 39% of flour processing capacity, imports most of its raw material. South Africa is its main maize supplier, contributing over 80% of Mozambique's raw maize imports and over 99% of its maize flour imports during the period 2017-2021. Maize flour imports were USD $36M in 2021, up from USD $14M in 2018.[20] Maize processed in the Nacala corridor comes from the SHF sector; it is bought directly from the field or brought by the producer to the processing site at their own cost, in 50 kg bags. All industrial processing work is controlled using appropriate management and quality systems and the processing steps are usually mechanized and automated. Most of the national companies have their processing stages and technology aligned with the cleaning, conditioning, degermination, milling, and sieving/separation manufacturing stages. Large processors are required by the government to fortify the maize they process, which raises the price of maize meal but is believed to have nutrition benefits. At the moment, small-scale mills that only provide milling services for family consumption are exempt from this requirement.

AFRO MOAGEM

Medium-sized maize processor, Nampula Afro Moagem, a medium sized company located in Nampula, processes maize from Gurué, Lichinga, and from other traders and vendors who bring it to the factory door. It has two 50 ton/day plant machines that operate in 3 shifts when raw material is available and six corn warehouses with a capacity of 500 ton each. However, it is not able to control certain physicochemical and biological factors that are conducive to growth of toxigenic fungi and mycotoxin production (e.g., relative humidity, temperature, atmosphere, nutrient availability, etc.). It was for similar reasons that a mill in Cuamba was closed by phytosanitary authorities due to inadequate hygiene practices.

[19] Regitano, et al., 2015. *"Processamento e industrialização do milho para a alimentação humana".* Visão Agrária No. 13
[20] Comtrade; TNS analysis

Figure 11 Breakdown of installed capacity for maize flour processing, Mozambique, 2019



Source: MAC/DNI, 2019

There are growing numbers of officially registered SME maize flour mills emerging and creating value in the industry; but there are also other unregistered mills that operate with unhygienic conditions that people often resort to for their milling product, indicating an opportunity to increase local processing levels. These SMEs overall contribute to stabilising the maize price and reducing logistics cost because they are widespread across the country. At the same time, most rural households consume corn flour which they produce and take to local small or micro mills for processing. At this level, Good Production Practices are not implemented and storage is inadequate, strongly contributing to contamination by aflatoxins.[21]

In addition, a very small volume of corn-soy blend (CSB) is processed by Winnua and MIRUKU. CSB is a fortified blended food, made from maize bran (a by-product) which holds the majority of the nutrition in the maize grain, to help eradicate malnutrition. The formulation of CSB according to the WFP guidelines includes fortification with: Vitamin/Mineral FBF-V-13; Dicalcium Phosphate Anhydrous or Tricalcium Phosphate and Potassium chloride. The product can be consumed by both adults and children. World Food Program (WFP) provide guidelines for CSB composition (i.e., energy density, moisture, fibers, micronutrients, and anti-nutrients) so that it is appropriate for older children and adults (CSB+) and for young children of 6-24 months (CSB ++). The product is distributed in places where people (especially children) have acute malnutrition. Winnua sells to local markets at 100MZN/kg and also distribute to hospital, schools and kindergartens.[22]

Major processors in the Nacala corridor are shown in Figures 12 and 13.

[21] Mycotoxins are widely studied. They occur largely during grain storage after harvest. There are 17 toxic compounds, among which the most important are aflatoxins B1, G1, B2, and G2. (B1 (AFB1) is the most carcinogenic known. http://www.cicrobiologia.vet.br/micotoxinas.

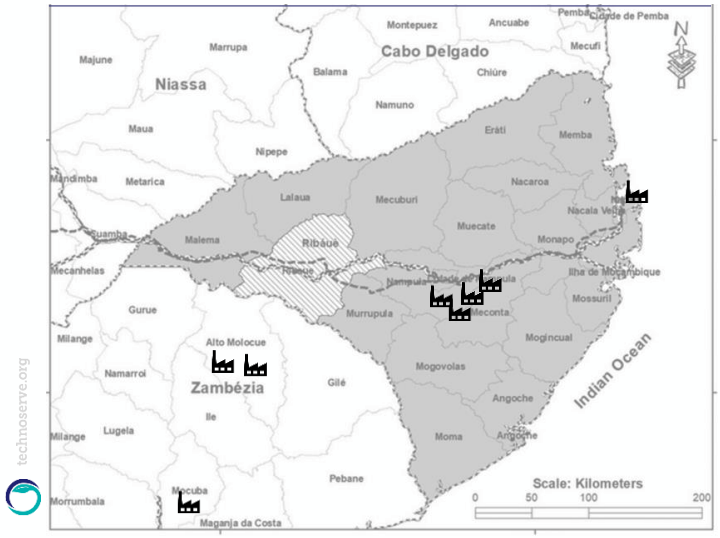
[22] To process the bran to a product suitable for human consumption it has to be pre-cooked and at the same time dried enough to allow storing. The bran is then mixed with maize and soya meal. The soya meal will make the porridge and hold all nutrition needed.

Figure 12 Medium-small maize processors in the Nacala corridor

Factory	Location	Installed capacity (ton/day)	Actual (ton/day)
Star Grain Processing	Nampula	100 (33,600 per year)	100
Grupo ETG	Nampula	100 (33,600 per year)	100
S & S Refinarias de Óleos, Lda	Nacala	90 (30,240 per year)	90
Novos Horizontes	Rapale (feed)	60 (20,000 per year)	60
MeTL	Nampula	56 (18,720 per year)	56
Halima Agro Industria	Nampula	100 (33,600 per year)	50
Afro Moagem	Nampula	100 (33,600 per year)	50
Rajan Export Moz	Nampula	100 (33,600 per year)	30
Rock	Nampula	30 (10,080 per year)	30
Fábrica de Produtos Alimentares do Norte – PAN	Nampula	79 (26,400 per year)	22 (7,500 per year)
Miruku	Nampula	22 (7,500 per year)[23]	22
Muthozane	Quelimane	20 (6720 per year)	20
Moagem Ali	Nampula	20 (6,720 per year)	20
Black Gold Trading	Alto Molócué, Zambézia	18 (6,000 per year)	18
Farinha de Namialo	Namialo	12.5 (4,200 per year)	12.5
Shima Golo	Zambézia	16 (5,400 per year)	8 (2,688 per year)
Winnua Lda	Mocuba	4.5 (1,500 per year)	3 (1,028 per year)
Sunay Commercial	Nampula	2.5 (840 per yr)	2.5
Moageira Alpha Agro	Nampula	1.5	1.5
16 micro maize mills	Various	15 – 75 per year each	Unknown

Source: MIC; Processor visits and interviews; TechnoServe analysis

Figure 13 Map of large and medium maize processors in the Nacala corridor



Source: TechnoServe analysis

[23] Also processes additional 1000MT soybeans into CSB

Soy

MIRUKU
Medium-sized maize/soy processor, Nampula

MIRUKU's factory produces CSB; however, the formula still needs improvement in order to be certified. It is working with DCM, a set of laboratories in South Africa as it sees a lack of "reliable" laboratory in Mozambique. The company buys corn from 10 - 14,000 small farmers, buying 50-60% direct from producers and 40-50% from aggregators. Major markets are WFP and UNICEF; others include Save the Children, supermarkets, retailers and wholesalers in Nampula, Nacala and Pemba.

Although historically Mozambique's soybean producers have supplied the poultry feed industry in the north, it is estimated that currently ±95% of the country's soybeans are being exported raw to India, due to an appreciation in global soy prices and relative attractiveness of the export opportunity versus selling to local processors. In turn, major poultry producers (Abilio Antunes in Chimoio and Novos Horizontes in Nampula) are importing soycake from Malawi and South America. The poultry sector in the south of the country has always imported soycake from South America as it is cheaper than processing soybeans from central/northern Mozambique. Two companies, JFS and APIL, have recently started processing soy oil in Cuamba; together they are processing about 3000MT per year and have scope to expand. They are able to source soy from local producers due to the prohibitive distance between the producers and the ports for export, and so far, their oil has been absorbed on the local market. As mentioned above, Winnua and MIRUKU are producing small quantities of CSB, and there are also small quantities of soy milk being produced, e.g., by a farmer in Malema and by SoSoja in Manica.[24]

Figure 14 Soy processors in Nacala corridor

Factory	Location	Installed capacity (ton/ year)	Actual (ton/year)
Soy oil mills – crude oil			
GEIN	Nacala Corridor	N/A	N/A
SANAM	Nacala Corridor	N/A	N/A
Soy oil mills – pressing plants			
JFS San	Cuamba, Lichinga	7,500 (5,376L)	1,000 (718L)
JFS San – Condensed oil	Cuamba, Lichinga	7,500 (5,376L)	1,000 (718L)
Agro Processing Investment Limitada, APIL	Cuamba, Lichinga	7,500 (5,376L)	2,000 (1,434L)
APIL – Condensed oil	Cuamba, Lichinga	7,500 (5,376L)	2,000 (1,434L)
Hoyo Hoyo	Ruace, Gurue	6,400	6,400
Wanza Farms	Lioma – Gurué, Zambézia (Soybean)	3,000	820
	Lioma, Gurué, Zambézia (Soybean) – Seed processing plant		436
Agri Mel		0.4	0.4
Soy grain and other products			
Novos Horizontes	Rapale, Nampula (Soya)	4,000	4,000
	Rapale, Nampula (Feed)	20,000	20,000
Abílio Antunes	Chimoio (Soybean)	34,000	30,000
	Chimoio (Feed)	34,000	42,000
Winnua	Mocuba	1,500	1,028
Miruku	Nacala Nampula	1,000 soy	1,000 soy

Source: Processor visits and interviews; TechnoServe analysis

[24] Neither Winnua nor Miruku is producing soy yoghurt, although SoSoja used to produce yoghurt.

Groundnuts

Groundnuts are primarily produced for the domestic market. Groundnut is processed at household level, typically by women. They process groundnut into oil, groundnut cake, paste, roasted groundnuts and other groundnut-based products for domestic consumption. Crushed groundnuts are also produced by individuals as well as by small businesses for sale (unbranded) to supermarkets and there are reports of cottage/micro groundnut paste and snack processors though the study team did not identify specific processors. Roasted groundnut is also sold by street vendors, mainly women and youth. JSF SAN in Cuamba has experimented with processing groundnut oil as well as soy oil, but found it was not competitive against imported palm oil.[25] The major functions performed by processors are: cleaning, roasting, milling and oil extraction of oil and butter. One of the most well-known groundnut processing units is located in Matola and is known as Xikhaba. Xihhaba produces peanut butter (and cashew nut butter) which is sold in the Greater Maputo area and exported to South Africa. Xikhaba is a processor[26] with a capacity to produce 1,000 kg of groundnut butter/month, and sources its groundnuts from the Nacala corridor. Another Maputo-based processor is Good Trade who produce branded products such as aflatoxin-free peanuts and peanut butter for sale to high-end Maputo and export markets. Good Trade has historically sourced from IKURU. In the past, JAM in Beira was producing ready-to-use therapeutic food (RUTF) from groundnuts, but stopped producing domestically due to aflatoxins.

