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Banana and Fruit Exports from Nacala

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Banana and Fruit Exports from Nacala

Supporting the Policy Enabling Environment for Development (SPEED)

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CONTENTS

EXECUTIVE SUMMARY 2
ON THE PROJECT TEAM 3
BACKGROUND 4
BANANA AND OTHER FRUIT CROPS ANALYSIS 5
BANANA: JACARANDA OVERVIEW AND POTENTIAL EXPANSION 7
OTHER POTENTIAL CROPS OF INTEREST 9
MANGO 9
AVOCADO 10
LYCHEE 12
PINEAPPLE 14
MELON 15
CASHEW 17
DRAGON FRUIT 18
PROCESSED PRODUCTS 19
SHIPPING, LOGISTICS, AND THE PORT OF NACALA 21
DEMAND FOR SPECIALIZED SHIPPING SERVICE 21
SUGGESTED ROUTE MAP (THROUGH NACALA/PEMBA TO SALALAH) 22
ESTIMATED GENERAL CARGO VESSEL PURCHASE AND RETROFIT COST 26
MARKETS OF INTEREST 28
MIDDLE EAST 29
EUROPE 31
INDIA AND CHINA 32
STAKEHOLDERS OF INTEREST 33
WESTFALIA 33
PRATIVITA 33
ELITE AGRO 34
SHABEEL 34
VISION 35
OWNERSHIP 35
FINANCING 35
DRIVER OF CHANGE 36
ASYAD GROUP 37
KEY RECOMMENDATIONS 37
ADDRESSING INVESTOR CONCERNS 37
JOINT PRESSURE TO IMPROVE PORT COSTS AND EFFICIENCY 38
"LAND GRANT" UNIVERSITIES 40
GLOBAL GAP CERTIFICATION 40
IMPROVED TRADE AGREEMENTS WITH INDIA AND CHINA 41
MINIMUM PRICE POLICY FOR CASHEWS 42
TECHNOLOGIES FOR ADAPTION TO CLIMATE CHANGE 42
IMPROVING GENDER EQUALITY IN AGRICULTURAL INVESTMENTS 43

TABLES AND FIGURES

Tables

Table 1 Comparison between select crops 6
Table 2 Current commercial producers of fruit in Cabo Delgado and Nampula 8
Table 3 Comparison between commodity shipping and specialized service 21
Table 4 Total transit time and fuel costs comparison between routes 26
Table 5 Initial investment per vessel purchased 26
Table 6 Monthly operating costs per vessel 27
Table 7 Middle Eastern Region top customers 29
Table 8 Middle East Region Customers' Historical Banana Volumes 30
Table 9 India imports from Mozambique in 2020 32
Table 10 Common concerns raised by investors 37
Table 11 Cost per container to export from Nacala 38
Table 12 Cost per container to export from Santa Marta in Colombia 39

Figures

Figure 1 Banana production in Jacaranda 8
Figure 2 Ngowe mango 10
Figure 3 Hass avocado 11
Figure 4 Launch of lychee commercialization campaign in Barue, Manica 12
Figure 5 Lychee 13
Figure 6 Pineapple 15
Figure 7 Brazilian "Dino" melon 16
Figure 8 Cashews 17
Figure 9 Dragon fruit (white flesh) 18
Figure 10 Suggested route map 22
Figure 11 Port of Salalah Regional Services 23
Figure 12 Proforma for Pemba - Salalah - Pemba 25
Figure 13 Proposed carousel operating model 28
Figure 14 Five drivers of change of Shabeel's approach 36
Figure 15 Example of local dam in a Chinese banana farm in Cambodia using solar power 42

EXECUTIVE SUMMARY

Developing a fruit strategy includes at a minimum, what can be grown at the chosen location, how can the product be sent to the destination market, and if the product can be sold at an acceptable return to the grower. But each of these questions has many more considerations behind them. In addition to producing healthy products that can be grown with minimal environmental impact using a gender balanced workforce, fruit growing operations can create significant employment in an area. This is especially true for products such as bananas, pineapples or coconuts, which can be harvested year-round and therefore create significant permanent employment. Other fruits require peak labor in harvest periods but still require year-round employees who maintain the crop production requirements.

There are several areas in the world where fruits for export are grown despite the presence of armed conflicts. Banana and or pineapple operations in Northern Colombia, Mindanao Philippines, Ivory Coast and Southern Somalia have all been able to operate despite local armed conflicts. These operations have provided employment to men and women who otherwise may have no alternative employment opportunities other than joining one side of the conflict.

This report consulted with individuals with experience in developing fruit operations, from both the multinational corporate sector, and private investors. One of the largest investors in agriculture with more than two decades of experience in Africa and elsewhere was consulted for his opinions as well as other experienced companies who are currently developing startup up operations in Mozambique.

No fruit strategy can be developed without including the critical components of a target market, and how the fruit would be delivered to that market in a timely manner that ensures that the quality of the fruit meets the buyers' requirements. Buyers in the target markets should first be consulted as to what fruits are in demand, at what time of the year and how much volume is required. These are critical questions to ask before farms are planted and should be an integral part in the crop selection process, including the hectarage to be grown and therefore the size of the needed workforce. There are already competing fruits in global markets so being able to clearly answer the question "Why is it a good idea to grow (a selected crop) in Northern Mozambique?" is a necessary first step to commercial and social success.

In addition to fresh fruits, processed fruits can also be part of the fruit mix if enough volume can be produced to offset the costs of the required processing plants. Examples of potential processed fruits from Northern Mozambique would be mango for juice and coconut water. Processing plants usually require a large workforce which is often composed of significant numbers of women at all levels of the organization and can often be supplied by a large number of small growers, once they understand the requirements for export fruit.

In addition to the fruit mix and target markets, logistics plays a crucial role in the fruit strategy in being able to get the exported product to the target markets at the lowest possible cost and within a time that allows the fruit to maintain the quality required by the markets. Therefore, shipping routes and transit time from the source to the discharge port are crucial to any fruit strategy. In "normal" times, a fruit producer may contact an existing logistics company with a request for a quote from a loading port, required transit time limits to maintain fruit quality, and destinations port or ports. Unfortunately, in present conditions that isn't possible for Northern Mozambique. Shipping lines have withdrawn their regular service from Nacala to go to more profitable routes. Although they will likely return, there can be no guarantee that in future, they won't decide to leave again.

ON THE PROJECT TEAM

The project is very fortunate to have Vino Kumar, a former ship captain with advanced studies in maritime logistics as a key member of the team. Vino has experience with banana transportation in other parts of the world and brings a creative solution to the logistics issues. In addition to the fronthaul (what the ship carries when sailing from the port of origin), also important in a logistics strategy is the concept of backhaul: what the ship can bring back to the port of origin, so that the ship is full both on departure and return. This helps lower logistics costs, while maintaining the required shipping time parameters for the fruit. In some cases, such as when the fruit farms may not yet be totally developed, and fruit volumes are still low, the backhaul, what could be brought back to Northern Mozambique from destination ports in the Middle East area, could be more cargo than the front haul of fruit products. This helps make smaller fruit volumes at the start of a project more feasible from a cost perspective. Vino, along with other team members, has developed a logistics plan for the fruit using his experience.

Jake Walter, who has decades of experience in Mozambique was able to initiate discussions with a Somali based company who not only may be able to provide the ships but could also be potentially interested in investing in agriculture in Northern Mozambique. Jake's involvement in the project has been invaluable given his experience with various local officials and in country knowledge. Potential investors in agricultural operations will want to know what opportunities there are for new investors as well as what the requirements are for social and environmental protection. They will also want to know who they would turn to in case of issues with water or land title rights.

Buck Keiser is familiar with what new agricultural investors in a country look for, as he was formerly Senior Vice President of Global Sourcing for Chiquita and met Jake during those times. Along with African investors they started the banana project which is now named Jacaranda. For this project they were able to obtain a list of all of the major fruit buyers in both the Red Sea and Persian Gulf as well as their contact information and approximate volumes of bananas that they buy annually, which is included in the report. It is suggested that at least initially, these buyers be the target market.

Shelsea de Oliveira, a volunteer consultant located in Mozambique, was invaluable in surveying and collecting data from the current commercial fruit producers in the provinces of Cabo Delgado and Nampula.

Finally, the help of Iris Yan, who formerly was with McKinsey & Company São Paulo and has previously spent time on the ground in Mozambique, was invaluable. Without her assistance we couldn't have completed this report.

BACKGROUND

Over the past decade, Mozambique has proven itself to be able to commercially produce high quality tropical fruit at a low cost, specifically in bananas. The industry has also shown resilience in effectively mitigating diseases by introducing tolerant varieties and adopting a set of sustainable cultural practices that further limit the impact and spread of Panama and other diseases in bananas. USAID was instrumental in identifying the potential of the banana industry in Northern Mozambique; in assisting the initial investors with feasibility studies and timely matching grants; and in training young fruit agronomists and funding visits of Mozambican public/private "learning" delegations to leading banana producing countries like Costa Rica. USAID also played a critical role in facilitating an ongoing dialogue between investors and government.

Jacaranda Agricultura has taken up an anchor investor role for bananas in the north, taking over from the previous Matanuska banana plantation that suffered from Panama Disease. This anchor investor is critical as it not only signals to other potential agriculture investors that Mozambique is an attractive location for ag-investment, but also helps develop the fruit value chain in the north, thus driving up export volumes which is critical for shipping lines to make Nacala a port of call. Jacaranda has worked to address possible diseases, grow bananas, hire thousands of workers, and secure export markets in the Middle East, currently producing about 40 containers of export quality bananas per week. However, shipping industry dynamics due to COVID-19, challenges around the Nacala Port and other business environment issues have been challenging Jacarandas business model lately, potentially forcing Jacaranda into bankruptcy as well as the loss of thousands of jobs. At a time when domestic extremism challenges the north and threatens further southward expansion from Cabo Delgado into Nampula, keeping valuable formal sector jobs may help to keep the violent extremism from expanding southward and seeking to ensnare a vast swath of unemployed population.

The development of stable fruit crops for export can potentially increase local employment directly and indirectly, impacting the lives of people in the region. Research has shown that agricultural exports are long-term determinants of economic expansion and a unit increase in agricultural exports can bring more than a proportionate increase in the country's GDP. Research has also suggested that "national economic development, mainly international openness, can moderate terrorism"[1]. Hence, the successful development of an export fruit chain in Northern Mozambique has the potential to help decelerate further terrorist advancement, an important factor to consider given the current political context.

The purpose of this study is to provide technical assistance to APIEX, MIC, MTC, APPACC and MADER to:

(i) assist Jacaranda to develop responses to the shipping and logistics challenges in order to export bananas;
(ii) identify demand and address investment obstacles to attracting other fruit industries to the region to create employment and increase demand for shipping lines to return to Nacala;
(iii) raise the issue to the Government of Mozambique in order to work collaboratively to address agriculture export issues in the north.

This study will also propose a viable solution to the export logistic problem producers in Northern Mozambique face. In addition to the low export volumes that make it difficult for Nacala to become

[1](Keefer and Loayza, 2008) "Terrorism, Economic Development, and Political Openness", Cambridge University Press, ISBN 9780521887588

a port of call, current events have drastically reduced the number of shipping lines passing through Nacala Port.

BANANA AND OTHER FRUIT CROPS ANALYSIS

The objective of this section of the report is to highlight some considerations in the crop selection process based on the specific conditions in Northern Mozambique. Job creation is an important driver. Initial data on inland transportation rates and port operation costs indicate that current local rates for these services may not be competitive with other locations that may be competing with Northern Mozambique fruit in future. If these costs continue to be high, other offsets in the value chain need to be identified to make the fruit from Northern Mozambique competitive in delivered cost to the target markets.