Figure 15 Groundnut processors in or buying from Nacala corridor

Factory	Location	Installed capacity (ton/year)	Actual (ton/year)
JFS SAN	Cuamba	7,500	No groundnut oil
Xikhaba	Maputo	12	N/A
Good Trade	Maputo	N/A	N/A

Source: Processor visits and interviews; TechnoServe analysis

Peanut storage is one of the steps that enables aflatoxin to exist at high levels, spread, and create losses. Aflatoxin mitigation requires the use of good varieties, good agricultural practices, and good post-harvest practices. The "Aflasafe" technology used in Nigeria to combat aflatoxin during the production cycle is being established in Mozambique with a new processing plant in Nampula.

Sesame

Sesame can be processed to several different stages, such as simply cleaning, or cleaning and dehulling, cleaning/dehulling/drying, cleaning/dehulling/drying/crushing for oil, etc. In

[25] FAO-IOAM 2020 oilseeds sector study ("Estudo do sector das oleaginosas") highlighted that from 2010-2017, 53% of the value of oil imported to Mozambique was palm oil, followed by soy oil (22%), sunflower oil (15%) and others (9%). The study team were also told of a processor in Nacala-Porto handling peanuts and other cereals but were not able to find further information or visit this processor

[26] While primarily a retailer, Good Trade carries out some processing, e.g., roasting cashew nuts

Mozambique, there are a few commercial cleaning facilities. There are also dehulling/ cleaning/color-sorting facilities but most of the sorting is done manually by women, some located at storage facilities. ETG in Nacala is the only processing plant known to perform color-sorting; it installed a cleaning and color sorting machine more than a decade ago and attracts premium prices on the end markets for their white sesame. Most other exporters just clean and bulk-package for export. Presently, there are no industrial crushing plants for sesame oil in Mozambique. Agrifeed is a micro-processor extracting sesame oil in the suburb of Nampula city, selling to a nice domestic market, particularly in Maputo. Sesame oil is being sold at 998 MZN/ litre (approximately USD $15.78/litre) which is unaffordable to many. The company is also selling clean processed sesame at 190 MZN/kg (USD $3.00/kg). Agrifeed is planning to expand its production capacity from 5L/day to 100L/hour.

Figure 16 Sesame processors in or buying from Nacala corridor

Factory	Location	Installed capacity (ton/year)	Actual (ton/year)
Agrifeed	Nampula city	100 litres/day	5 litres/day
ETG Process Export	Nacala Corridor	33,600	33,600
Nacala Process Export	Nacala Corridor	10,080	10,080

Source: Processor visits and interviews; TechnoServe analysis

Beans

Beans are a staple crop, primarily produced for household consumption and sale via informal markets, including trade from the north to the south of the country. A large percentage of common beans are threshed and dried at the household level. They are then cleaned, packed in bulk bags and transported mostly to the informal markets in main cities and towns to be consumed by urban families. There are a few exporters operating small processing plants that clean and sort the beans by hand (employing women) and then package them for export, primarily to South Africa. These low-tech processing centers rely on agents who buy for them at the standards the processors have set. Investagro is exporting quality common beans to South Africa, is starting to pack in retail packages (less than 5kg), and is exploring export to Europe. There is one Mozambican company, AGRI, based in Matola, which sells canned products including beans; however, they simply import and label rather than canning domestically-produced beans.

Pigeon pea

Pigeon pea is grown mainly as an export cash crop exported to India. The exporters have warehouses where they clean and grade the pigeon pea before shipping *dry and shelled pigeon pea* to India. The main players are ETG, Royal Plastics, Patel Trading, Indo Africa and a number of smaller exporters, some of whom arose with the quota system. Only ETG has facilities to process *dahl.* In 2013/2014, ETG installed two plants in Beira and Nacala Port, both able to

clean, grade and process (de-husking and splitting the pigeon pea) in readiness for the dahl market. The two plants had a combined capacity to process 60,000 MT of pigeon pea per annum (on one shift) and could produce much more by adding shifts given favourable market opportunities and crop availability. When the quota system was installed, ETG got an allocation equivalent to 25% of their average volumes during the free market operations up to 2016. They had to close their *dahl* processing plants in Beira and Nacala. The Beira plant was subsequently destroyed by Cyclone Idai and ETG decided not to rebuild the plant. Miruku aggregate whole pigeon peas and sell to exporters, but don't process the pigeon peas.

Figure 17 Pigeon pea processors in or buying from Nacala corridor

Factory	Location	Installed capacity (ton/year)	Actual (ton/year)
ETG Process Export	Nacala Corridor	115,000	115,000
PATEL Trading	Nacala Corridor	33,600	33,600

Source: Processor visits and interviews; TechnoServe analysis
Note: According to SELINA WAMUCII (2022, "Mozambique pigeon peas"), in 2021 Mozambique exported 170,000 tons, which corresponded to about 125 million USD. This suggests that installed capacity could be higher than the values captured in the table above.

Cassava

Cassava is mainly a food security crop, important within local farming systems for resilience and nutrition. It is traded largely informally and processed at home to make it palatable to eat. The industrial use of cassava in Mozambique is estimated to be less than 0.5% of production. Although there is high theoretical potential to develop a processing sector for a range of products from beer to high quality cassava flour (HQCF), starch, ethanol and animal feed, in practice there are many barriers. Other countries including Nigeria have failed to capitalize on this opportunity yet.

Most cassava processing in Mozambique is traditional, requiring chipping, soaking to rinse out the cyanide, drying and then grinding into flour. This is labor-intensive, low-profitability work. For home-based food consumption, cassava must be ground up, washed to remove the cyanide and then dried into chips. These can be stored for several months once dried and can then be ground into flour for mixing as food. The predominant processing is toll processing, where households bring the cassava that they want to consume for the week to the mill to grind.

DMM is the leading industrial processor of cassava in Mozambique focusing on high quality cassava flour (HQCF) but needs to invest significantly (more than $1 million) to improve its processing capacity. DMM, pulled out of the north for Inhambane where the structure of production is more favorable; but even there it is struggling. Its mobile mechanical processing units (AMPUs) are sitting idle in the south and could go back to the north if there were demand. Black Gold, in Alto Molocue, which is processing maize grits for CDM, is now exploring the prospect of processing cassava into wet cake or even the more efficient starch for sale to CDM.

However, achieving this will require them to develop an effective supply chain that is able to take cassava from harvest to the factory within 48-72 hours. Demand is uncertain, but it could reach back to the 17,500 MT that DMM was consuming from 4,000 farmers before it left the north. Cassava is not generally associated with mould and aflatoxin contamination when fresh but can become contaminated during storage. There is an opportunity to reduce aflatoxin contamination through promotion of best practice post-harvest handling including processing and storage.

2.3 Key Processing Opportunities by Value Chain

There is a range of opportunities to support expansion of processing in each value chain, both **expanding** existing levels of value-addition, and **upgrading** value chains to add more value to the crop through additional or more complex levels of processing, and/or improved quality standards, which may be certified. Key opportunities include:

- ***Maize*:** Support small-medium mills – including rural service providers (i.e., those offering farmers opportunity to mill own maize) to professionalize operations and improve quality standards; support larger processors to improve quality standards and obtain relevant certifications

- ***Cashew*:** Halt the decline of primary processing by supporting existing processors; develop further processing and exports to South Africa of both primary and secondary processed cashews; develop higher-end branded primary/secondary processed cashews for markets demanding traceability and a processor/farmer "story"; diversify into the production of other cashew containing products e.g., cashew nut shell liquid (CNSL), cashew apple vinegar; support informal cashew roasters with business and technical assistance

- ***Soy*:** Support feed processors with general business TA and as opportunities arise (based on market and pricing conditions) help to build local inclusive sourcing models that can be competitive against imported soycake; support nascent soy oil processors to develop markets and smart distribution systems for soy oil to maximise their competitiveness and growth; explore and support niche opportunities to develop other soy products e.g., CSB and soy chunks

- ***Groundnuts*:** Develop "closed" sourcing arrangements linked to high end markets that require and pay premium for aflatoxin-free peanuts (demonstrating model which can be replicated further over time); explore any synergies between high end, branded, traceable cashew/groundnuts/sesame; look for clusters of small-scale micro businesses which could be supported through micro-entrepreneurship approaches

- ***Sesame*:** Explore opportunities to increase value-addition in country, e.g., supporting processors to invest in colour sorters for bulk export; supporting niche opportunities to process sesame oil or other sesame products for high end domestic or export markets; explore learnings from Ethiopia's successful high-end sesame sector

- ***Beans*:** Explore opportunities to develop beans processing in the Nacala corridor, e.g., following East Africa's success with beans products such as pre-cooked beans, flours and porridges (including for institutional markets); look for clusters of small-scale micro businesses which could be supported through micro-entrepreneurship approaches

- ***Pigeon pea*:** Look for opportunities to support processing of pigeon peas into dahl, to offer market stability and job creation vs. "export only" scenario; explore opportunities to promote increased local consumption of pigeon peas and small-scale processing opportunities tied into this growing domestic market[27]

- ***Cassava*:** Support any new processing initiatives in the Nacala corridor; explore feed formulations with cassava and seek to test with feed mill partners

Despite the major challenges in northern Mozambique at the moment, it may be possible to catalyze new investments, potentially linking in with the Government's Special Economic Zones (SEZs) in the Nacala corridor (see p. 46). However, it will also be important to develop a strategy to work with the processors who are already represented in the corridor, including medium and small-scale processors.

Overall, it is clear that the processing industry is most developed for the cashew, maize and soy value chains; as such, these three sectors offer the strongest potential to further develop agro-processing in the Nacala corridor given the range of existing players and the range of products being produced for both human consumption and animal feed. Maize and soy are very complementary, as they are often both used in key products including poultry feed and (niche but growing) CSB. Maize processing is growing fast, and – despite the general shift towards processing imported soy – there has also been growth in installed capacity for soy processing with the addition of 2 new soy oil factories in Cuamba. **Maize and soy** processing has the potential to be competitive within the Nacala corridor and to compete with "imports" from elsewhere in Mozambique. The maize and soy processing industries in the Nacala corridor are not currently able to competitively supply the domestic market in central/southern Mozambique or export markets.

In contrast, the **cashew** processing sector has been declining overall. The level of value addition has declined from processing 100% fully-processed kernels, to a share of the kernels being exported "skin-on". Many of the factories do not seem to be interested in upgrading their

[27] There are no specific barriers to eating more pigeon peas but people generally prefer beans.

quality standards. As such, cashew represents a difficult opportunity, though we believe there is potential over the medium-term. A recent study into the competitiveness of Mozambique's cashew processing sector versus Vietnam and other countries concluded that "the cashew processing industry in Mozambique is competitive with the current public policy, but its situation remains very precarious."[28] The strongest strategic opportunity for the Mozambique cashew sector is to position itself as a supplier of high quality, traceable nuts with a "story"; however, interest from processors in uniting around this vision remains to be seen.

Groundnut, sesame and beans offer interesting and high value niche processing opportunities. These have potential to expand and the ability to incentivize SHFs to produce higher quality raw materials through win-win business models which offer stability, resources and/or potentially price premiums to farmers. These products are often already sold under high-end brands which stand for quality. Because these are consumer packaged goods (CPG) products with high margins and high quality standards, these opportunities offer the greatest potential for engaging SHFs in win-win business models. In contrast, a majority of processing in Mozambique's other key value chains is at the primary processing level where incentives to create these win-win sourcing models are typically the weakest.

Opportunities in **pigeon pea and cassava** seem to be limited, with just one potential opportunity in cassava with Black Gold / CDM. The opportunity to process pigeon peas for domestic markets – e.g., into flour for badjias – could be analysed; concerns regarding competitiveness and potential to shift food habits (people are used to the taste of cowpea bean flour in badjias) would need to be assessed.

3. Overview of Processor Segments and Needs

3.1 Processor Segmentation

There are 3 major segments of processors in Mozambique, each with unique needs and opportunities and exist across value chains (though the needs and opportunities within a segment might differ somewhat by VC). We have labelled the three segments large, medium and small in Figure 18 below.

Figure 18 Summary processor segments

	Maize	Cashew	Soy
Large	**Capacity:** 100 – 240 tons/day (±35k - 80k MT/year[29]) **Characteristics:**	**Capacity:** 10-12,000 MT **Characteristics:** Semi-mechanized model (peeling); Mechanized model (calibrating, peeling); Automatic model	**Capacity:** ±10 – 50,000 MT p.a. feed; ±7500 MT p.a. oil **Characteristics:** Integrated poultry producers; large oil mills

[28] Competitiveness of the Cashew Industry in Mozambique, Nitidae 2020
[29] Assuming 6 working days/week x 28 days/month x 12 months. In practice, smaller mills often only work when they have maize to process

	Own silos storing ±50k MT grain where the quality of the grain is regularly checked (e.g., for diseases or weeds) and warehouses. Mainly focused on corn and wheat flours. Modern equipment and use of by-products. Must fortify. Final product, after complete packaging, mainly sold to consumer in grocery stores, supermarkets, etc. **Examples:** Companhia Industrial da Matola; Merec; D.E.C.A.; GS Holdings; ETG	(selection, grading/classification), packaging) **Examples:** ETG/Korocho – Rex; CN Caju; Sunny M. Internac	**Examples:** HIGEST; Abilio Antunes; Novos Horizontes; JFS San (Cuamba); AGRO PROCESSING INVESTMENT LIMITADA, APIL (Cuamba)
Med	**Capacity:** 60 tons / day (+20k MT/year) **Characteristics:** Usually corn only. Generally have acceptable storage conditions and meet some but not all quality attributes. Processed products with labeled packaging are sold in various places for public consumption (e.g., households, supermarkets, grocery stores, popular markets, stores and small stores) **Examples:** ECA; COMPAGRI; MeTL (Nampula); Afro Moagem (Nampula); MIRUKU (Nampula)	**Capacity:** 7,500; 6,000; 5,000; 1,000 ton/ year **Characteristics:** Manual (peeling); Semi-mechanized model (peeling); Mechanized model (calibrating, peeling); Automatic model (selection, grading, packaging); manual work (peeling, selection, grading) **Examples:** ETG KOROCHO Chiúre; CAJU ILHA (Angoche); CAJÚ ILHA (Lumbo); CONDOR ANACARDIUM (Gaza); INDO AFRICA (Meconta); AGRICO MARKETING (Namialo)	**Capacity:** ±1000 – 10k MT p.a. **Characteristics:** CSB producers **Examples:** Miruku Indústria Agro-Processamento (Nampula); Winnua
Small	**Capacity:** 20 tons /day (±6500 ton/year) **Characteristics:** Process corn inc. bran and other products such as sorghum, dried cassava, millet, beans, and bran. Often they process the customer's grain for them, and the processed products are delivered directly to the customer, in a container (e.g., plastic/metal bucket) or in raffia or plastic bags, for which the customer has to pay the price. Widespread in all districts inc. in rural areas. Accessible and flour sold at lower price than refined flour from larger processors **Examples:** AGRO TRADING & COMÉRCIO GERAL (Mocuba); BIVE (Mocuba); MUTHOZANE (Quelimane)	**Capacity:** 300 tons/ year **Characteristics:** Manual (cutting, peeling; selection); Automatic model (packaging); manual work (peeling, grading, selection) **Examples:** ADPP	Some small-scale soy milk operations

3.2 Key Challenges

With only about 10% of produce across the 8 VCs processed today, there is a significant opportunity to increase processed volumes. However, a series of inter-related challenges constrains the growth of processors in the Nacala corridor. This has resulted in poor capacity utilization and low-quality standards, compounding the challenges even further. The major challenges facing processors in the Nacala corridor include:

- ***Access to capital (investment and working capital):*** Financing for the food processing industry/companies is one of the main constraints for the realization and growth of the sector. This is primarily due to high interest rates and is especially a challenge for single-season sectors where companies have to buy a year's supply at once, with high associated capital and storage costs. For many years USAID set aside a revolving guarantee facility for cashew procesors in partnership with the MIC and participating financial institutions. . Since that was withdrawn, no suitable mechanism has emerged that can adequately support small and medium-sized companies in this area. GAPI has several relevant products[30] but they are insufficient to meet the need. Many processors may still be struggling to organize their accounting and financing history. Interest rates for bank loans applied are high – starting from 15% - making investment unfeasible. And small producers (who constitute about 99% of farmers) have no access to credit

- ***Access to markets*****:** Access to markets is a bigger challenge for processors versus large trading companies selling bulk commodity products. SMEs are typically uncompetitive suppliers to supermarkets and international markets due to quality issues, lack of certification and lack of consistency of volume. Because these processors have weak market connections, their incentives and ability to invest in addressing these issues are reduced. For small/micro-processors, low purchasing power of consumers as well as a lack of marketing initiatives by the companies, negatively impact sales. These circumstances often force production to stop temporarily, jeopardizing the preservation of product quality and safety while in their possession (leading to e.g., reduced shelf life, spoilage, etc.)

- ***Access to labour*****:** Many SMEs struggle to hire staff with expertise in food processing and other relevant areas for the business due to the high salary costs involved. They typically hire their staff locally, without expertise in food processing, and with limited literacy and numeracy skills. This limits the SMEs' development and affects their capacity to grow. In the cashew sector, Mozambique has a higher technical and administrative labour cost: "due to stronger demand and less qualified and experienced people in Mozambique than in Asia, companies have to pay their technicians and managers a higher wage than in Asia. This phenomenon has been increasing recently by the growth of the extractive sector in Mozambique (Mining and Gas), which accentuates the demand for skilled and experienced workers."[31]

- ***Access to technology/ equipment*****:** A number of processing factories in Mozambique are still operating with obsolete technologies making it difficult for them

[30] Relevant GAPI products include: LCCA (line of credit from ICM for agricultural marketing); Danida Agri-Invest loan guarantee fund
[31] Competitiveness of the Cashew Industry in Mozambique, Nitidae 2020

to be globally competitive. Interviews with stakeholders in Mozambique indicate that most food processing companies use traditional, outdated and inefficient technologies. Cashews, for example, can be processed in different forms, but the technology is more or less standard worldwide and accessible through imports from India and Vietnam. Whilst some of the processing phases of cashew nuts are done manually (such as grading), and others automated, overall there appears to be low use of modern technologies, putting Mozambican processors at a competitive disadvantage. Many SMEs have financial limitations on buying machinery that could help them grow, while others lack information about technologies that can facilitate their work and where to find it. Technological upgrading is key for enhancing the international competitiveness of domestic firms and although there are existing programs to advance technology, it appears to be happening in silos, at a small scale, and not targeted at specific food industries. The largest share of Mozambique's import from the SADC region is machinery and equipment, mainly from South Africa.[32] See p. 41 for more details

- ***Access to packaging*:** The right packaging can add significant value to food products; it is a "purchase influencer" and enables entry to certain markets e.g., supermarkets. The low quality of packaging used by processors can be a gateway to poor competitiveness of Mozambican products placed on the market. Many managers look at packaging as an additional cost to the product rather than understanding the value and message it gives to the customer. Packaging material is imported from South Africa at high prices because the 71 companies that make up Mozambique's plastic and paper packaging industry do not satisfy the market needs, or its quality and safety standards. Most cashew factories depend on imported packaging, e.g., jute sacks and plastic wraps from India, and cardboard from Portugal. A study conducted by GAIN in 2016 found that the absence of a strong domestic packaging industry contributed to food price increases in Mozambique, with the cost of imported packaging reaching US$100 million dollars in 2016.[33] In the cashew sector, the cost of packaging is estimated to add an additional cost between 5 and 10 USD/MT of RCN processed in Mozambique compared to Asian countries (though Mozambique does have the advantage of being able to buy from South Africa; West African inputs are even more expensive, because the import cost is even higher)[34]

- ***Ability to source raw materials*:** Processors struggle with availability, affordability and quality of raw materials. A major challenge to processors being able to operate at good capacity utilization rates is their ability to source sufficient raw materials for processing. Even with sufficient working capital, processors can struggle to compete