One major consideration in developing a fruit strategy is the time from planting to first harvest, which varies from less than a year in bananas to about five years or more in mango and other fruits being considered. The long planting to harvest times would mean that a new operation may not have any cash flow for several years until the first harvest, which might make an operation with long first harvest times more difficult to finance. Often an existing fruit operation may diversify into a second crop using the positive cash flow from the existing crop to finance the new crop and eventually diluting fixed costs of the operation.

Another important consideration in deciding on crops for a new farm or adding on fruits to an existing farm is the harvest season. Some crops, like banana, oil palm and pineapple, can be harvested year -round. Other crops such as avocados have two harvests a year; a principal harvest and then a secondary harvest months later. Coffee and cocoa have just one primary harvest during which labor needs on the farm increase dramatically. When the harvest is over there is usually a reduction in labor force. In Central America the labor force migrates with the harvest, across borders sometimes. In the Chilean grape harvest season, workers migrate from North to South of the country based on harvest dates, and in Ivory Coast, workers harvesting cocoa come from neighboring Burkina Faso and Mali to Ivory Coast for the cocoa harvest. This can have social implications especially for families with children as to schools and health care. Provisions for farm worker housing and meals are part of the cost of the operation in these cases.

The labor instability and the social ramifications help the case for farms to have either a year-round productivity, such as banana or pineapple farms, or to have more than one agricultural activity at the farm to provide labor stability rather than having workers move on to look for other opportunities once the harvest has been completed. Since bananas provide that consistent harvest and packaging year-round labor demand, indirect labor that provides services to the banana operations, such as stores, banks, regional transportation services and others result in community development and a stable economy. Cities such as Guayaquil in Ecuador, Limon in Costa Rica, San Pedro Sula in Honduras, Davao and General Santos in Mindanao, Philippines, and Santa Marta in Colombia all developed around banana operations. In some of these locations, bananas or pineapples are now a smaller industry as other nonagricultural business opportunities have opened up.

Gender balance and environmental awareness are issues that have become more top of mind in agricultural operations around the world. These issues will be considered in our crop recommendations.

There were three main criteria for the crop selection: agricultural suitability, logistics viability, and market.

Another idea to consider in a fruit strategy development are opportunities with nontraditional fruits in Mozambique as supermarkets worldwide continue to increase their fresh fruit offerings, especially with fruits that are perceived to be healthy. In the United States, Europe and China, from a rather limited seasonal selection of fruits years ago, there has been an increasing variety of fruits, now available year-round because of cold chain improvement in long distance transportation and increased conscious about the health benefits of fresh fruit. Today, fruits such as rambutan, lychees, mangosteen, several varieties of mango and dragon fruit can be found in supermarkets in places like Montana, which is not considered a cosmopolitan location. Mozambique may want to consider trials in some of these newer global offerings, such as dragon fruit, to identify potential fruit opportunities and advantages in seasonality or quality of some of these new fruits for future exports.

Using the aforementioned criteria for crop selection, the most interesting fruit crops for the North of Mozambique are bananas, mangoes, avocados and lychees. The table below shows the major fruits of interest and a summary of the rationale behind their inclusion in the shortlist.

Table 1 Comparison between select crops

Fruit	Time to harvest (approximate)	Advantages	Disadvantages
Banana	11 to 12 months	• Already being grown at Jacaranda. • Additional area available near current side ready for planting. • More suitable land in Cabo Delgado, near Mocimboa da Praia. • Creates at least 1.3 full time jobs per hectare.	• Bananas require about 5cm of water a week, rainfall or irrigated. • It's not a small farmer crop, and requires at least a USD 20-25k/ha of investment and a packing station • It's a mature global market with many competing countries that are often located closer to target markets.
Mango	3 to 5 years	• There are plenty of native mangoes already available. • Its harvest is counter-seasonal to India's and Pakistan's.	• The market is very sensitive to acceptable varieties
Avocado	3 years	• Demand for Hass avocados is expected to grow in the future. • There's already a producer in Manica (Westfalia).	• Logistics from Lichinga to Nacala port remains a challenge.
Lychee	5 years	• It's mainly a small farmer crop. • Madagascar trees are aging. • There's already a producer in Manica (Westfalia).	• Logistics from Lichinga to Nacala port remains a challenge.

Pineapple	18 months	• Existing demand from the Middle East • Dole was previously interested in Matanuska's production	• Not a smallholder crop
Melon	100 days	• It has a short plant to harvest cycle. • Mozambique can produce off-season melons for Middle Eastern markets.	• It would be a new export crop in Mozambique. • The rainfall pattern could mean that its harvest would not be in the best export market windows.
Cashew	3 years	• It's a high value crop. • Mozambique is a traditional exporter.	• Current exporters are facing logistic challenges due to container shortage and bad roads.
Dragon fruit	2 years	• There is market demand in South East Asia. • Mozambique may provide counter-seasonal supply. • There is a possibility of taking advantage of existing shipping to Singapore from Port of Nacala.	• It would be a new export crop in Mozambique

BANANA: JACARANDA OVERVIEW AND POTENTIAL EXPANSION

Jacaranda Agricultura Group[2] employs 1400+ people across its operations in Mozambique and produces food for export and for the local market. The company seeks to build sustainable farming enterprises, supporting local economies and development and creating employment for local communities.

Jacaranda Agricultura has taken up an anchor investor role for bananas in the north, with over $40 million invested, taking over from Matanuska, that suffered from Panama Disease and high leveraging. Jacaranda currently produces around 40 containers/week of bananas on 750 hectares, and has additional 2000 hectares of irrigated land available for plantation.

As an anchor investor, Jacaranda is essential not only as it signals to other potential agriculture investors that Mozambique is an attractive location for agricultural investment, but also helps develop the fruit value chain in the North, thus driving up export volumes to attract shipping lines to make Nacala a port of call. Jacaranda's demise would imply not only on the loss of a thousand jobs, current employees at the farms, but it would also set back many years of development in the region, repeating Matanuska's history.

A recent survey of the current commercial producers of fruit in Cabo Delgado and Nampula shows that Jacaranda is the largest commercial fruit farm located in the North of Mozambique and the only one with conditions to export.

[2] http://www.jacaranda-agricultura.com/index.php/jacaranda-agricultura-group/jacaranda-agricultura-lda

Table 2 Current commercial producers of fruit in Cabo Delgado and Nampula

Producer	Crop	Province	Hectares in production	Full Time Employees	Part Time Employees
Veggie Basket	mango	Cabo Delgado	10	4	5
Agropecuaria Joaquim Ferreira Canas	mango	Cabo Delgado	20	15	10
Horpec	pineapple	Nampula	300	25	45
Naicuru	lychee	Nampula	30	20	5
Jacaranda	banana	Nampula	750	1000	
Total			1110	1064	65

In addition, Jacaranda Agricultura Group has played a leading role in pioneering research and efforts to tackle the spread and impact of the Panama TR4 disease affecting bananas in the region. Its soil improvement techniques could be transferred to smallholders as well as other banana plantations in the country.

Figure 1 Banana production in Jacaranda

While banana is a mature global market with many competing countries that are often located closer to target markets, Mozambique has many advantages that could justify the expansion of its production:

- Mozambique can take advantage of its counter-seasonality as many banana exporters are located in the Northern hemisphere.
- Banana is currently the fruit with the highest export volume.[3]
- Jacaranda has successfully developed meristems and techniques to prevent the spread of the Panama disease.

[3] MADER, Inquérito Agrário Integrado 2020.

- Mozambique's climate is slightly dryer than other banana producing countries, hence its bananas require fewer pesticides and fungicides, which in turn get washed away less with rain. This would allow Mozambique to export higher priced, organic bananas, in the future.[4]
- Mozambique's "central" location places it closer to the Middle East and Europe than its Asian counterparts, while on the other hand it is closer to Asia than its Latin American counterparts.
- Late Dr. Panfilo Tabora, a distinguished professor of Earth Univesity in Costa Rica, had previously identified[5] around 6.000 hectares of land near Mocimboa da Praia, Cabo Delgado, as the best land for banana production in Mozambique.
- As each hectare of banana plantation employs around 1.3 FTE year-round, the 2,000 ha of additional available land from Jacaranda and the 6.000 ha near Mocimboa da Praia have the joint potential to create 10,670 full-time jobs. Given that the indirect job multiplier for bananas is around 2.5, the total impact of making the suitable land productive would be 26,675 jobs.

Therefore, the export fruit strategy in Mozambique could be rolled out in three main phases:

(i) Short term (1 to 2 years): in which the banana industry is strengthened by increasing its production, coupled with the creation of an alternative logistic solution in response to the global shipping crisis; at the same time the planning of other crops such as mangoes, avocados, cashews, and especially fruits that are already been planted in Mozambique or short-term crops can start

(ii) Mid-term (2 to 5 years): in which banana's production efficiency is improved with training and technology, thus reducing its cost and farm gate price. Once banana export volumes are large enough, more shipping options will be available as larger and more conventional companies will be willing to make port calls. This competition should help lower shipping costs and benefit the exporters. At this stage the planting of other crops may start.

(iii) Long-term (over 5 years): in which crops that had been planted in the initial phase should be ready for harvest, and Mozambique's export volumes would allow for new export crop trials.

OTHER POTENTIAL CROPS OF INTEREST

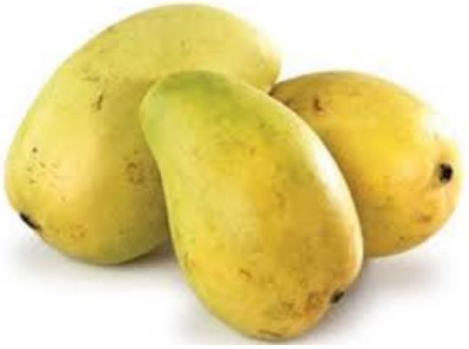
MANGO

Mango is natively grown ubiquitously in Mozambique, and the mango tree is also more climate-resilient than other crops. Mozambique could also take advantage of its harvest being counter-seasonal to India and Pakistan's. That is, the right mango variety in Mozambique would be counter seasonal to production in India and Pakistan and therefore could fill an empty space for mango supply to Middle East markets during the Mozambique mango harvest season. The "Rodo" cultivar in Mozambique is similar to Kenya's Ngowe, but the global market is very sensitive to acceptable varieties, and new varieties might take more time to establish themselves. Hence, the recommendation is to first process the mango into pulp until commercial production in Mozambique becomes more mature.

[4] Going organic from an existing farm is complicated due to the transition phase. It would be easier to start a new farm as organic.

[5] Personal communication to Jake Walter.

Figure 2 Ngowe mango[6]



Mango is one of the common fruit in most continents, particularly in Asia, Central and South America and Africa. Global production of mangoes is concentrated mainly in Asia and more precisely in India which produces an average of 15 million tons a year. Mangoes are now growing in more than 100 countries of which more than 65 countries produce each more than 1,000 million tons a year. Total world production of mangoes is about 40 million tons which played an integral part in the lives of many, not only by being a rich nutrient source but also as a source of livelihood for millions of peoples in the tropics. Mangoes were not commonly known among the consumers outside the tropics before 1960s and there was virtually no trade of fresh fruit. In recent years, mangoes have become well established as fresh fruit and processed products in the global market. World demand for mango is ascertained to be increasing particularly from temperate countries where mangoes are rapidly gaining in popularity. Leading importing country is the United States and in the European Union the leading countries are Netherlands, France, England, Portugal, Spain, Belgium, Denmark, and Sweden. Apart from India, other major producers of mango are China, Mexico, Thailand, Indonesia, Pakistan, Philippines, Nigeria, Brazil, Peru, Australia, South Africa, Malaysia and Venezuela. India's major marketing season is April to July while harvesting continued for 8-10 months a year in Brazil, Columbia, Kenya and Venezuela. The season is also quite long in Burkina Faso, Costa Rica, Indonesia, Jamaica, Mexico, Nicaragua, and Puerto Rico. There are many mango varieties grown in different countries; India alone has nearly 1,300 mango varieties (20 grown commercially) and Thailand has about 100 varieties.