[32] Developing Capabilities in Mozambique's Food Processing Sector - The Role of South African Food Processing Firms and Supermarket Chains, 2018
[33] Developing Capabilities in Mozambique's Food Processing Sector - The Role of South African Food Processing Firms and Supermarket Chains, 2018
[34] Competitiveness of the Cashew Industry in Mozambique, Nitidae 2020

with exporters – as well as informal traders and other processors – to secure enough supply, due to more limited buying structures or lower ability to pay for the product. In addition, quality is also often low, especially vs. imported crops. For example, the maize produced in Mozambique does not yet meet the standards sought by the processing industry to ensure quality and safety in the processing of maize flour. Marketing without quality is also a major challenge for farmers, as they have great difficulty in accessing demanding markets

- ***Quality standards*:** Formal markets are requiring increasingly high quality standards, demanding official requirements related to products and services. For example, all products sold to this segment must be clearly labelled and with different useful customer information.[35] This in turn puts pressure on processors to upgrade quality standards. All food handlers require concrete planning procedures at their sites as a way to ensure food safety and reassure the consumer that the food s/he is about to consume will not transmit disease. Product quality management and Quality Certification systems adopted by producer, processor, trader, etc. can open new and potentially more profitable markets; and can present an opportunity to organize all actors of the value chain and establish backwards dialogue – and opportunity for premium payments – with the farmers and farmer groups. However, although they may recognize the importance of assuring quality in relation to hygiene, food safety and good manufacturing practices, many food processing companies, mainly the SMEs, still struggle to develop products with high quality, maintain the quality in all the batch produced, and follow international standards. None of the processors visited by the study team in the Nacala Corridor were implementing food safety methods well. Their concern is to control only the visual aspects (e.g., colour, smell, appearance and humidity); know-how on more comprehensive management of quality and safety was lacking. Many processors would benefit from a comprehensive quality program and quality assurance work including and awareness-raising and training. Top management buy-in and leadership is essential to upgrade quality.

- ***Acquiring certifications*:** Significant assistance to factories is required to build up their capabilities to conform with product standard requirements, because non-compliance with the required requirements can be a barrier in the export of products to the most demanding countries. The national companies rely on international organizations to acquire the certification to be able to export their products. Due to the financial limitation, the SMEs struggle to get certified and consequently they are not able to export their products directly and compete with international brands. Some buyers of Mozambican food products occasionally request certification from a recognized body. Given that, there are limited accredited labs that can certify products,

[35] In contrast, in informal markets, people tend to buy what is provided to them without complaint. Products can be sold unlabeled and unpackaged.

companies tend to go through South Africa for certification. Firm interviews indicate that obtaining certifications from a third party is costly

- ***Technical capacity*:** Large and medium processors typically have required technical capacity; however, there is an opportunity to introduce appropriate monitoring and auditing measures, capable of managing and improving quality standards. On the other hand, small/microprocessors, while representing an opportunity for local people who cannot find jobs to generate income and sell into a market that absorbs their product, still need to further build their technical knowledge, and are constrained by lack of ability to innovate in their businesses. In the cashew sector, since the introduction of more automatic machines, machine technical knowledge has become very important, and helps in programming maintenance operations, which in these circumstances is a critical exercise. Cashew processing plants need semi-skilled labor for shelling, peeling and grading. They also need strong middle management to oversee the employees responsible for shelling and peeling; this oversight is critical for ensuring a high % of white whole kernels and high yields

- ***Environment and waste management*:** Producers, industry and processors should implement lines for safe handling and storage of waste, i.e., a waste storage and handling program for the purpose of maintaining good "environmental housekeeping" practices. This, to include all areas, container handling, empty drums, waste storage and handling, collection and transportation, waste treatment and disposal, waste minimization and energy conservation

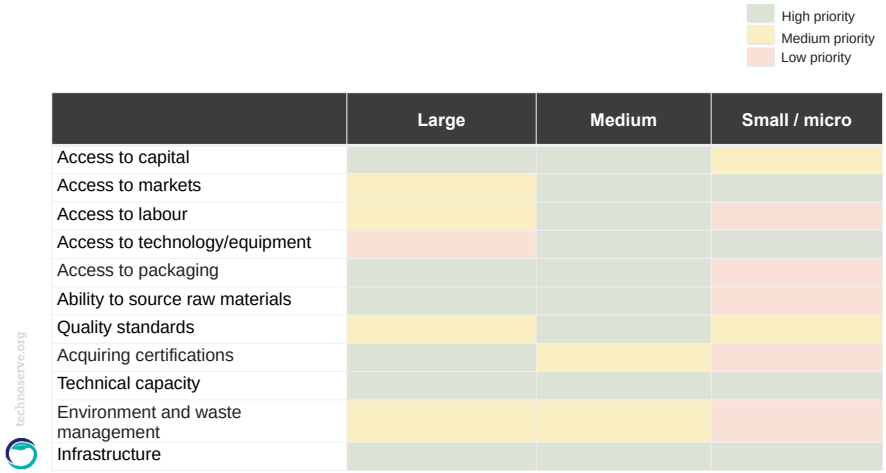
- ***Infrastructure*:** Underlying these challenges are various infrastructure challenges, including availability and reliability of energy (only 30% population have access to electricity, among the worst levels of access in the world)[36], and limitations of the road network (Mozambique has 969km roads per 1M people vs. an average of 2151km per 1M people in Africa)[37]. The lack of infrastructure facilities is hindering the growth of the food industry, this in particular relates to road and transport infrastructure in the northern regions of Mozambique which are key areas for production, transportation and trade of food products. There is also need for facilities to expedite border processes. This however requires coordination at a more regional level. A re-orientation of strategies that create an enabling environment for goods to be efficiently transported within the SADC region can significantly contribute to greater regional integration. Mozambique is strategically located to export through ports. Increasingly however, ports are not efficiently operated, yet serve as a viable alternative to road freight. This is a challenge that the Mozambican government is aware of and efforts are being made to expand the capacity and efficiency of port infrastructure and make the Mozambican

[36] World Bank indicators, 2020
[37] https://www.worlddata.info/africa/mozambique/transport.php

ports more competitive. In addition, there are few or no storage options for small/medium processors without their own silos and warehouses, adding to quality challenges especially aflatoxins

Some of these challenges are higher priority for some of the processor segments vs. others. For example, access to labor is typically not a constraint to small-scale processors, while acquiring certification is generally only a relevant challenge for medium-large processors. Some challenges like technical capacity are important across the board, though the specific needs differ by segment, e.g., from basic business and entrepreneurship training for small/micro-processors, to more sophisticated tailored technical advisory for larger companies. In Figure 19 below we lay out a prioritization to show in general what the highest priority needs are per segment.

Figure 19 Priority challenges by processor segment



Source: TechnoServe analysis

Figure 20 illustrates for some of the processors interviewed, where they see their biggest challenges and support needs.

Figure 20 Processor challenges and opportunities to support

Company	Products processed	Capacity	Key challenges
LARGE			
ETG Process Export	Export dried cereals and grains (pigeon pea and sesame)	100 ton of sesame per day 50 tons of pigeon pea per day	Access to packaging Technical capacity (sesame handling)
MEDIUM			

APIL Lda, Cuamba	Maize flour and soy oil, with soy cake byproduct to poultry sector	Corn flour – 60 tons per day; Soybean oil – 500L unrefined & 400L refined per day; Ration – 60 tons per month = 2 tons per day.	• Technical Capacity • Access to labor (women inclusion) • Quality Standards (set up a lab) • Access to new markets
JFS SAN, Cuamba	Export cotton fiber, process cotton oil, soy oil and groundnut oil. Potential to sell soy cake byproduct to poultry sector	20 tons of cottonseed oil per day 20 tons of soybean oil per day	• Access to markets (cotton fiber internally, groundnut and cotton oil) • Technical Capacity (seed certification) • Access to labor (women inclusion) • Access to packaging
PAN- Produtos Alimentares do Norte based in Nampula	Fortified maize flour for local consumption	More than 26,400 ton of maize flour per year	• Access to capital • Technical capacity (reduce electricity costs) • Access to packaging
Sunay Commercial	Process maize flour and commercialize locally	2.5 tons of maize flour per day	• Technical Capacity • Ability to source raw material • Access to packaging • Access to market • Access to labor (women inclusion)
Nacala Process, Nacala	Exports sesame to Japan; Europe; Guiné and Dubai	30 ton per day	• Access to markets • Access to technology • Access to packaging
PATEL Trading, Nacala	Exports pigeon pea to Dubai; Índia and Europe	30 ton per day	• Access to markets • Access to technology • Access to packaging
RAJAN Export, Nampula	Process maize flour and commercialize locally	100 ton per day	• Access to markets • Quality standards • Access to packaging • Access to capital
Moageira Ali, Nampula	Process maize flour and commercialize locally	20 ton per day	• Access to markets • Quality standards • Technical assistance
Rock Farinha de Milho	Process maize flour to commercialize locally	30 ton per day	• Access to markets • Access to technologies • Technical assistance • Access to packaging

Source: Processor visits and interviews; TechnoServe analysis

3.3 Key Opportunities

Through stakeholder discussion, a range of opportunities have been identified to help address the challenges outlined above. These opportunities include:

Access to capital (investment and working capital):

- Structure and incentivize affordable working capital financing for agro-industry; study mechanisms for a strong guarantee fund or facility to enable increased bank loans to processors for working capital and/or lower costs
- Develop specific financing solutions for smaller processors, and access to special finance for dedicated resources and process improvements, according to quality audit results[38]
- Assist processors with identifying and applying for finance; training on financial management and technical support to reduce the costs in production could help the SMEs to overcome this challenge in the long term
- Encourage business certification which can in turn enable access to finance through guaranteeing end markets leading to reduced interest rates and easier bank loans

Access to markets:

- Develop backward linkages between local SMEs and buyer firms (including international investors) through formal partnerships governed by a legal instrument to support local procurement and upgrading
- Connect SMEs with identified national and international markets and support them to meet the requirements to supply them
- Develop local service providers to train SMEs in packaging/labeling and marketing
- Provide technical assistance to SMEs to develop market strategies to reach new markets

Access to labour:

- Develop local service providers to train processor staff in relevant technical skills and personal / professional development
- Seek partnerships with local institutions to offer courses and short trainings in Food Science, as they are unavailable in many learning institutions

Access to technology/ equipment:

- Facilitate the identification and acquisition of affordable, suitable technologies (e.g., in cashew) and financing mechanisms which support increased ability to invest in improved equipment (e.g., leasing options)
- Facilitate premix and dosage device acquisition for flour fortification, for some processors that do not have them[39]
- Map and identify technologies developed at national level that can be adopted by SMEs

[38] These two opportunities depend on the interest of the financial institutions to engage on these solutions; assessing this was not part of this study and is being covered in a separate study

[39] In 2012 HKI, GAIN and PAM supported the investment. HKI did training and managed premix subsidy disbursements. GAIN, supported the premix micronutrients purchasing and also funded the mixing equipment purchase (in the prescribed ratio). Some companies that did not come forward at the time, lagged behind. Now they must invest because is a requirement.

Access to packaging:

- Develop packaging Industry Strategic Plan to further assess challenges and potential to support this sector
- Develop partnerships with other organizations with the same interest in strengthening the capacity of local packaging industries to improve quantity, quality and safety (e.g., International Trade Center, INNOQ, IPEME)
- Provide Technical Assistance (through local service providers wherever possible) to support packaging companies to develop high quality and safe packages for food products
- Create a packaging design, for a group of processors in the same area, that can be made from renewable or biodegradable packaging and is compliant with national technical packaging standards
- Support industry to advocate for government support to the development of packaging industry in Mozambique to support the needs of agro-processing SMEs; consider advocacy for short-term exemption from import taxes on packaging material for SMEs while the local industry grows

Ability to source raw materials:

- Support processors to build strong linkages with producers (including associations) developing structured contracts covering the desired quality and quantities; where possible, the processor should explore provision of price premium and technical support to farmers to increase quality and productivity, and to improve post-harvest handling and storage methods
- Build strong groups of producers capable of supplying the processors with the desired quantities; promote viable aggregation models and build trust among those involved
- Explore price stabilization mechanisms for corn so that processing plants can buy at good prices which avoid fluctuations and high final prices (ensuring that these do not negatively impact SHF prices and margins)
- Raise awareness where market requires a particular quality linked to seeds, e.g., pigeon pea quality is influenced by the type of seed used as well as rainfall patterns

Quality standards:

- Assist selected producers and processors with TA focused on implementing Good Manufacturing Practices, improving quality and safety standards and ensuring national legislation is adhered to; for example, provide customized support to SMEs to develop the PPR (Pre-Requirements Program) and Standard Operating Procedures (SOPs)in each step of the flowchart to monitor the hazards; ensure hygienic conditions in all places where food is handled

- Develop initiatives for aflatoxin control in Mozambique, e.g., through the creation of partnerships with producers, implementation of Good Agricultural Practices, quality certification etc.
- Work with AICAJU to generate and incentivize processor interest in tackling quality issues, especially by the smaller cashew factories (AICAJU's strategy is to certify all cashew nut factories with at least the HACCP system or another one that the company prefers)
- Support processors with implementation of food fortification requirements, including the development of a Code of Practice for food premix operations

Acquiring certifications:

- Provide guidance to cashew producers and processors about the quality assurance measures that should be implemented in their facilities, following internationally recognized standards such as GLOBALGAP (for producers), Hazard Analysis Critical Control Points (HACCP), British Retail Consortium (BRC), Food Safety System Certification (FSSC), ISO 22000:2018, ISO 14000:2018; and ISO 45001:2018
- Build capacity of local service providers to support cashew factories with implementation of quality pre-requisites (GMP, GHP, EHS) and certification requirements (e.g., HACCP) and to connect SMEs with national and international accredited institutions to obtain products certification (INNOQ at national level)

Technical capacity:

- Provide tailored hands-on technical assistance to processors (through local service providers wherever possible)
- Provide support to increase and improve the production capacity, quality, and efficiency of medium and small processors and help them to introduce product innovations/diversification
- Build capacity and encourage focus on key emerging end market opportunities, e.g., CSB
- Build technical capacity in fortification to support Government strategy

Note that in all cases, ability to capitalize on these solutions depends on interest and incentives of relevant market actors to engage in driving these solutions. For example, interest of the financial sector in engaging in financing solutions needs to be tested to understand feasibility of developing working capital solutions. Interest from processors in engaging with SHFs in win-win inclusive sourcing models also needs to be further tested; without strong commitment on the part of the processor, these models are unlikely to be successful.

4. Overview of Enabling Environment

Many of the challenges faced by the processors depend on the surrounding enabling environment; and fully addressing quality concerns and reaching potential growth rates also depends on the development of an appropriate supporting enabling environment. Below, we look at 4 aspects of the required enabling environment: (1) Research institutions and laboratories; (2) Training and capacity building institutions; (3) Equipment and materials suppliers; (4) Policy and regulation.

4.1 Research Institutions and Laboratories

In Mozambique, there are few institutions that do laboratorial analyses of food products. This is driven by a number of supply and demand-side issues. On the supply side, although some labs exist, their location is more concentrated in urban areas and distant from the companies that need their services, and even those that exist have internal problems, e.g., most of the existing labs face challenges in acquiring regularly the reagents needed to conduct the analyses, and also offer a limited package of analyses. Insufficient technical knowledge may also be a barrier to investment. On the demand side, the big companies and some medium companies have their own internal labs. Many small and medium enterprises, for different reasons (e.g., lack of will, lack of knowledge/information) do not value laboratory analysis of their products, and the smaller companies struggle to pay the fees to do regular lab analysis. The weak legislation in the area of food safety in the country also contributes to the low investment in facilities. The legislation does not require the food companies to have a quality management system or internal lab. Entities like INAE that audit the quality standards and micronutrient content usually request lab analyses for some products to check if they follow the recommended patterns in the relevant parameters.

At country level, the National Water and Food Hygiene Laboratory (LNHAA) is the institution under the Ministry of Health dedicated to the control of quality of food, water and environmental factors likely to cause harm to man, directly or indirectly. They focus on microbiological and chemical analysis on food and water; mineral elements; food additives; cosmetics; detergents and soaps, toxicology and entomology. Their central lab is in Maputo, and they have some small labs in the provincial capitals. Companies in the food industry hire their services submitting samples for various analysis. Most of their clients are large and medium enterprises in the south of Mozambique.

In the Nacala corridor, the UniLúrio lab (CEIL) on campus carries out microbiological, physical, chemical and nutritional analysis on food and water, seeds and animal food. They also focus on aflatoxins. Their major clients are agro-processors, millers, CDM, MOZAL, Smart Catering Nacala, interested students and individual clients, again large and medium businesses. Some small enterprises claim that they cannot afford the fee to do the analysis. Like the other labs,

CEIL works with 3 parameters, however, they want to work with all the necessary parameters so that the analyses are higher quality and their clients do not need to travel to other countries due to the lack of one or more analyses. Most of the agro-processors and millers look for their services to do analyses of maize, cooking oil and other products.

In the cashew sector, testing laboratories are not used by the majority of processors, even though some of them know the requirements for testing and final product laboratory analysis. The factories don't do these tests because their buyers don't ask them for the analyses.

There are other private labs (SWISS lab and ACT-UIS Lab Moz) that do food and water analyses, but they are costlier than the two mentioned above. The other government lab is the National Lab of Inspection of fish dedicated only to seafood products. The IIAM lab with their installation in the Veterinary Faculty-Maputo also do some analysis on food products, with a focus on poultry products and food. The academic institutions that provide courses related to food quality also own small labs operating for academic ends, which could potentially be scaled up to provide services at lower costs. Delivering laboratory analysis services for the private sector would strengthen the linkage between academia and the food industry, offer students the opportunity to practice by doing – solving food industry problems with realistic cases – and facilitate use of good machines and reagents to do analyses in the lab which is currently a constraint.

4.2 Training and Capacity Building Institutions

Only four courses in Food Science are currently offered in Mozambique and this limits the availability of professionals to cover the demand of Mozambique's food industry for talent. Many companies in the food industry end up hiring people that do not have a background in food processing, food engineering and/or quality, and this contributes to lower standards in terms of quality of final products that go to the market. Even when a company wants to install a quality system, they often struggle to maintain it without professional oversight. The four courses are:

- Universidade Eduardo Mondlane (UEM) – offering undergrad courses in Food Science and Technology (duration 4 years), located in Maputo
- Instituto Superior Politécnico de Gaza –offering undergrad course of Food Processing Engineering (duration 4 years), located in Lionde, Chókwé
- Universidade Zambeze (UNIZAMBEZE) – offering undergrad courses in Food Science Engineering (duration 4 years), located in Tete, Angonia
- Universidade Católica de Moçambique (UCM) – offering undergrad courses in Food Science Engineering (duration 4 years), located in Chimoio, Manica

Implementing quality improvements usually requires training management and workers. When workers understand that they are also part of the change planning and implementation

process, this allows for a greater likelihood of successful training implementation. Workers usually have experiences that can benefit the process of planning and implementing new ways in the factory, because they are closer to the processes. Understanding the reason for the changes they execute, for achievement of the (desired) product quality and services, they usually get enthusiastic and participate in the creation of the necessary new processes. Two key areas of training focus for training institutions are imparting useful information that serves productive supply capabilities and interpreting the standards and capabilities for use by processors in their operational areas. The former creates a basis for competition and the latter for compliance.

Training on QMS and related issues, such as GHP, GMP, 5S, GAP, implementation, or internal auditing, etc. is usually offered through an experienced consultant, while specific topics for certification (e.g., ISO, BRC, etc.) have to be done by the right institution (e.g. INNOQ, SGS, SABS, etc.).

Mozambique has no institution that give technical training in standards. Factories in the sector perform in-house training. They do informal on-the-job training. Other institutions and Universities offer general courses about food but not specifically prepared for these sectors.

4.3 Equipment and Packaging Suppliers

Equipment

The processing machines (mills) used by small grain processors (mainly micro-enterprises) are an "easy" technology and most of them are manufactured locally, from local materials and motors, which are not expensive, compared to the machines used by large industries. For example, cornmeal processed in a large factory always comes out clean. But with the cheaper machines used by microprocessors the product can come with bran, which is more preferred by certain people and is cheaper. Another example is the construction of simple mechanical equipment used for RCN grading in 4 types of measures: 18mm, 21mm, 24mm and 27mm, for micro or small processors.[40]

However, large processors usually import their machinery, e.g., from SA, China or India. For example, Pro Campo is a Mozambican agro-equipment supplier operational since 2005, with four shops in Maputo, Chokwe, Maxixe and Chimoio. Pro Campo targets small and medium firms with land prep, irrigation, agro-processing, renewables, agro-inputs and silos. Pro Campo brings in

[40] To make the grading machine, you need to assemble a square vat with four metal plates for sides and one for base, perforated with the measures, calculated for a capacity of 250 - 300 kg of RCN per hour and to adapt a crank for cylindrical drum rotation (also made of a circular plate on sides, mesh to allow the controlled exit of the nut to perforated base and bearings fixed to allow the rotation of the drum). The placement of a receiving box at the base, will allow the evacuation of the falling RCN which is collected for bagging and batch identification, before cooking. While the crank is not preferred, a small electric motor can be attached, with calculated rotation, and a switch to turn it on and off.

inventory for sale and can also import on an order basis; once the equipment is received, they typically reinforce / adapt locally for the local market / environment (e.g., painting, new screws etc.). Customers need to make 50% down payment and waiting time is approx. 90 days. They feel sourcing from SA ends up being more expensive than China. Pro Campo would like to explore financing options for purchasers of equipment; solving this would significantly expand the market for agro-processing equipment.