Mexico (February-October), Venezuela (November-August), Colombia (September-July) and Puerto Rico (February-November) produced mangoes for 8-10 months a year while in Asian countries the normal harvesting seasons lasts for 4-6 months. The peak harvesting season in India is between April-June (some cultivars harvested in July and August). The peak harvesting period in Pakistan, Philippines, China, Thailand, Indonesia and Bangladesh is between April to June/July; however, out of season production by flower induction is also in practice in Thailand and Philippines well as in many South American countries, noteworthy in Brazil.[7]

AVOCADO

The rationale behind suggesting avocado as a crop of interest for Mozambique is mainly due to the fact that avocado is a fruit whose global demand is expected to keep growing in the foreseeable future, and the existence of a multinational avocado producer in Westfalia. Westfalia could expand its production in Manica if it could export to China and India, and it would be able to plant in

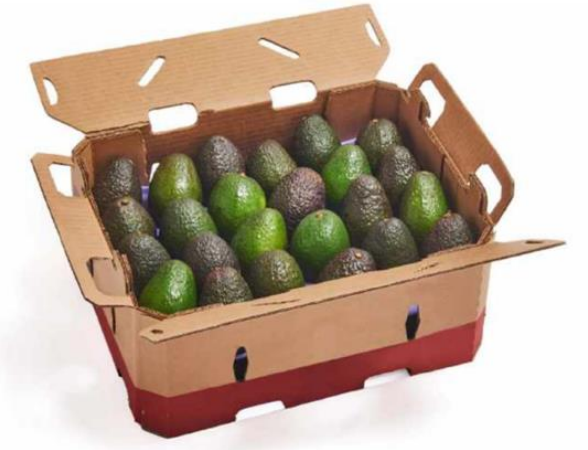
[6] Image source: https://agrowthtradeinternational.com/product/ngowe-mango-per-pc/ (accessed December 14, 2021)

[7] S.K. Mitra, Mango production in the world – present situation and future prospect, 2016. DOI 10.17660/ActaHortic.2016.1111.41

Lichinga as well were it not for the logistical challenges. During our interview, Mike Jahme of Westfalia specifically expressed the need for support from the local country government to establish protocols to be able to export Mozambique avocados and lychees to Chinese markets.

At the end of the 2009 avocado season, approximately 693,000 tons of avocados were exported around the world. In 2019, the number of avocados exported was 2,140,000 tons. The majority of this increase can be accounted to the increasing demand for avocados around the world and worldwide understanding of the benefits the avocado provides[8]. The global Hass avocado market is projected to register a CAGR of 4.8% during the period 2020-2025.[9] Hass avocado is the most popular variety of avocado in the world. In the United States, per capita consumption of avocados, with more than 95 % constituted by Hass avocados, has tripled since the early 2000s, according to the USDA. Hass avocados, native to Mexico and Central America, are now grown in many countries across the globe. Mexico, Peru, Chile, and Colombia are the major avocado exporting countries in the world.

Figure 3 Hass avocado[10]



Some African countries have been making major strides with their export levels of avocados. South Africa, Kenya and Tanzania are the three countries that have notable export levels. South Africa has been a key contributor to the world supply of avocados over the past ten years. With average export levels around 40,000 tons of avocados during that period. However, in the 2018-19 season exports peaked to 90,000 tons, putting South Africa in fourth in export volume for the 2018-19 season. Kenya is also another African country to take a large leap over the past season increasing from 47,000 tons in the 2017-18 season to 75,000 tons in the 2018-19 season. This pushes Kenya into the sixth spot for avocado export volume in the world. The latest country in the rise is Tanzania who only started exporting in the 2009-10 season with less than 100 tons exported for its first three years of exporting. The past ten years has seen great increases for the small producing country, rising to 6,000 tons in the 2018-2019 season.

Mexico is a major producer and exporter of Hass Avocado. The export volume of Hass avocados is facing an increasing trend owing to the increased demand from the neighboring countries as the consumption increases. Similarly, the value of the export is also anticipated to increase during the forecast period. Mexico has the largest cultivation area in the world. With an area of 218,000

[8] https://industry.nzavocado.co.nz/world-avocado-market/
[9] https://www.mordorintelligence.com/industry-reports/global-hass-avocado-market
[10] Image source: Hass Avocado Board, Avocado Quality Manual – a guide to best practices

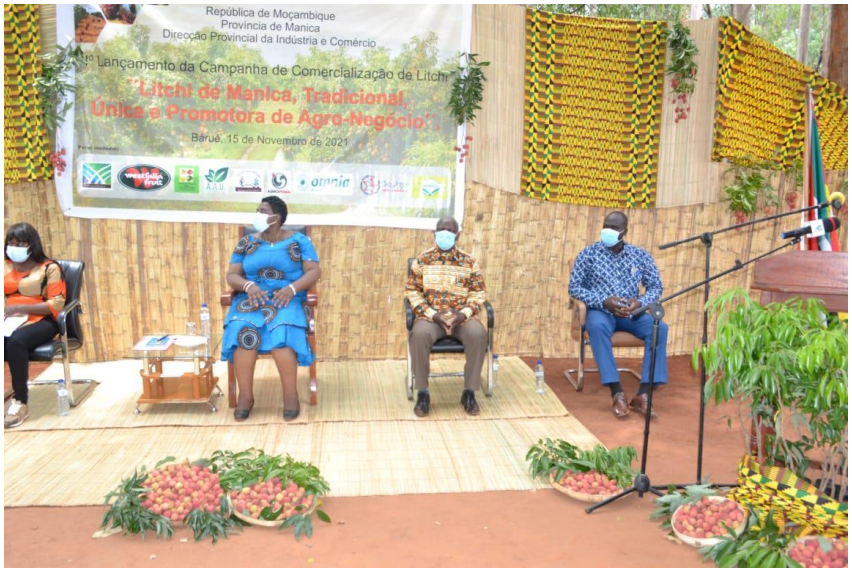
hectares planted towards the end of 2018, it represents between 55% and 60% of the world's planted surface area of the Hass variety of avocados.

North America remains the world leader for importing avocados at 52% of the world's imports, with the majority of imports coming from Mexico, followed by Peru, Chile, Dominican Republic and Colombia. The European market is the second largest importing market in the world importing 684,232 tons of avocados in the 2018-19 season, equating 33% if the world's imports this and has more than doubled over the past 6 years from 307,358 in 2013-14. The main country contributing to the import amount is the Netherlands. They are the second largest importing country in the world accounting for 400,999 tons of avocados in the 2018-19 season. The European Union imports its majority of avocados from Peru, followed by Chile, Southern Africa and Israel. Due to its geographic location a large and varying number of countries, supply the Europe Union depending on market demand. The Asian market contributes to 7% of the world's imports of avocados. Japan is the main consumer of the Asian market, and is the seventh largest importer in the world. However, the two countries whose demand is increasing the most are China and South Korea.

LYCHEE

The inclusion of lychee in our shortlist is due to the fact that lychee is mainly a small farmer crop, hence its production for export would improve the livelihood of many smallholders. This has already been proven by Westfalia, an international avocado company that has found lychee was already been grown in the surrounding communities of their farm in Manica, Westfalia then leveraged local familiarity with the crop and built a successful outgrower project which currently involves 200 smallholders.

Figure 4 Launch of lychee commercialization campaign in Barue, Manica



Lychee trees require temperatures around 15°C (or lower) to flower successfully. A period of dry weather at this time can also assist cropping. Once trees have set fruit, warm weather with good soil moisture is usually associated with heavy yields. Cropping is thus limited to areas with some cool weather before flowering. Production is very erratic in the true tropics where night-time temperatures seldom fall below 25°C. The majority of the industries are thus based in areas with night-time temperature falling below 15°C. Lychees can be grown on a range of different soil types, including soils with a pH ranging from 5 to 8. In very acid or alkaline soils there can be problems with iron, zinc, boron and other nutrients. The soil must be freely draining, although the trees can

tolerate a wet profile for part of the day. Tree health and production are probably best with sandy, sandy loam and clay loam soils. Heavy clay soils are best avoided.[11]

In 2016, the total European lychee market was around 25,000 tons annually, with Madagascar providing roughly 80% of it.[12] Low rainfall and aging groves of lychee trees are now negatively impacting productivity of lychee in Madagascar, and the former Minister of Agriculture of Madagascar believes that[13] lychee should do well in Northern Mozambique, with the harvest season coinciding with a high lychee demand peak in the UK around Christmas time, as has been the case with lychee from Madagascar. This opens an opportunity for Mozambique to become a competing supplier in the region. Other than Manica, it is likely that lychees could also be produced in Lichinga. However, further detailing of soil and climate and verification of local vegetation would be necessary to determine suitability of the region.

Lychee is indigenous to Southeast Asia and makes a significant contribution to the lives and economic health of many millions of people in the Region. The species originated in southern China and northern Viet Nam, but has now spread to most countries that experience a sub-tropical climate for part of the year. The crop is most important in China, India, Viet Nam, Thailand, Bangladesh and Nepal. There is also interest in Australia, the Philippines and Indonesia. Production in the Asia-Pacific Region accounts for more than 95 percent of world cultivation, at about 2 million tons. Most of the fruits are sold fresh, with a third of the crop dried in China, and limited processing and canning. The bulk of the crop is produced by smallholders with less than 100 trees each. Orchards with more than 1,000 trees are rare, except in southern China where there are single plantings of more than 10,000 trees. The fruit has a high value, and can significantly add to the income of smallholders.

Figure 5 Lychee[14]

The global lychee market is projected to witness a CAGR 3.5% during the forecast period (2020-2025).[15] China, India, and Vietnam are the major producers of lychee in the globe. According to the International Society for Horticultural Science (ISHS), China ranked first with a production volume

[11] M. Papademetriou and F. Dent (editors), Lychee Production in the Asia-Pacific Region. FAO Thailand, March 2002
[12] https://www.theguardian.com/sustainable-business/2016/jan/28/lychees-madagascar-exotic-fruit-lifeline-farmers-poverty
[13] Personal communication to Buck Keiser.
[14] Image source: MADER, Inquérito Agrário Integrado 2020.
[15] https://www.businesswire.com/news/home/20201208006005/en/Global-Lychee-Market-2020-to-2025---Growth-Trends-and-Forecast---ResearchAndMarkets.com

of 2,000.0 thousand metric tons, followed by India and Vietnam with 677.0 thousand metric tons and 380.0 metric tons, respectively; in 2018. Vietnam has become the second-largest exporter of lychee despite its smaller output when compared to China and India. This is majorly due to favorable climatic conditions and seed quality, which has led to better fruit quality resulting in an increase in imports. Around 98-99% of the lychee produced in India is domestically consumed.

China and Vietnam are the two major exporters of lychee. According to the International Society for Horticultural Science (ISHS), Southeast Asian countries accounted for 19% of the global lychee market in 2018. China is a major producer and an exporter who accounted for a major market share of lychee exports from China. According to Litchi Cooperative, Guangdong, the cooperative has exported lychee valuing around USD 10.0 billion in 2018.

The United States, Canada, and Europe are the major importers of lychee which accounted for 80% of China's lychee export market in 2018. Vietnam was the second-largest exporter of lychees during 2018. The major reason for the increase in exports of lychee is the increasing demand for Vietnam's lychee due to the better fruit quality when compared to India and China, the largest lychee producers in Asia during the same period.

PINEAPPLE

Pineapple plants flower 12-15 months after planting and the fruits become ready 15-18 months after planting depending upon the variety, time of planting, type and size of plant material used and prevailing temperature during the fruit development. The fruits are harvested for canning purpose when there is a slight change at the base of developing fruits. The fruits used for table purpose are retained till they develop golden yellow color.[16] The same plant can do another crop in twelve months, and then it needs to be replanted. A pineapple farm is managed in blocks based on fruit age so that one can have continual harvests. The dry sunny climate of Mozambique reduces disease pressure as long as there is water available for irrigation.

The pineapple market has changed quite a lot over the last few years. Costa Rica has grown to be the main producer of pineapples, overtaking the Philippines and Brazil. In 2018, the total produced volume was 28.3 million metric tons and the export of fresh pineapples was valued at USD 2.1 billion. The top producing countries in 2018 were Costa Rica (3.4 million metric tons), Philippines: (2.7 million metric tons), Brazil (2.7 million metric tons), Thailand (2.1 million metric tons), and Indonesia (2 million metric tons).

Both the supply and the demand for pineapples have been rising. The demand has been rising continuously. The increase in demand is not evenly distributed over the fresh and canned pineapple market. The total value of exported fresh pineapples has increased by 11% between 2014 and 2018, while the total value of exported canned pineapples has decreased by 13.3% in the same period. The total value exported for fresh pineapples in 2018 was 2.1 billion USD. The total quantity exported was 3.9 million tons. The main exporters in 2018 were Costa Rica (1 billion USD, 49.6%), Netherlands (207.2 million USD, 9.9%), Philippines (192 million USD, 9.2%), Belgium (108.4 million USD, 5.2%), and USA (90.3 million USD, 4.3%).

The total imported value of fresh pineapples in 2018 was 2.7 billion USD, or 3.6 million tons. The main importers were USA (725.9 million USD, 26.6%), Netherlands (202 million USD, 7.4%), China

[16] http://nhb.gov.in/report_files/pineapple/PINEAPPLE.htm

(182.7 million USD, 6.7%), Germany (156.9 million USD, 5.7%), and Spain (144.5 million USD, 5.3%).[17]

Figure 6 Pineapple[18]

With a history rooted in pineapple plantations, Dole Foods has become the world's largest producer of fresh fruit and vegetables. Recognized by its Dole label on bananas, pineapples, and tropical produce, the company boasts some 200 food products that are sourced, grown, processed, marketed, and distributed in 90-plus countries.[19] Dole Foods has previously considered Mozambique as a Southern hemisphere supply source, and was investing in trials with Matanuska. Unfortunately, the Dole Matanuska Pineapple Project was discontinued when the company filed for bankruptcy. With the presence of new agricultural investors, nothing prevents Dole from investing in and buying from Mozambique again. Mozambique, as a Southern Hemisphere source, will have a peak different from the Philippines. In addition, the country is also located closer to the Middle Eastern markets.

MELON

The rationale for the inclusion of melons in the shortlist of suggested crops for Mozambique is due to the fact that melons have a short cycle from plantation to harvest, of around 100 days. The fruit can provide better cash flow returns for the investors, whether smallholders or large commercial enterprises.

In 2019 the top exporters of Melons were Spain ($849M), Mexico ($539M), Brazil ($269M), Netherlands ($220M), and the United States ($207M). In 2019 the top importers of Melons were the United States ($807M), Germany ($450M), France ($323M), Netherlands ($241M), and United Kingdom ($219M).[20]

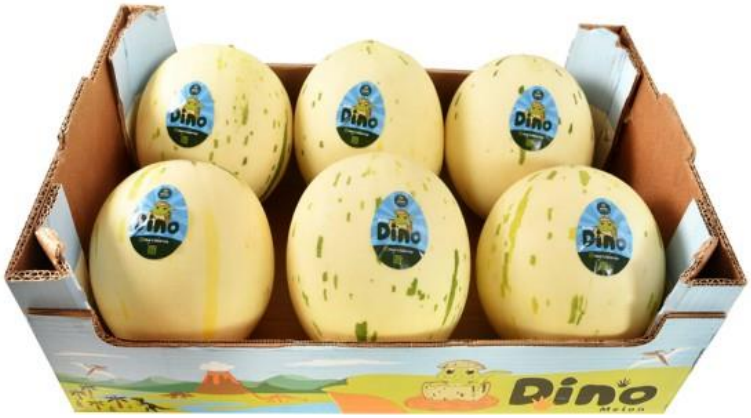
Melons grow best on well-drained, sandy loam soils, with a pH between 6.0 and 6.5. Soils with a pH less than 6.0 will produce plants with yellow foliage that set few or no fruit. Melons perform best in hot, sunny locations with fertile, well-drained soils.[21] It requires on average temperatures from 18 to 35°C, while soil temperature should not fall below 18°C. Most commercial melon varieties can be

[17] https://www.tridge.com/stories/global-market-update-pineapple
[18] Image source: Dole Matanuska Pineapple Project, November 2016
[19] https://web.archive.org/web/20130116165632/http://biz.yahoo.com/ic/10/10303.html
[20] https://oec.world/en/profile/hs92/melons
[21] https://extension.umn.edu/fruit/growing-melons-home-garden#soil-and-fertility--1139160

harvested 78-90 days after transplanting. Harvesting can only be made through hand scissors or knives. After harvesting, melon growers plow and destroy the remaining of the crop. They may also rotate the crop, in order to control diseases or prevent soil from depleting. As a general rule, one should avoid growing melons in the same soil for more than two consecutive years. Generally, muskmelons have high water requirements, but watering the foliage has been linked with diseases outbreaks. Excess humidity in general may favor the development of pathogens such as Powdery Mildew. On the other hand, water-stressed plants are more susceptible to diseases. The most commonly used irrigation system is drip irrigation.[22]

One variety of interest could be Brazilian "Dino" Melon, which is being exported to China by Brazilian business Agricola Famosa[23]. Famosa is the largest exporter of Brazilian melons, exporting huge volumes annually around the world. In 2021, Famosa exported their first container of melons to China, and Dole China was responsible for the repackaging, promotion, and distribution of Brazilian melons which will be sold in Sam's Club China. The arrival time of Brazilian melons supplements a gap in the domestic supply season, as it coincided with the low production period of the Chinese domestic melons, with only a small volume of Hainan melons still available. Second, only a small number of countries have permission to supply the Chinese market, including Myanmar, Kyrgyzstan, Uzbekistan, Brunei, and Brazil. Myanmar primarily supplies large volumes of average quality melons to China. The other three countries struggle with transport and product quality, with only small volumes shipped to the Chinese market, which provides a great opportunity for the Brazilian 'Dino' melons in the Chinese market. [24] This indicates that exporting to the Chinese market has huge potential, but requires additional effort to tap, an issue we will discuss later in the Key Recommendations section.

Figure 7 Brazilian "Dino" melon[25]



Melons would have a good price window from February to late May, which falls between Brazilian and Spanish harvest seasons. This would ideally require the dry season for melons to lie between December and April. Unfortunately, this time period coincides with Northern Mozambique's rainy season. Mozambican melon harvest would happen during the mid-year months and it would not be in the best export market windows.

[22] https://wikifarmer.com/growing-melons-outdoors-for-profit-complete-growing-guide-from-start-to-finish/
[23] http://www.agricolafamosa.com.br/produtos/373-2/
[24] https://www.freshplaza.com/article/9379254/first-brazilian-dino-muskmelons-will-reach-china-in-early-december/
[25] Image source: https://www.freshplaza.com/article/9379254/first-brazilian-dino-muskmelons-will-reach-china-in-early-december/ (accessed on December 14, 2021)

CASHEW[26]

According to Carlos Costa's 2019 report "The Cashew Value Chain in Mozambique", "Mozambique has a low average yield of raw cashew nut of 3 kg/tree. The latest census of agriculture in 2015 estimated that 1.33 million households owned cashew trees. Another 30,000 households were involved post-harvest. One-half of raw cashew nut production sold was processed in 2015, up from 1/3 in 2008. A large share of cashew exports are raw nuts, mostly "informal" (no tax). In 2017, national production was only two-thirds of 1972, when Mozambique was the world leader in cashew exports. An export tax was imposed on raw cashew nut exports in 2001, currently 18% of the F.O.B. price, to promote domestic processing. Key challenges for production include replacing aging trees with improved root-stock and stepped-up anti-fungal spraying. Industrial processing now comprises 15 factories employing 17,000 workers, 57% of whom are women.

Main recommendations are: a multi-stakeholder Platform to periodically review cashew developments; smallholder participation in producer organizations; privatization of seedlings distribution and tree-spraying without subsidies; public and private commercial infrastructure (warehouses, transportation, access roads); accessible international market and technical information; using cashew shells to generate energy; using cashew apple to produce packaged fermented beverages; and a cross-Ministry push on food safety protocols for cashew."

Figure 8 Cashews[27]

Currently cashew processing in Mozambique is not as profitable due to the fact that: (i) processors in the northern hemisphere have been purchasing raw materials from Mozambique during their countries' off-season in order to keep their factories running all year round, making cost of raw material high for Mozambican processors; and (ii) the quality of Mozambique's raw cashew nuts is poor, reducing processing efficiency. It is recommended that Mozambique continues to focus on improving the quality of the raw material in order to increasing farmers' income, with initiatives such as private run nurseries. In order to avoid a previous situation in which there was a collusion among international raw cashew nut buyers due to the lack of competition from local processors (a situation that might reoccur if existing factories shut down), a minimum price policy could be considered. Government protection of local processing factories is not advised, as this type of policy

[26] References for this section: Carlos Costa, The Cashew Value Chain in Mozambique, 2019 International Bank for Reconstruction and Development / The World Bank.

[27] Image source: https://www.hivenetwork.online/2021/06/the-mozambican-raw-cashew-nuts-processing-sector-is-under-pressure-how-hiveonline-can-strengthen-small-holder-farmers-position-through-mycoop-online/ (accessed on December 14, 2021)

proves harmful to the farmer. However, a minimum price policy needs to be well designed in order to avoid placing Mozambique out of the international market, while at the same time guaranteeing a fair price to the grower as well as encouraging productivity improvements.

DRAGON FRUIT[28]

Dragon fruit is suggested due to its relative short growth time from plantation to harvest, and its popularity in South East Asia. The crop is suitable for the northern climate, and Mozambique could provide a counter-seasonal supply to northern hemisphere growers such as Vietnam and the Philippines. In addition, there is still a weekly shipping service between Singapore and Nacala that could be leveraged to transport the fruit to its Asian market. However, being a new export crop, investors might not know the best land for its production, and the country would be in lack of agricultural technicians familiar with the fruit.

Dragon fruit are sweet fruit from cactus plants in the genus Hylocereus and Selenecereus. Dragon fruit can also be referred to as pitaya, pitahaya or strawberry pear. Another cacti fruit that goes by the same common name pitaya is from the genus Stenocereus. Fruits from the genus Stenocereus look similar to dragon fruit; however, they are rounder and have a sour flavor. Dragon fruit is primarily grown for the fresh market and is often sold through specialty stores and farmers' markets. The fruit also has good potential to be processed into many products, thus adding value. These processed products include energy and fruit bars, ice cream, jelly, marmalade and preserves, juice, pastries, pulp, and yogurt. The juice of the red varieties can also be used as a natural food colorant and dye, and, when unopened, the flower bud can be cooked and eaten as a vegetable.