Maintenance and spare parts are an additional challenge. The internal maintenance program carried out by the agro-processor is a critical factor to equipment operating performance. Spare parts are available from the supplier. A recent study of the competitiveness of Mozambique's cashew processing sector highlighted Mozambique's higher cost of equipment, spare parts and inputs hurts their competitiveness: "as Mozambican processors need to import almost all processing machines, spare parts, most of their inputs and pay import taxes, their final cost is very disadvantageous compared to India and Vietnam, where most of them are available locally. Mozambican factories also need to create stocks of spare parts and inputs to avoid interruptions in supply, while Asian processors can easily and quickly find these supplies when they need them."[41]

Figure 21 Example equipment used by cashew processors and origins

Equipment name	Example suppliers
Automatic film peeling machine (250kg/h capacity)[42]	• Oltremare – Italy • Cao Thanh Phat • Export Import Co., Ltd Vietnam
Automatic shelling machine for small nuts (150kg/h capacity)	• BUDDHI INDUSTRIES PVT LTD – EDB Sri Lanka
Manual cutting machine (cuts from 90 – 97%)	• Muskaan – India • Gayathri Machinery - India
Vacuum packing machine	• Oltremare – Italy • Muskaan – Índia • Multivac - Egypt
Post-harvest treatment and packaging system	• Oltremare – Italy

Duties on imported goods range from 0 to 25%; duty on consumer goods = 20%; and value-added tax = 17%, levied at the time of importation. The weighted average trade tariff = 7.2%.[43] The Government's fortification program (The National Food Fortification Program – CONFAM - co-headed by the Ministry of Industry and Ministry of Health, designed by GAIN and implemented by WFP/HKI) – involving wheat millers, edible oil refineries, maize flour, cassava and sugar – supported the machinery purchase (during the first round) and is still currently offering VAT tax benefits.

[41] Competitiveness of the Cashew Industry in Mozambique, Nitidae 2020
[42] These machines have a peeling capacity of 250 kg/h, but they do not remove the film all at once, need to repeat the operation 2 or 3 times. These cycles produce breaks and breakage rate must me calculated, in order to know the yield
[43] Mozambique Country Commercial Guide, November 2022, International Trade Administration

Packaging

Packaging should be treated as a specific area that requires competence and education of food production managers, since it incorporates quality issues, related to people's safety and health. People use it in different situations, both in the preservation of processed and unprocessed food products and other non-consumables. Food products should not be packaged in expressionless plastic bags, or in unspecified cans and bottles. Only by improving their presentation, content and image they can appeal to all market segments and consumers, while complying with the formal and legal requirements of (food) labelling. The problem with national packaging, plastic or carton, lies in its high price and low quality. The packaging should attract the customer, must have good quality and proprieties that inhibit the growth of microorganisms. For example, cashew kernels are packed in plastic film and carton boxes for secondary packaging. Many other cereal-packaging sectors use transparent plastic film for packaging of products such as flour, beans, grain, rice, cashew kernels, peanuts, etc. Cardboard packages are produced by:

- CARMOC (Cartonagens de Moçambique) located in Maputo, especially for cashew processing companies
- INCEP is located in Nacala, a company that works with corrugated packages, converts papers to carton boxes
- NEOPACK is located in Durban, RSA
- TOPACK, in Maputo, food packaging products find great application mainly in secondary sugar, cereals, rice, and pasta. For example, "PP oven" bags (polypropylene) are used for food storages

There is an opportunity for FTF Premier to understand and catalogue the packaging needs of the northern processors and match against the capacity and interest in supplying this demand from the local packaging industry. Companies with potential can be linked with companies providing TA to help them to improve quality and address other business constraints.

4.4 Policy Environment

Food Processing Regulations

Mozambique does not yet have a single policy on food safety and quality; legislation with potential impact on food processing safety and quality of flour is scattered which poses significant implementation challenges. There is a lack of appropriate mechanisms for policy integration of quality standards and traceability issues. The policies and strategies that directly or indirectly can impact the quality and safety of maize, cashew, sesame and other products are consistent, albeit relatively general with respect to quality. A more detailed analysis to assess the complementarity of the different legal instruments, identify and eliminate duplications and

overlaps is needed. The various strategies and regulations with potential impact on food quality and safety include:

- **National Development Strategy (ENDE), 2015 – 2035:** Provides the framework for policies and strategies that guide investments with direct impact on food processing, and the structural transformation of the economy through industrialization
- **National Strategy for Food Security (**Estrategia de Seguranca Alimentar e Nutricional (ESAN)**), 2007 – 2015**: Access to foods that provide an active and healthy life[44]
- **National Strategy for Food Fortification (ENFA), 2016 -2021:** Is at the center of food quality and safety[45]
- **Strategic Plan for agricultural development (PEDSA), 2011 – 2020**[46]: Ensure certification of national laboratories to international standard
- The **National Institute for Standards and Measures (INNOQ)** has set standards for food in general and published norms on food fortification under the National Food Fortification Program (CONFAM), co-headed by the Ministry of Industry and Ministry of Health
- Minimum requirements associated with good hygiene, production and environmental practices are established by law (**Diploma 51/84: Regulation on food hygienic requirements**); in the licensing process, it is mandatory that inspection reports compliance with these safety and hygiene requirements stipulated by law
- Decree No. 15/2006 of June 22, 2006, approving the Regulation on Hygienic-Sanitary Requirements for the Production, Transportation, Commercialization, Inspection and Supervision of Foodstuffs
- **International agreements and treaties** that may impact the quality and safety of processed products in Mozambique are: Codex Alimentarius; Sanitary and Phytosanitary Agreement, IPPC international standards (plant health) applied to the import of corn/other raw materials; SADC Trade Protocol; other international standards and guidelines, e.g., HACCP

Compliance: Good food processing practices are voluntary. Knowledge and application of the legislation on the safety and quality of food processing by the private sector is still limited. In general, only industries with the intention/ambition to enter the international market are in the process of building the capacity of their industries to meet the internationally required safety and quality standards. For example, factories/companies that already have quality certification/s know exactly how to do their major actions, because they rely on known principles (which are evaluated by an external entity on regular basis) and understand the sense of quality. In a situation where the sloppiness starts to be noticeable, the risk (if there is no corrective action program) is to lose the quality certificate acquired, withdrawn by the certifying entity. In many countries the use of Good Manufacturing Practices is made

[44] Updated version not identified
[45] No updated strategy has been published yet
[46] PEDSA II and PNISA II are developed but not public yet

mandatory by legislation. Communication campaigns and dissemination of growth opportunities resulting from improved safety and quality systems in food processing can also be supported.

Additional voluntary certification systems include GLOBALGAP to producers, and Hazard Analysis Critical Control Points (HACCP), British Retail Consortium (BRC), Food Safety System Certification (FSSC), ISO 22000:2018, ISO 14000:2018; ISO 45001:2018. Although the application of the standards in Mozambique is not yet mandatory, factories recognize that their implementation (i) ensures compliance with good practice, (ii) uses correct standardized procedures, (iii) brings confidence to the consumer, and (iv) facilitates international trade.

Import/Export Barriers

Imports of maize/soy products impact the potential to develop local processing. For example, in the south of Mozambique, the poultry sector imports soy cake from South America more cheaply than they can process cake from beans transported from the center/north of Mozambique. Various policy proposals have been made to level the playing field for local processors, such as (1) standardized 12.5% import duties levelled for raw and refined oil; (2) 2.5% import duty on soy cake import; and (3) Export surcharge for soya, charged until national demand is fulfilled. It will be important to continue to watch for any changes in these areas during the lifetime of FTF Premier.

Exporters of raw or semi-processed agricultural products, in any cross-border trade, must observe the World Trade Organization (WTO) Sanitary and Phytosanitary (SPS) - Technical Barriers to Trade (TBT) agreements, though again there is a very low level of implementation of regulations in these areas due to inability or corruption. Alfândegas de Moçambique is responsible for the enforcement of legislation related to the import, export, and storage of goods, commodities, valuables, and the means of transportation while Intertek carries out pre-shipment inspections. Other relevant bodies are Ministério da Saúde, Instituto Nacional das Actividades Económicas (INAE) and MADER.

Concerning the cashew export tax, the proposed Revision of the Cashew Law is still in progress (Law No. 13/99, proposed by INCAJU for revision), but the Cashew Nut Surcharge is still maintained at the current level of 18%.