Figure 9 Dragon fruit (white flesh) [29]

Dragon fruit are native to Mexico, Central America, and South America. Many species of Hylocereus have been recognized, but there are still issues about correct identification. The main two species grown for commercial production include Hylocereus undatus, which has fruit with bright pink skin and white flesh, and Hylocereus sp., which has fruit with bright pink skin and varying hues of pink flesh. Both have multiple varieties. Selenecereus megalanthus is another dragon fruit grown for commercial production, which has fruit with yellow skin and white flesh. All dragon fruit have black

[28] References for this section: https://www.agmrc.org/commodities-products/fruits/dragon-fruit, https://eresources.nlb.gov.sg/infopedia/articles/SIP_768_2005-01-11.html, https://www.producereport.com/article/vietnamese-dragon-fruit-exports-china-plummet

[29] Image source: https://www.agmrc.org/commodities-products/fruits/dragon-fruit (accessed on December 13, 2021)

tiny edible seeds that are similar in appearance to kiwi seeds. The texture of dragon fruit is similar to kiwi or watermelon, and the flavor is mildly sweet with subtle earthy notes. The cultivars with deeper pink flesh are said to have the most flavor. Dragon fruit are roughly the size of a baseball, but oval shaped.

Dragon fruit plants are quite drought tolerant, and require anywhere from 25 to 50 inches of water per year, and too much irrigation must be cautioned to avoid flower drop and fruit rot. Because of its epiphytic nature, it grows best in soil with a high level of organic materials. An epiphyte is an organism that grows on the surface of a plant and derives its moisture and nutrients from the air, rain, water or from debris accumulating around it. Therefore, dragon fruit most likely won't need heavy applications of commercial fertilizer and should be environmentally friendly. Dragon fruit plants are considered a climbing cactus, and commercial orchards need to use some form of trellising to support the plant. Dragon fruit plants can produce fruits after one year of establishment and can stay in production for approximately 30 years. Another important note when establishing a dragon fruit orchard is the pollination requirements. Many cultivars are self-pollinating; however, some happen to be self-incompatible, and thus need cross-pollination to develop fruit.

The summer (June through September) is the main season in the Northern Hemisphere for fresh dragon fruit. August and September are the peak months for most varieties; however, varieties of Selenecereus megalanthus produce fruit during the winter months of November through February.

Many countries commercially produce dragon fruit, including but not limited to Nicaragua (primary producer of Hylocereus sp. in Central America); Colombia (primary producer of Selenecereus megalanthus); Ecuador (producing Hylocereus sp. and Selenecereus megalanthus); Vietnam (primary producer of Hylocereus undatus in Southeast Asia); Thailand; Malaysia; and Israel.

In 2013, it was reported that Vietnam is the world's leading exporter of dragon fruit, with revenues from dragon fruit making up 55 percent of the country's fruit export turnover. However, other countries such as Thailand, Israel, northern Australia, southern China, the Philippines and Hawaii have also been trying to grow the fruit. The United States imports the majority of its fresh dragon fruit from Southeast Asia (most notably Vietnam) with the fruit primarily being the white-fleshed cultivars. While Vietnamese dragon fruit is exported to several markets, such as Thailand and Indonesia, China remains the country's top market for dragon fruit, accounting for 80% of total exports. In fact, dragon fruit accounts for one-third of Vietnam's produce exports, frequently earning over $1 billion in annual export sales. China Customs statistics show that China imported 281,000 tons of dragon fruit from Vietnam from January to June of this year, representing a steep year-on-year decrease of 23.4% compared with the 367,000 tons imported during the first six months of 2020. Moreover, the value fell by 33% year-on-year. Industry insiders estimate that although Vietnamese dragon fruit still holds a 65% share of China's dragon fruit market, this share will decrease in the coming years. In response to these challenges, Vietnamese exporters are making efforts to expand into other foreign markets, setting their sights on Australia, Japan, the European Union, North America and the Middle East. This year, the Vietnam Trade Office in Australia organized a Vietnamese dragon fruit week in large Australian cities, and Vietnamese dragon fruit can reportedly be purchased in Australia at $4.90 per fruit. Vietnam has also already exported dragon fruit to Japan, India, New Zealand, Chile and Pakistan in recent years, albeit in limited quantities.

PROCESSED PRODUCTS

While fruits tend to obtain better market value when sold fresh, processing fruit is an alternative that provides certain benefits to the producer:

- Processed products are not as perishable as fresh fruit.
- Processing can be a good way to make profit from leftover, non-exportable fruit.
- Processing into pulp or juice is an alternative when the fruit variety produced does not match market demand or there are mixed cultivars.
- A shorter time is required to set up a processing plant, compared to the time between planting to harvest. In other words, if there is native fruit available locally, setting up a processing plant may be considered, which would be the case of mangoes and other fruits that are already grown in North of Mozambique.
- Each processing plant has the potential to create around 200 jobs as direct employees and involve 2,000 more people indirectly in its supply chain.

Processing fruits such as coconut for water, and mangoes for puree offers employment opportunities both for workers at the plants, which tend to be mainly women or at least more gender-balanced, as well as opportunities for small farmers to supply the processing plant. However, given the cost of the processing equipment and the plant infrastructure, the scale of mango and coconut production and volume demands required to operate the plants near capacity aren't likely present in Northern Mozambique at this time and wouldn't likely justify the costs of large processing plant construction. Potential investors may be willing to operate on a smaller scale until volumes were ramped up.

One exception to this situation would be juice from locally grown cashews which is fermented in a low-tech manner and bottled locally. Aloe vera, a crop that would do well in drier Mozambique climates, is processed in rural India using low tech methods and might be adapted for Mozambique. Coconuts for packaged coconut water may be another opportunity although we understand that local coconuts have been infected with the Coconut Lethal Yellowing Disease that has eliminated many of the trees. Therefore, there might not currently be enough volume of available coconuts to sustain a bottling plant for coconut water.

There are two major challenges when deciding on setting up processing plants. The first one is where to locate the processing lines to minimize total transport time. The logistic impact needs to be taken into account and a "satellites-hub" system needs to be created with collection points and one or more hubs together with the processing line installed. Collection points need to be organized with own property vehicles. The second challenge to be considered relates to the training of the farmers to collect and transport fruit properly. Incorrectly harvested or transported fruit might not be usable or have reduced value. For example, it is best to educate the farmers to collect mango not completely ripe, and finish the ripening in the room of the factory, in order to avoid problems of contamination of the fruit that is collected from the ground.

There are three main types of processing lines that would be relevant to Northern Mozambique: a specific line for bananas, a multipurpose line for mango and similar fruits, and another specific line for coconut (as low acid product coconuts need specific machines especially in the sterilizing and filling unit). The minimum volumes for industrial activity are, respectively: 80 tons/day for banana puree or 40 tons/day for banana puree and flours, 20-25 tons/day of mango for pulp or 50 tons/day for mango concentrate, and 3 tons/hour (or 20-24 tons/day) of coconut for water (green coconut) or cream (milk, oil and dehydrated cream from brown coconut). The processing lines can produce aseptic 55-gallon drums with 12 month of shelf life in room temperature. According to Tropical Fruit Machinery[30], a small mango hub to process 25 ton/day complete with everything may cost around $2 million euros. A middle-sized processing factory that is multipurpose for mango, papaya, and

[30] https://www.tropicalfood.net/en/; main contact person: Stefano Concari (stefano.concari@tropicalfood.net)

pineapple, that processes 10 ton/hour may cost around $8 million euros. Other units for banana or coconut processing lie between these two figures.

SHIPPING, LOGISTICS, AND THE PORT OF NACALA

In the current supply and demand equilibrium where demand exceeds the supply in the primary market, the East-West routes, capacity has been of shortage in the niche markets. Major carriers are dedicating their tonnage to profitable routes affecting the Mozambique market with a lack of capacity and schedule reliability. Weekly shipping calls have either turned into bi-weekly or none. Transit time has also been a significant disadvantage to Mozambique exports, particularly for the perishables, which need shorter transit days to be competitive and offer better quality products.
Mozambique is also at a geographical disadvantage as it is not on the path of any standard shipping route. The ship's diversion will cost the operator an additional bunker, thus adding up to the voyage cost. Reliable and consistent shipping creates a fluidity in the supply chain, and the Northern Mozambique market needs one to advance its fruit exports and further investment. Mozambique has one of the longest coastlines in Africa, the country faces intermodal challenges, shipping companies will have to make calls in each port for a better- utilizing factor in Twenty equivalent units (TEU).
The solution to helping the agriculture market and fruit exporters in Mozambique will be a dedicated and reliable weekly shipping service. Mozambique fruit exports can be competitive with shuttle service to a central transshipment hub in the Arabian Sea. Three or four multipurpose vessels capable of lifting 200 TEUs will eradicate future service failures and logistics disruption.
The country is well-positioned to export bananas to large regional markets like South Africa, Tanzania, Zimbabwe, and the growing international appetites, primarily the Middle East.

DEMAND FOR SPECIALIZED SHIPPING SERVICE

The global crisis has created an opportunity for change in the shipping industry. Many sectors (humanitarian, military, perishables, mining) with specific needs value reliability and resilience over economies of scale. All these sectors require critical timing, value reliability and resilience, are willing to pay a little more for specialized services, and may require flexible logistic arrangements. The table below compares the benefits of economies of scale of a conventional, commodity shipping service to the benefits of specialization of a new, tailored, value added service:

Table 3 Comparison between commodity shipping and specialized service

Commodity shipping service	Tailored, value added service
• Reduced long-term unit costs • Increased profits, higher return on capital investment • Ability to offer lower prices • Larger business scale gives more negotiation power with customers and port authorities	• Better value proposition for your target markets (reliability) • Smaller learning curve due to focus on specific niches • Able to capitalize on niche opportunities or start-up markets • Higher customer loyalty • More opportunities for building profitable relationships

While the unit price charged by a commodity shipping service will usually be lower, what has been observed during the global crisis are large lines providing unreliable service, breaching contracts and running off to highest profit routes (i.e. United States and Europe to and from China). Furthermore, even disregarding the global crisis, Mozambique is at a geographical disadvantage as it is not on the path of any standard shipping route, and its current fruit export volumes do not justify port calls.

Therefore, the establishment of a new type of service that provides flexible and tailored shipping solutions to the aforementioned sectors is Mozambique's current best option.

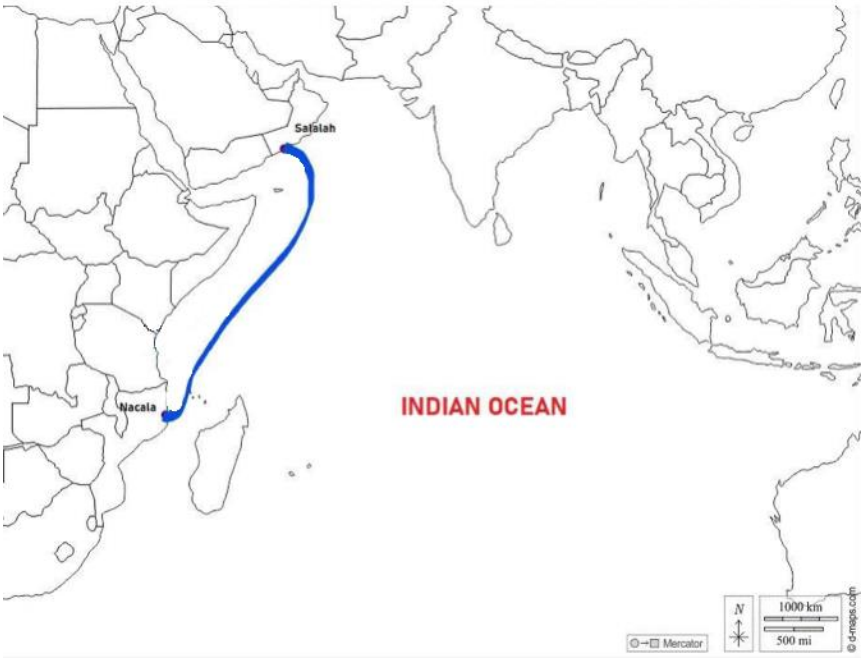
Backhaul market

According to CTA (Confederação das Associações Económicas de Moçambique), Mozambique has around 500 SMEs associated with the extractive industry, generating around 155,000 jobs[31]. Many of these extractive companies are located in the North of Mozambique, and their workers have purchasing power and consume goods that are oftentimes imported into the country, or transported north from the south. There is an opportunity for the specialized shipping service company to supply the extractive companies and their workers by bringing non-perishables in bulk from the transshipment port of Salalah for sales and distribution throughout the northern region of Mozambique.

SUGGESTED ROUTE MAP (THROUGH NACALA/PEMBA TO SALALAH)

For this study, we have selected Salalah as the transshipment hub, due to its strategic location directly adjacent to the central East-West Shipping Lane, providing the region's fastest access point to the broader Middle East, Indian subcontinent, and East Africa. The Port of Salalah also relays cargo through the Port of Tanjung Pelepas in Malaysia to Southeast and East Asia destinations. In addition, the port is situated well away from the Straits of Hormuz – reducing carrier insurance premiums and overall freight costs.

Figure 10 Suggested route map



Salalah

The Port of Salalah is the biggest port in Oman, and handled 7.2 million tons of general cargo traffic and 3.65 million twenty-foot equivalent units (TEUs) of container traffic in 2012. It handled 9.34 million tons of cargo and more than three million TEUs of container traffic in 2014. The ongoing

[31] https://covid19.cta.org.mz/wp-content/uploads/2020/06/ANALISE-DO-IMPACTO-DA-COVID-19-NA-INDUSTRIA-EXTRACTIVA-.pdf

expansion will increase the port's annual dry bulk cargo handling capacity to 20 million tons, general goods handling capacity to 140 million tons, and liquid cargo handling capacity to six million tons. It will also double the port's quay length. Plans to build a permanent cruise terminal along with a 6,000m² business incubator space at the port are under consideration.[32]

Figure 11 Port of Salalah Regional Services

Service Name	Line	Destination
AE1 East	Maersk	Salalah
AE12 East	Maersk	Salalah
AE20 East	Maersk	Salalah/ Abu Dhabi/ Jebel Ali
AE7 East	Maersk	Salalah/ Abu Dhabi/ Jebel Ali
Blue Nile Express	Maersk	Salalah/ Abu Dhabi/ Jebel Ali/ Jeddah
IOI	Maersk	Salalah
ME2 East	Maersk	Salalah/ Jebel Ali/ Jeddah
ME2 West	Maersk	Salalah/ Jebel Ali/ Jeddah
ME3 East	Maersk	Salalah/ Jebel Ali/ Dammam
ME3 West	Maersk	Salalah/ Jebel Ali/ Dammam
ME4 East	Maersk	Salalah/ Jebel Ali/ Jeddah/ Hamad Port
ME4 West	Maersk	Salalah/ Jebel Ali/ Jeddah/ Hamad Port
ME7 West	Maersk	Salalah
ME7 East	Maersk	Salalah/ Jeddah
MECL1 East	Maersk	Salalah/ Jebel Ali
MECL1 West	Maersk	Salalah/ Jebel Ali
Masika Express	Maersk	Salalah/ Jebel Ali
Mawingu Express	Maersk	Salalah
Middle East - East Africa	Maersk	Salalah
Musafir Express	Maersk	Salalah
Nubian Express	Maersk	Salalah/ Jeddah
ME2 Samba	Maersk	Salalah/ Jeddah
TP11 East	Maersk	Salalah
TP12 West	Maersk	Salalah
JJS	GFS	Salalah/ Jebel Ali/
Gulfomaf	APL	Hamad Port/ Jebel Ali/ Abu Dhabi/ Dammam/ umm qasr
MEFD3	APL	Abu Dhabi
WA3	APL	Hamad Port/ Abu Dhabi/ Dammam/ umm qasr
WA2	APL	Abu Dhabi/ Dammam
Gulfein2	APL	Gulf
Gulfemf2	APL	Gulf
Epic	APL	Gulf
Gulfemif	APL	Abu Dhabi/
Gulfekhf	APL	Hamad Port/ Dammam
CIMEX1	APL	Dammam
GulfJJS1	APL	Jeddah
GA2	APL	Gulf
Gulfsak2	APL	Gulf
SE8	APL	umm qasr
FAS	CMA/CGM	Hamad Port/ Jebel Ali/ Abu Dhabi/ Dammam/ Umm Qasr
MEGEM	CMA/CGM	Hamad Port/ Dammam
Europe Pakistan India Consorti	CMA/CGM	Abu Dhabi/ Dammam
MEFD3	CMA/CGM	Abu Dhabi/
China India Middle East Exprex	CMA/CGM	Abu Dhabi/ Dammam
Condor	MSC	Jebel Ali/ Dammam

The port has been in operations since 1998, and benefitted from over USD 800 million in investment, making it one of the world's largest transshipment ports. Salalah also offers terminal capabilities for liquid bulk and mineral bulk handling. It has state-of-the-art freight handling infrastructure and is the closest mega-hub from Nacala compared to the regional competitors. It is

[32] https://www.ship-technology.com/projects/port-of-salalah-expansion/

one of the fastest-growing port operations worldwide with further expansion plans to add capacity in all terminals, and it's one of the world's largest transshipment ports in the region.

The port is owned by APM Terminals of Holland (30%), Omani government (20%) and institutional and private investors (50%). The port is managed by APM Terminals and is operated by Salalah Port Services Company (SAOG), a public listed company with principal shareholders between ASYAD and APM Terminals, one of the world's largest container terminal operators. Figure 11 shows Port of Salalah regional services.

Zanzibar

The Port of Zanzibar is a middle-sized port located on the central west coast of Zanzibar Island and its main exports are cloves and clove stem oil, coconuts, sea shells and grain. Main imports are building material cement, consumer goods, oil, machinery and electronic goods. The port handles approx. 50,000 TEU and 1,500,000 tons per year[33]. The types of vessels regularly calling at Zanzibar are Sailing Vessel (21%), General Cargo (13%), Cargo (10%), Container Ship (8%), Oil Products Tanker (8%).[34]

Recently, USAID's Global Health Supply Chain activity procured respiratory and sanitation supplies valued at $400,000 that were delivered in March 2020 to the Port of Zanzibar and onward to public medical facilities through the central medical store. The shipment included respiratory equipment such as pulse oximeters, pediatric and adult nasal cannulas, masks; and sanitation supplies such as backpack sprayers, and biohazard disposal bags.[35] The value-added shipping line may need to deliver medical or humanitarian aid supplies at ports such as Zanzibar along the coast of Africa, in which case additional port calls would need to be added to the main route.

Estimated costs and travel time from Pemba to Salalah

A proforma has been created for this study to illustrate the operational travel costs for a basic route Pemba to Zanzibar to Salalah and back to Pemba. This route would take around 20 days, which means that, in order to provide a weekly service line, at least three rotation vessels would be required. Total HFO (Heavy fuel oil) costs would be around USD 145,000.

There are certain advantages of using Pemba as the port of call for Mozambique instead of Nacala, such as lower port costs (the costs of handling refrigerated containers at the Port of Pemba tend to be 4.8% cheaper than the tariffs at Port of Nacala[36]) and shorter maritime trajectory to destination, which would imply cheaper total costs provided that the cost of land transport to cover the distance from farm to port does not surpass the reduction in maritime costs. Although Pemba as a port is not as well developed as Nacala, following our recommendation the retrofitted vessels would have all the necessary equipment to load, unload and maintain the containers refrigerated, hence reducing the need for port terminal storage or reefer plugs. However, producers' final choice on which route to take would depend on the conditions of the roads that lead from the farms to the ports and the overall logistics costs. It is advisable to have at least both Pemba and Nacala operational and available as export route options, not only to increase competition among ports, hence increasing efficiencies

[33] https://www.findaport.com/port-of-zanzibar
[34] https://www.marinetraffic.com/en/ais/details/ports/19436
[35] https://www.usaid.gov/tanzania/press-releases/apr-20-2021-united-states-government-delivers-medical-equipment-combat
[36] CFM, Livro de tarifas portuárias, Março 2020.

and lowering costs, but also to have a second port as backup in the case something happens to the primary port of choice.

Figure 12 Proforma for Pemba - Salalah - Pemba

Main Liner
18.5 days

	SB Capa.	200
Nominal	NB Capa.	200

PORT	Pemba	Salalah	Pemba				
Port code	MZPOL	OMSLL	MZPOL				
EOP	04:00	19:00	14:00				
Berth time	08:00	21:00	18:00				
Day	fri	sun	tue				
Port stay	24	24	24				72
CANAL	0	0	0				
Unberth time	08:00	21:00	18:00				
Day	sat	mon	wed				
FAOP	12:00	23:00	22:00				
Sea time	198	183					382
Sea speed	10.0	10.8					
Moves	200	600	200				1000
Ops. prod.	20	10	20				
Idle time	1.0	2.0	1.0				4.0
Man. distance	4	2	4				10
Man. time	4	2	4				10
Zone diff.	0	1	1				
Q/Q miles	1981	1981					3962
Days to departure		8.5	17.4				
Port to port days		8.5	7.9				16.4
Margin to 12.0	33.5	18.8	0.3				
Margin to 14.0	57.0	42.4	0.3				
Conso FO		128	118				247
Conso DO		17	16				33

VOYAGE DETAILS					
Voyage		443.5	hours	18.5	days
Berth		48	hours	2.0	days
Man time		10	hours	0.4	days
At sea		381.5	hours	15.9	days
Canal		0	hours	0.0	days
Idle		4.0	hours	0.2	days
Distance		3962	miles		
Man dist		20	miles		
Canal dist			miles		
Sea speed		10.3	Knots		
Reserve at	12.0	52.7	hours	2.2	days
Reserve at	19.0	99.7	hours	4.2	days

FO Cons	voy	price/mt	total/USD
MDO	32.9 tons	350	11507.01
HFO	246.6 tons	500	123289.4

STEVEDORING	
Moves	1000
Ops prod	22.7
Berth prod	20.8

TRANSIT TIME			
SB	Zanzibar	Salalah	Pemba
Pemba		8.5	17.4
		8.5	
Salalah			7.9

More transshipment ports may be added to the route, but each addition will increase the total transit time and chances of delays in delivering to the final destination. It is recommended that a weekly service is provided as this is the usual schedule set by fresh fruit buyers. In the case of bananas from the producer's side, the harvest should also happen weekly, or with a maximum tolerance of ten days between harvests. A ten-day gap between harvests for bananas would only be for emergencies to avoid losing fruit in the case of a force majeure event and it is not something that one should plan for regularly. A gap of more than seven days forces the producers to hold some of the supply as green fruit or to harvest early, incurring extra cost and quality degradation, in order to supply the required number of cartons per week consistently to the buyer for supermarkets.

Table 4 below compares the differences in transit time and costs when ports of departure and destination are changed slightly.