Investment Promotion

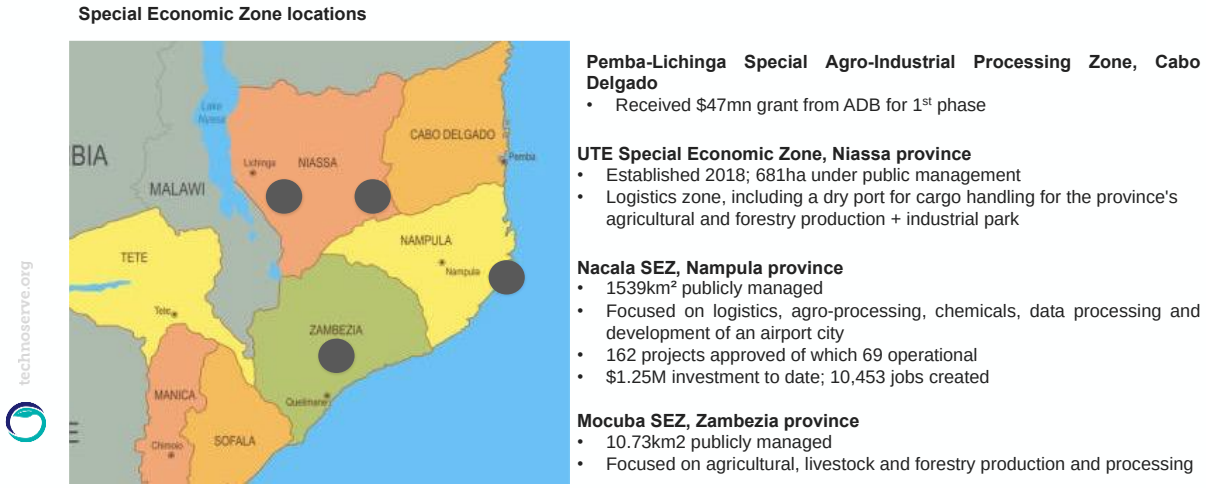
Mozambique's Investment & Export Promotion Agency (APIEX) was formed in 2016 via a merger of the Investment Promotion Center and Office for the Accelerated Economic Development Zones. It reports primarily to the Ministry of Industry and Commerce (MIC) but also to the Ministry of Economy and Finance (MEF). APIEX is responsible for the promotion and approval of new investment projects, export promotion services, and Special Economic Zone

(SEZ) regulation and development. Other stakeholders directly or indirectly involved in SEZ development include:

- MIC and MEF
- Federation of Mozambican Chambers of Commerce (FMCC)
- Mozambican Confederation of Business Associations (CTA)
- Donors (e.g., AfDB, WB, UNIDO)
- Private developers (e.g., Swiss-Mozambican consortium behind Beluluane Industrial Park)

SEZs including those in the Nacala corridor (see Figure 22 below) offer attractive tax and custom conditions but remain under-developed. SEZs can be either publicly or privately managed (on a PPP basis) – SEZs concessioned to private management are often more effective. For example, SEZ-based investors benefit from a full corporate tax exemption in the first 3 tax years of operation, a 50% reduction in from the 4th to 10th tax year, and a 25% reduction from the 10th to 15th year. In addition, companies based in SEZs are exempt from customs duties and VAT on imports of construction materials, machinery, equipment, accessories, spare parts and other goods essential to the pursuit of the licensed activity. (This exemption also applies to VAT over internal market purchases and transfers of goods and services made within the SEZ). Imports into SEZs are also exempt from customs tariffs and other customs duties. Such goods can be exempt of pre-shipment inspections. Exit of goods from SEZ to external markets is not subject to customs tariffs, if directly exported in accordance with customs transit regulations.

Figure 22 Mozambique's SEZs



Source: APIEX

SEZs in Mozambique are not yet proven, and new or recent SEZs in Nacala, Mocuba & Manga-Mungassa are underdeveloped, lacking adequately serviced industrial land connected to road,

water, power, drainage, telecoms and wastewater infrastructure. (APIEX lacks close relationships with local municipalities, Roads Commission, and power/water providers.) In addition, Mozambique lacks an autonomous regulating agency for SEZs that can independently approve projects and conduct proper master planning to protect investments, minimize land use conflict, ensure environmental safeguards, and guarantee quality supporting infrastructure/utilities. Instead, the functions of the regulator, developer, and promoter are all under the same roof at APIEX, creating conflicts and preventing a business and service culture. These gaps in institutional capacity and coordination make it hard for individual zones to stand up to the regional SADC competition.

5. RECOMMENDATIONS

Despite very low levels of processing today, the Nacala corridor has the potential to expand its agro-processing sector, which would create new job opportunities, improve opportunities for SHFs and stabilize the market. A vibrant and resilient agro-processing sector in the Nacala corridor will be characterised by a range of agro-processors, from large to small, offering a variety of nutritious and ethically-sourced and processed products and services to meet diverse of customer needs, within the Nacala corridor and beyond.

Recap of value chain prioritization

Overall, it is clear that the processing industry is most developed for the cashew, maize and soy value chains; as such, these three sectors offer the strongest potential to further develop agro-processing in the Nacala corridor given the range of existing players and the range of products being produced for both human consumption and animal feed. Maize and soy are very complementary, as they are often both used in key products including poultry feed and (niche but growing) CSB. Maize processing is growing fast, and – despite the general shift towards processing imported soy – there has also been growth in installed capacity for soy processing with the addition of 2 new soy oil factories in Cuamba. **Maize and soy** processing has the potential to be competitive within the Nacala corridor and to compete with "imports" from elsewhere in Mozambique. The maize and soy processing industries in the Nacala corridor are not currently able to competitively supply the domestic market in central/southern Mozambique or export markets.

In contrast, the **cashew** processing sector has been declining overall. The level of value addition has declined from processing 100% fully-processed kernels, to a share of the kernels being exported "skin-on". Many of the factories do not seem to be interested in upgrading their quality standards. As such, cashew represents a difficult opportunity, though we believe there is potential over the medium-term. A recent study into the competitiveness of Mozambique's cashew processing sector versus Vietnam and other countries concluded that "the cashew processing industry in Mozambique is competitive with the current public policy, but its

situation remains very precarious."[47] The strongest strategic opportunity for the Mozambique cashew sector is to position itself as a supplier of high quality, traceable nuts with a "story"; however, interest from processors in uniting around this vision remains to be seen.

Groundnut, sesame and beans offer interesting and high value niche processing opportunities. These have potential to expand and the ability to incentivize SHFs to produce higher quality raw materials through win-win business models which that offer stability, resources and/or potentially price premiums to farmers. These products are often already sold under high-end brands which stand for quality. Because these are CPG products with high margins and high quality standards, these opportunities offer the greatest potential for engaging SHFs in win-win business models. In contrast, a majority of processing in Mozambique's other key value chains is at the primary processing level where incentives to create these win-win sourcing models are typically the weakest.

Opportunities in **pigeon pea and cassava** seem to be limited, with just one potential opportunity in cassava with Black Gold / CDM.

Overall agro-processing support strategy

We recommend that FTF Premier supports 2 clusters of agro-processors:

- ***Nutritious foods for local consumption cluster*:** Key VCs for this cluster are maize and soy, linked also to poultry as a key source of animal protein (consuming maize/soy-based poultry feed). There could be potential also to include beans, groundnuts or other VCs depending on interest of processors (e.g., following East Africa growth in processing of beans products such as pre-cooked beans and flours for local markets). There is scope to support medium and small-scale processors with a range of assistance tailored to their needs and including both business and technical elements, including upgrading quality standards. A particular focus may be placed on developing innovative, new nutritious foods including CSB and soy milk. Support to small-scale maize mills will be an important element of supporting this cluster, promoting localised food systems which deliver nutritious foods to the rural communities. These small-scale maize mills, which often process cassava as well as maize, can be supported to improve the range of products and services they are selling to improve their business model and support their communities; additional products could be locally-fortified or nutritious blends of flours; provision of poultry inputs including day old chicks (DOCs) and simple feed to support local poultry micro-entrepreneurs. Links can be made to health and nutrition programs, and to institutional markets including school feeding programs.

- ***High-value products cluster*:** A cluster of processors developing high-end branded products for sale to niche markets in Maputo, South Africa and other export markets

[47] Competitiveness of the Cashew Industry in Mozambique, Nitidae 2020

should be supported to expand and upgrade their offerings. Key VCs for this cluster include cashew,[48] groundnut (aflatoxin free/ low aflatoxin) and sesame. TA could include: produce formulation support; marketing, branding and packaging design support; bringing processors together for peer learning support, exploration of joint branding and marketing initiatives, field study learning visits to other countries and relevant trade fairs. These products may be branded Made in Mozambique and linked to iconic images of northern Mozambique invoking its rich cultural history and beautiful landscapes; links with the local tourism sector may also be promoted.

The first cluster is likely to engage more SHFs and has the potential to create more jobs, stabilise local markets and improve nutritional status of people living within the Nacala corridor. The second cluster is likely to engage lower numbers of SHFs and support fewer jobs but has potential to deliver higher per SHF impact (incremental revenue).

Note that significant investment in addressing cross-cutting barriers such as a comprehensive initiative to develop the packaging sector or support of long-term research programs, is not the goal of FTF Premier. This kind of sector development work would be better carried out by national food processing support programs and initiatives which can engage higher numbers of processors including larger processors in southern Mozambique. This does not mean that FTF Premier should not make targeted investments in packaging as well as research, training, BDS services and finance as required to support the needs of processors in the Nacala corridor. FTF Premier should connect into, but not seek to drive, policy-making related to nutritious products including food fortification, food safety and quality standards. FTF Premier should also follow the process of SEZs in the Nacala corridor and explore on an ongoing basis any related opportunities to catalyse new investments, or link into relevant investments being made in these zones, e.g., new poultry investments.

Types of technical assistance provided

Technical assistance (TA) can be divided into “core business TA” and “inclusive TA”. Core business TA supports the processor business and includes support with finance, accounting, product development, marketing etc. Inclusive TA is focused on developing improved relationships with SHF suppliers, through win-win business models that improve processor economics while delivering value for SHFs.

Many small and medium-scale processors in the Nacala corridor have significant need for core TA and need to focus first on stabilizing and expanding their own businesses, before they can invest in their SHF suppliers. Key core TA needs include support accessing finance, especially

[48] We have not identified through this study a widespread interest in developing high-end, branded nuts; however, it could be worth exploring with the industry whether there would be broad industry appetite to invest in this kind of vision. If so, there could be opportunities for shared branding and marketing of cashew only, e.g., resurrecting Zambique brand or developing a similar brand and arrangement to the Zambique collaboration

working capital, support accessing markets and support accessing appropriate equipment and packaging solutions.

In general, it is only the larger processors – especially those processing higher value products – who can absorb inclusive TA. Provision of inclusive TA should begin with the development of an Inclusive Business Plan, which assesses the business case for the proposed improved sourcing model from the perspective of the processor and the SHFs. This analysis serves as input to a go/no go decision on whether to provide further TA to support the implementation of the new sourcing model; only models that offer significant benefits to both processor and SHFs, under a range of likely scenarios, should be supported.

The business case for the processor can be based on quality and/or efficiency. In general, the higher levels of processing have higher quality requirements alongside potential for efficiency gains. Elements of improved sourcing models might include more direct sourcing, improved aggregation models, premium pricing for improved quality standards, addressing post-harvest loss within the supply chain, and supplying agronomy assistance and/or inputs on credit (including specific seed varieties where desired).

Technical Assistance (TA) should be provided through a network of local, regional and international service providers. Where possible, FTF Premier should link with and leverage local institutions including Universities/labs and relevant government institutions. For example, Universities could be supported to develop relevant short training courses or consultancy services to meet industry needs.

While TA for larger processors will need to be tailored to their needs, support to small/micro-processors will need to be delivered in group format to ensure cost-effectiveness. Micro-entrepreneurship programs can be developed and run focused on maize mills but incorporating other relevant micro-processors in other value chains if/as these are identified during the process.