Table 4 Total transit time and fuel costs comparison between routes

Route	Rotation time (days)	Total fuel oil costs (thousand USD)
Pemba – Salalah - Pemba	18.5	134.8
Pemba – Jebel Ali - Pemba	25.8	194.5
Pemba – Zanzibar – Salalah - Pemba	20.4	142.3
Nacala – Zanzibar – Salalah - Nacala	21.0	147.7
Pemba – Mocimboa da Praia – Salalah - Pemba	19.8	137.8

ESTIMATED GENERAL CARGO VESSEL PURCHASE AND RETROFIT COST

As mentioned previously, a tailored shipping line is recommended to provide a weekly service through the chosen route. Given today's shipping climate, it will be more cost-effective to buy a general cargo ship and retrofit it than to buy a reefer ship. To be able to rotate the vessels in the previously proposed route in time, the purchase of at least three secondhand self-geared vessels would be required.

Table 5 below shows the estimated cost of buying and refitting the vessel. At the time of this study, the cost was estimated at USD 8 million per ship. Actual price would depend on the market and second-hand price index at the time of purchase.

Table 5 Initial investment per vessel purchased

Assumptions: • Vessel ships around 8000 to 10000 tons – equivalent to 200 to 300 TEUs • Year of construction 2000 or later • Second-hand containers purchased in the eastern Mediterranean region	
Item	**Cost (thousand USD)**
Vessel	6000
Additional reefer equipment to reach 200 plugs plus retrofit for containers	40
Container spreader bars 4 angles (2 pieces)	40
200 40-foot containers	2000
Total	8080

Table 6 below shows the costs of running a refitted vessel with characteristic as described above. At the time of this study, the monthly operating cost was estimated at USD 364,000.

Table 6 Monthly operating costs per vessel

Assumptions: • Average bunker consumption of 17 ton/day • Average cost of US$ 600/ton bunker[37] • Vessel and crew management costs already include repair & maintenance and insurance. The insurance will be on the high side compared to other ports due to infrastructure and security in Mozambique.	
Item	**Cost (thousand USD)**
Fuel (bunker	306
Vessel management	15
Crew manning and supervision	3
Crew salary (full complement)	40
Total	364

The prices above are based on the market condition at the time of this study. The ship prices, particularly the container vessels with commanding record-high charter and freight rates, have increased the secondhand price index. Clarksons' – a world's leading provider of integrated shipping services – overall secondhand price index has risen by 33% since September 2020 to a seven-year high.[38]

Containers

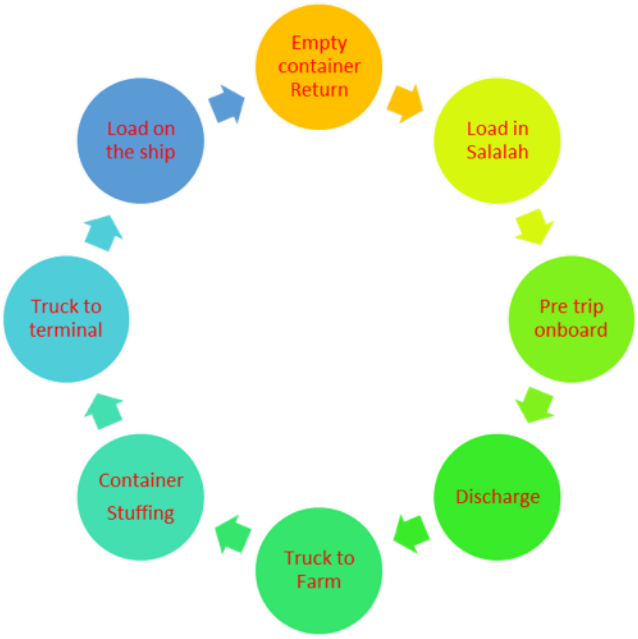
The purchase of forty-foot refrigerated containers as Shippers' Own Containers (SOC) will help with the flow and guarantee container availability for securing export volumes. Well maintained secondhand containers can be purchased from the East Mediterranean region for USD5000 for a twenty-foot and USD10000 for a forty-foot. A maintenance and repair shop can be set up locally to store, pre-trip, and repair the containers, preferable in a suitable and safe location near the Port or at a free zone. In addition, a spare part dealership license can be obtained from a regional dealer for lower import costs.

Carousel operating model

In order to shorten transit time and reduce costs, we propose a carousel operating model (Figure 12) for discharging and loading the container units onto the vessel. In this model, one of the main points is the preparation of the empty container on board the vessel (i.e. pre-tripping, which includes cleaning and bringing the container temperature down) on the return to Mozambique leg of the trip, saving the additional time that is usually spent at the port or farm to bring the containers to the temperature required to condition fresh fruit. In the case that there is a full backhaul cargo, this will go below deck and the empty containers will be above deck, hence they can still be pre-tripped, saving total operation time. Given that the vessels and container are owned by the producers/shipping company, the same containers, once emptied, will be loaded back on the same vessel in Salalah, hence saving storage costs at the terminal.

[37] https://shipandbunker.com/prices
[38] https://splash247.com/surging-secondhand-prices-see-value-of-the-world-fleet- surpass-1trn/

Figure 13 Proposed carousel operating model



Globe Tracker

In order to avoid the risk of exports from Mozambique getting mixed in narco-trafficking chains, it is advisable that reefers are set up with a tracking device such as Globe Tracker's solution[39] or similar. Globe Tracker's solution tracks all the containers from the farm to the destination and back to the farm. The Danish company specializes in supply chain visibility telematics and sensor data solutions, enabling customers to drive ROI benefits, improve performance, increase customer retention, and add new revenue streams in crucial supply chain verticals. One of its solutions is the placement of a small device inside the container that measures container temperature and angle at all times, as well as the GPS location of the unit. The device also registers when the container door is opened, which will be useful to track whether potential tampering or smuggling occurred during any part of the shipping process.

MARKETS OF INTEREST

One of the strategies to make Mozambique known in the international fruit export market is to participate in expo shows. Fruit Logistica[40] is a flagship event held annually in Germany that covers every single sector of the fresh produce business and provides a complete picture of the latest innovations, products, and services at every link in the international supply chain. It thus offers superb networking and contact opportunities to the key decision-makers in every sector of the industry, as 3.300 exhibitors and 72.000 trade visitors attend the fair every.

Setting up a Mozambican booth at the largest fruit and vegetable trade show in Berlin is a good way to start placing the country on the world fruit map and make it known, as all the major global buyers will be present. As a precondition to participate in such an event, Mozambique's export fruit sector

[39] https://www.globetracker.com/
[40] https://www.fruitlogistica.com/

must be already solidly developed and able to respond to all the issues that will be raised during networking, from logistics solutions to production capacity and export volumes.

MIDDLE EAST

Mozambique is strategically located close to the Middle East. Philippines is currently the main source of Bananas for Middle East and Far East and is poised to supply the increased demand coming mainly from China. Mozambique could easily become an alternative supply source. In the Middle East Mozambique will be able to offer high quality bananas at a better market price especially during the low season, while achieving better profit margins than the ones realized by the competition. Bananas take 20 days to arrive from the Philippines, and 40 days from the Americas. With tailored shipping service, Mozambican bananas could arrive from Pemba to Salalah in 7 days, and another 5 days from Salalah to Abu Dhabi by vessel, or 1 day by truck. Once inside the Middle Eastern market, there are also geographic expansion opportunities within Middle East/North Africa, South East Asia, and Commonwealth of Independent States. The table below shows the Middle Eastern Region top customers.

Table 7 Middle Eastern Region top customers

Country	Company	Seller	Brands	Purchase frequency	Discharge port	Discharge method
UAE	Fresh Fruits Company	Chiquita Lapanda	Chiquita Estrella	weekly	Sharjah Abu Dhabi	Pallets
	Iran Dubai Company	Chiquita	Chico Dana	weekly	Sharjah Abu Dhabi	Pallets
Saudi Arabia	Sanaad	Chiquita	Chiquita	weekly	Damman	Pallets
Kuwait	Fresh Fruits Company	Chiquita	Chiquita	weekly	Kuwait	Pallets
	Suma Fruits	Chiquita Del Monte	Chiquita + Del Monte + Frutia	weekly	Kuwait	Pallets
Iran	United Fruits Export Co	Chiquita Lapanda	Chiquita Estrella DM	weekly	Bandar Bushehir	Brake bulk
	Arjomandi Trading Co	De Nedai	Chiquita DM Dana + Other	weekly	Bandar Bushehir	Brake bulk

Iran is the largest market for bananas in the Middle East, with an average historical volume of 19 million 13.5kg boxes, followed by Saudi Arabia, with 12 million boxes. Table 8 below shows the average historical volumes per country, together with the main companies.

Table 8 Middle East Region Customers' Historical Banana Volumes

Country	Companies	Volume in '000 13.5kg boxes
Iran	United Fruits Export Co., Arjomandi Trading Co., Pishroo Rah Toos, others	19,067
Kingdom of Saudi Arabia	Sharbatly, Abbar & Zainy, Arabian Trading Co., Sanaad	12,032
United Arab Emirates	Fresh Fruits Company, Abbar & Zainy, Ahmed Abughazal, Iran Dubai Company, Abuseed Trading, Allana IFFCO, Sharbatly	5,557
Kuwait	Suma Fruits, AlOras, Al Azriq Fruits, Jamal Trading, other	1,830
Bahrain	Bahrain Fresh Fruits, Nader Ibrahim, others	982
Qatar	Abu Khalifa, others	308
Total		39,776

Health and quality remain the biggest concern in the consumer's mind while purchasing products and for demand fulfillment organizations to maximize returns on their investments they must focus on the following trends:

Innovation: Organizations that focus on innovation as a core value will find success by adopting new methodologies, partnerships, products, concepts and ideas and sustainability practices will move to the forefront of customer and consumer agenda.

Retail and Packaging Innovation will drive agricultural decisions: Intelligent Packaging Innovation will involve hyper-connectivity, a trend that will be driven by: Food safety, Traceability, Country of origin and Nutrition labeling needs.

Convenience and Health will take the center stage: We will continue to see rapid changes in consumer taste and expectations as people place more emphasis on their health and time. The competition trend will continue in produce, fruit and fruit juices versus the traditional snacks and beverages.

Direct Consumer-Producer relationships: As technology evolves and as people become more concerned about the safety of what they eat, a natural result is direct relationships between growers and consumers. Food quality and safety ratings will become a commonplace and must.

Partnerships and Strategic Alliances will define success: No one individual or organization can know everything there is to know. There will be an increasing number of partnerships between growers and suppliers, buyers, producers and retailers, so they learn to deal with the massive complexities that emerge from rapid changes and innovation.

Differentiation: By setting new benchmark for quality, innovation, service to solidify customer relationships and staying ahead of competition.

In that region, Mozambican bananas might also compete against India's exports. In 2020, India's leading banana importers were[41]:

- Iran: As of 2020, India's total exports of bananas were worth 11.79 percent to Iran. Iranians received bananas from this country worth USD 5741004. White Globe produced the most banana business in Iran of any company listed here as an exporter of fresh bananas from India.
- Qatar: During the period covered by the report, Qatar was the sixth-largest export country for Indian bananas. 2020 yielded a USD 4158076 million purchase of bananas from India. Besides the United Arab Emirates, the banana export company India did well in Qatar, too.
- United Arab Emirates: United Arab Emirates was the main destination of Indian bananas in 2020, with exports worth USD 15381297 million. Total exports were accounted for 30.58 %. Most of India's banana export company's bananas were exported to the UAE, where banana exports comprised 5.24% of its exports.
- Saudi Arabia: As India's top export destination for bananas, Saudi Arabia held the third position among Middle East countries. The country purchased Indian banana exports worth USD 6012705 with a 12.34% value share. The banana suppliers to Saudi Arabia who sold their bananas most frequently were Mayi Industries.