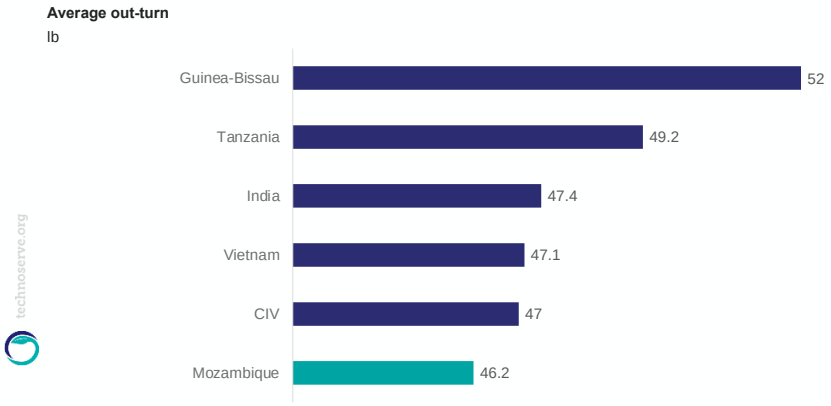
Processors who could be supported include:

- ***Maize*:** Winnua (CSB producer); BIVE – maize (micro company); Muthozane in Quelimane; small-scale “service provider” mills
- ***Cashew*:** Cajú Ilha Angoche; Cajú Ilha Lumbo; Agrico Marketing; ETG Korocho; ADPP; Indo Africa

APPENDIX 1 – CASHEW QUALITY STANDARDS

Out turn test: All factory managers, exporters or importers need to know how much kernel they get from a given lot. The calculation takes into consideration processing standards that will be useful for quality control in different steps, such as kernel yield after shelling, moisture loss, oven moisture loss in peeling, content after peeling, etc. Not all factories do the out turn test, especially the small ones. According to data, gathered from a TNS study, Mozambican cashew nuts are at an average of 46.2lb[49], comparable to other cashew producing countries – see Figure 23 below.

Figure 23 Comparative out-turn values of different countries



Source: TechnoServe

***Yield*:** In the processing industry the main technological variables, such as size, yield, film and cotyledons[50] are the basis for expected yield. As per technical specifications, they influence kernel final properties and process yields, since larger nuts usually have lower yield. Figure 23 illustrates RCN industrial processing yields; the size is referred to special large whole, SLW, with 160 - 180 kernels/pound weight.

Figure 24 RCN industrial processing yields

Size	Yield (%)
Large	18
Medium	22
Small	24
Lower	26
Avg	23

Source: TechnoServe

[49] Mishra, S.; Martin, W., 2016. "Mozambican Cashew Industry Analysis", TNS.
[50] A primeira folha que surge no embrião de uma planta fanerógama. https://www.todamateria.com.br

At an industrial level, the intended kernel quality starts with these ratios, in which the coefficient ratio “kernel weight/nut weight” gives guidance on yields to be obtained. Another RCN evaluation indicator is the kernel count, which measures RCN/kg. A lower kernel count corresponds to larger kernels, which generally command a higher price. Nuts from different harvests or from different places should not be mixed, as they create problems with control system, traceability and final product quality classification. In practice, due to lack of good internal organization, all kernels (from different batches) are mixed, especially when they reach peeling stage, where their origin is no longer identifiable and the tracking process becomes almost impossible. This is a problem occurring in almost all visited factories.

Grading: The final product is graded mainly on color, size and shape. Each Grade has its own definition: White Wholes, Scorched Wholes, Dessert Wholes, White Pieces, Scorched Pieces, and Dessert Pieces.
For Wholes, broken kernels and kernels of the next lower grade shall not together exceed 5% m/m at the time of packing. For scorched whole seconds, slightly shriveled kernels may be permitted. For pieces (butts, splits, bits), a tolerance of up to 5% of the next lower grade is permissible at the time of packing.

Shelling: The average of broken nuts in shelling is between 7 – 10%. A sample of 1kg roasted nuts should be tested to measure total output of wholes and broken kernels.

Selection: The % value of processed kernel has limits of 12 - 21%, and is determined by the quantity processed in selection, scraping (which decreases the desired quality and makes more broken kernels appear) and existing stocks.

APPENDIX 2 – SMALL/MICRO MAIZE PROCESSORS

Figure 25 Maize micro processors, Nacala corridor

No.	Factory	Address	Capacity	
			installed (ton/year)	Actual (ton/year)
1	BLUE SKY-LDA	Nampula	75	TBC
2	Abwe Anzuruni	Napipine, Nampula	50	TBC
3	Moagem-António	Meconta	20	TBC
4	Farinha Star Chima	Nampula	25	TBC
5	Top Talento	Nampula	30	TBC
6	Paróquia de são Pedro de Napipine	Napipine, Nampula	50	TBC
7	Abasse Dremane	Nampula, Bairro Namicopo	20	TBC
9	Moagem Ussene	Namialo	15	TBC
10	Moagem Adriano	Namialo	20	TBC
11	Albino José Salomão	Nampula	15	TBC
12	Arco Aliou	Nampula	20	TBC
13	Moagem Essiaca	Bairro Triângulo, Nacala-Porto	35	TBC
14	Farinha Star Chima	Nampula	25	TBC
15	Moagem- Nacute Ussene Anli	Bairro de Naherenque, Nacala	20	TBC
16	Moagem Fátima	Nampula	15	TBC
		TOTAL	**435**	

Source: MIC database

APPENDIX 3 – PROCESSOR PROFILES

Winnua[51] Lda

Company Overview:

Ownership: Private
Location: Mocuba City in Zambézia province
Sector: Grains
Portfolio: Maize, CSB

Business model:

The Company produces a high-quality, low-cost porridge made from local materials, a porridge consisting of maize meal, maize bran and soya (corn-soy blend, CSB) at a cost of 100.00Mt/kg. CSB is a blended food designed as supplementary food to meet special nutritional needs, as it contains high protein, vitamins and minerals.

Challenges/Opportunities:

Christopher Tham, a Swede, serves as Managing Director. A staff of qualified middle and junior manager and the company's local partner is a former Rector of Eduardo Mondlane University (51% shareholder).
Winnua original and long-term strategy was to plant teak. It remains involved in this and plants about 10 hectares of teak each year.
Winnua buys corn, processes it and sells it already packaged and labeled. The main product is high quality maize meal, offered to the market in 25, 10 kg and 1 kg bags, and also sells bran to be used in animal food, through its own store in Mocuba, though retailers and wholesalers in Zambézia and Nampula provinces.

Production:

- Its product line has capacity of 1 ton per hour and will be upgraded with the introduction of the new product. For the CSB production Winnua buys soybean from wholesalers for a price of 30 - 35 MT/kg. Now is busy with a yellow maize grain for CSB trial. Prices of soybean are at 25kg = 660 Mt; 10kg = between 290 to 300 Mt.
- Actual end product:
  Trends - 60 ton (breakeven)/month;
  Needs for 60 ton = 85 ton of raw material; For 12 month = 1028 tons; Actual = 10 ton CSB/sale;
- Winnua has a list of suppliers for maize and are presently working on educating them, when it comes to quality of the maize grain;
- Currently, Winnua has been working with 1,000 small producers and in 2022/23 campaign the plan is to reach 2,000 producers. It has more technical intervention, close to the "lead farm", who is the one that makes direct connection using the "survey solutions" system (program financed by USAID) that allows each technician interact with 100 producers at a time, through the development of a questionnaire that has to be answered by them, regarding the reception of the raw material and quality.
- The bran and germ is a by-product that is sold as animal food at low prices to animal food producers. The grain consists of 25-30 % of bran and germ;
  The production facility is clean and equipped with electricity and production equipment, as well as the warehouse.

  Markets: Nampula, Beira, Chimoio, Gaza, Maputo

  Responsibility - Winnua multiplies seed corn and sells it to small farmers. These, in the end, sell the corn to the factory for processing

  Perspectives:

  - To grow, as it intends to introduce yellow corn into marketing, in the hope that the market will respond positively;
  - Winnua is thinking about introducing new CSB production method in a more professional way. But the desire is to make natural yogurt. This project will only start in 2 or 3 years.
- GIZ is assisting with the implementation of HACCP, until the middle of next year;
- Export: W is organizing the necessary bureaucracy for exporting its products to potential interested parties, as they already have contacts in the market of potential interested parties in their products (they work with a company called APIEX).

[52] October 25, 2022. Type of Entry: General Manager.

Company Overview:	***Business model:***
Ownership: Private **Location:** Quelimane City, Zambézia province **Sector:** Grains **Portfolio:** Maize	Muthozane is a small corn flour processor established in Quelimane city, about 20 years ago, providing milling services to customers, as needed.

Company overview:

Production:

The purpose is also to get to know the existing link between the small processors and Industry processing, as well as the ways of working in the segment, without neglecting the quality of the corn brought by the clients for milling. Another point, no less important, is to know the truth about the "quality of the Zambézia maize," which is being said somewhere that has "low quality," compared to that of Niassa.

Muthozane owns two brands of packaged maize flour: "Zana" and "Muthozane". Now he is busy searching information, regarding agricultural inputs that can assist him in processing and productivity.

He provides corn and cassava milling services to family-owned customers. He has an electric mill with a milling capacity of 20 ton/day and 4 production machines: two for husking and two for flour. The processes include: husking - introduction of the corn into the machine - milling - reception (packaging, in case it is your own production).

Wet milling: There is low services for cassava milling, due to the dust that comes during the milling process (needs humidification). In 50 kg of cassava, there is a waste of 7 to 10 kg; In corn the waste is 2 kg. For either case, it has no recovery/control system, and the quantities in dust are spread around, resulting in sanitation and cleaning problems (GMP and GHP implication). Two main advantages of wet milling (besides dust reduction), which were not known to the mill owner until our discussion and teaching, are:

- Higher volume capacity inside the mill; and
- Lower energy consumption.

- Milling service charges are: 1 kg = 50.00 Mt; 10 kg = 400.00 Mt; 25 kg = 960.00 Mt;
- **% of family labor**: 98% (16 Workers – 13 M; 3 F); **% paid**: 10%

Challenges / Opportunities

- No quality standards implemented;
- His ambition is to modernize and expand its facilities, to acquire larger machines with better production volumes;
- He aims to implement quality management systems and good production practices, as well as training to improve the product quality and safety;
- He does not know the Mozambican standards, and neither a dosing device or premix for food fortification. Perhaps this is a challenge and a necessary reflection to the sector, in the search for more comprehensive solutions to this segment.