EUROPE

While Mozambique's bananas may not reach Europe faster than those from Ecuador, as an ex-Portuguese colony traditionally there has always been a fair amount of trade between the two countries, with Portugal occupying the seventh country of origin for Mozambique's imports, with 3.3% of total 2019 imports coming from that country. Also, Italy was the first country Matanuska, the banana operation prior to Jacaranda, exported to, and its fruit was well received then, demonstrating there is potential to market to Europe.

The organic food industry in Europe is a lucrative market, with a retail sales value of 29.8 billion euros in 2015. While the well-established Western European market experienced growth of 5.4 percent between 2015 and 2016, Eastern European sales are catching up with a growth rate of 8.8 percent in the same period.[42] Mozambique's low agricultural productivity is a case where a shortcoming can be worked to its advantage: according to Anson et al.[43], this low agricultural productivity in Mozambique appears to exist together with limited use of yield-enhancing agricultural inputs, such as fertilizer, improved seeds, and pesticides. Therefore, many crops in Mozambique are organically produced, and could be certified and marketed as such into Europe. According to Fruit Logistica's European Statistics Handbook, the pandemic has led to a change in consumer thinking, boosting demand for organic food in Europe, including organically produced fruit and vegetables.

For both fresh fruit and fresh vegetables, the EU's trade balance is negative – more so for fruit than for vegetables, because very few bananas and other tropical fruits are produced in the EU. According to preliminary data, EU fruit imports (intra and extra) fell by 0.5 % in 2020. However, the main importers – Germany, the Netherlands and France – took in slightly larger quantities. Imports of fresh vegetables fell by about 5% compared with the previous year's volume, with the main buyers importing smaller quantities. Exports also lagged behind those recorded in the previous year, by 5%

[41] https://www.freshplaza.com/article/9341191/top-nations-that-import-bananas-from-india/ (Publication date: Fri 23 Jul 2021)
[42] https://www.statista.com/topics/3446/organic-food-market-in-europe/#dossierKeyfigures
[43] Anson, R.; Mutondo, J.; Zavale, H.; Mandlhate, G. Mozambique Agriculture Public Expenditure Review: Assessment and Result-Focused Expenditure Management; World Bank: Washington, DC, USA, 2019.

for fruit and by 2% for vegetables. The biggest exporters for both fruit and vegetables are Spain and the Netherlands.

The share of extra-EU trade is comparatively high for fruit at 43%. This is led by number-one fruit import bananas, almost 67% of which come from countries outside the EU. In contrast, intra-EU trade predominates for oranges in second place. Other important fruits in terms of import volume are apples, easy-peel citrus and watermelons.[44]

INDIA AND CHINA

India has played an important role in Mozambique's imports and exports. In 2018, India was the top country destination for the country's exports (27.3% of the total) and the fifth country of origin of Mozambican imports (7.1% of the total, after South Africa, China, UAE, and the Netherlands).

India imports from Mozambique was US$711.59 Million during 2020, according to the United Nations COMTRADE database on international trade.[45]

Table 9 India imports from Mozambique in 2020[46]

India imports from Mozambique	Value
Mineral fuels, oils, distillation products	$361.22M
Edible vegetables and certain roots and tubers	$158.27M
Copper	$86.09M
Edible fruits, nuts, peel of citrus fruit, melons	$29.88M
Oil seed, oleagic fruits, grain, seed, fruits	$22.53M
Ores slag and ash	$20.16M
Iron and steel	$13.55M
Lead	$10.96M
Aluminum	$3.15M
Salt, Sulphur, earth, stone, plaster, lime and cement	$2.15M
Others	$3.63M

Although Mozambique is not located as close to China as Cambodia or Indonesia, China is the fourth country of destination for Mozambique's exports (after India, South Africa and the Netherlands), and one of the major countries of origin of Mozambican imports, second only to South Africa[47]. In 2016, China and Mozambique established a comprehensive strategic partnership, and bilateral exchanges and cooperation in various fields entered the fast lane.

China became one of the largest sources of investment in Mozambique. There were more than 100 Chinese companies in Mozambique, in the fields of infrastructure, energy, mining, agriculture, manufacturing, tourism, telecommunications and digital television. Nonfinancial direct investment reached $1.997 billion, and total investment was almost $8 billion[48].

[44] Fruit Logistica, European Statistics Handbook 2021.
[45] https://tradingeconomics.com/india/imports/mozambique
[46] https://tradingeconomics.com/india/imports/mozambique
[47] INE, Estatísticas do Comércio Externo de Bens – Moçambique, 2018.
[48] https://www.globaltimes.cn/content/1206694.shtml

This existing cooperation between the two countries could be leveraged to increase Mozambican fruit exports into China.

Banana was the third most imported fruit by China, totaling 1.01 million tons in the first six months of 2021. The Philippines remained the largest supplier of bananas to China with a market share of 39%, followed by Vietnam, Cambodia and Ecuador, which accounted for 27%, 20% and 11%, respectively, of China's imported banana market.[49]

The top 11 fruit exporters to China in the first half of 2021 ranked in order of decreasing export value were Thailand ($3.24 billion), Chile ($2.18 billion,), Vietnam ($520 million), the Philippines ($310 million), New Zealand ($250 million), Australia ($210 million), Peru ($190 million), Cambodia ($120 million), Egypt ($87 million), the United States ($84 million) and Indonesia ($83 million,).

STAKEHOLDERS OF INTEREST

WESTFALIA[50]

Westfalia Fruit is a leading multinational supplier of fresh fruit and related products to international markets. Through their vertically-integrated supply chain they grow, source and ripen, pack, process and market quality avocados and other produce – across the year and across the globe. Avocado estates are operated in all major origins, including southern Africa, Mexico, Chile, Colombia, Peru and California in the USA. Westfalia now also supplies a wider range of fresh fruit including mangoes, blueberries, pomegranates, apples, grapes, stone fruit, citrus, cherries and passion fruit. Processed products on offer in specific markets include flavored and plain avocado oils, avocado puree and guacamole, IQF (individual quick frozen) avocado pieces, HPP (high pressure processing) products and dried fruit.

Westfalia is currently growing avocados in Manica region, with planned expansion to 12,000 tons of avocados by February 2024. They currently ship their production South to Johannesburg by truck, but would much prefer exporting to India and China. The company would be interested in investing in avocados in Lichinga were it not for the logistic challenges.

Westfalia also runs a successful lychee project with 200 outgrowers, in which the company facilitates marketing, packaging, transport and export, and charges producers a commission of around 2%. All the product is sold on consignment, and whatever producers achieve subtracted of Westfalia's expenses goes into their pockets. According to manager Mike Jahme, it took some time to build the trust with the community initially, but at present the project has brought positive impact on the welfare of the surrounding communities.

PRATIVITA[51]

One interesting opportunity that has come up during our investigation is the possibility of a Brazilian company, Prativita, possibly locating an operation in Mozambique. Prativita specializes in making dehydrated meal kits for use in remote locations such as mining camps that don't have facilities to provide meals on site. They also provide dehydrated meal kits in humanitarian relief situations where

[49] https://www.producereport.com/article/chinas-fruit-imports-exports-both-first-half-2021
[50] https://www.westfaliafruit.com/; main contact person: Mike Jahme (michaelj@westfaliafruit.com)
[51] https://prativita.com.br/en/; main contact person: Andrei Mamede (andrei@manchesteragrogroup.com)

food assistance is needed. If the company were able to establish an operation in Mozambique, domestic opportunities to produce crops like high protein pigeon peas and other grains and protein sources would add to Mozambique's agricultural domestic production and could also be used for Prativita requirements. Often agricultural projects just look at export, but increased domestic production also creates jobs and is often much simpler to implement.

As explained in our logistics section, using the port of Salalah as a transshipment port to areas where both Prativita's products, as well as fresh fruit exports of banana, mango and other Mozambique fruits are in demand should also lower Prativita's costs as compared to a Brazil only based source and at the same time, help fill the ship with fresh fruit from Mozambique for ports in the Middle East, Eastern Mediterranean and the Gulf, bringing down unit fruit shipping costs as well in competitive global markets. The cargo that would come back to Nacala or Pemba once the fruit was discharged offers opportunities to bring back fertilizers and other agricultural inputs from Middle East production centers at a lower cost than trucking products all the way to the North of Mozambique from South Africa.

In personal communication with SPEED project team, Prativita's CEO Andrei Mamede showed strong interest in investing in Mozambique. Expansion to Africa is a priority for the company, and locating the company's operation in Mozambique would be more cost-effective, as the country climate is similar to Brazil's to grow crops of interest, and Mozambique is located much closer to Prativita's target markets – Asia, Middle East, and conflict zones – than Brazil. The dehydration technology could be transferred from Brazil to the Mozambican plant, and the company would be willing to reduce machinery used in processing in order to accommodate more opportunities to employ local labor.

Of high interest to Prativita are melons (from February to May, when there is a shortage of production in Brazil), avocados, corn and other crops that do not harvest in the mid-year months (competing harvest with their Brazilian crops). For its protein source, Prativita would be interested in chicken or aquatic production.

ELITE AGRO[52]

Another potential investor of interest would be Elite Agro LLC, a UAE-based fruits and vegetables company that currently farms in UAE, Serbia and Morocco, growing a wide range of vegetables, cereals and fruits in all three countries. Elite Agro also engages in growing, sourcing, importing and marketing a wide range of high-quality agricultural products through world-class technology and effective distribution chain, with the most economic use of the natural resources, conserving water, energy and land. Before the pandemic, the company was looking into potential projects in Sierra Leone and Mauritania.

SHABEEL[53]

Shabeel Group is a Somalian based company that is specialized in security and risk management, logistics, energy and extractives, finance, government, automotive, ICT, and project management. It has been involved in banana production and marketing in Somalia. At the time of this project, the company has already made one exploratory visit to Mozambique, with another planned for 2022, and

[52] http://www.eag.ae/; main contact person: Chandra P Singh, Director of Business Development
[53] https://shabeel.so/; main contact person: Suleiman Abdullahi (suleiman@shabeel-group.com)

has shown interest in refitting general cargo ships to carry fruit products out of Mozambique and bring back non-fruit cargo to the country from the Middle East.

VISION

Shabeel envisions the company becoming a full range supplier of perishables to the gas, heavy sands, and mining industries, as well as a full range supplier to supermarkets in the north of Mozambique. Perishables would be sourced locally when feasible and sourced otherwise from Jebel Ali (Dubai), thus displacing present supplies by truck from South Africa. The Group agrees with the basic idea of the SPEED project team to solve the logistics problem by chartering or purchasing three to four dedicated vessels of approximately 200-300 container capacity, and refitting them to be able to transport refrigerated goods as well as other general cargo on a weekly schedule.

The vessels would bring perishables in bulk from the transshipment port to Salalah for sales and distribution throughout the northern region of Mozambique. The company would invest in cold storage facilities in Pemba (and at the farms, if necessary) and a fleet of vehicles for distribution around the region by road. Products destined to the gas project in Palma/Afungi would travel by barge from Pemba to Mocimboa-da-Praia and trucked from there to Palma. The barges would return to Pemba with bananas and mangos from planting areas near Mocimboa, most likely initially Meangawela on the Messalo River, about 60 km from Mocimboa. The refrigerated vessels in Pemba would return to Salalah with bananas, mangos and any other perishables (including perhaps seafood?) for sales and distribution out of Dubai. Any containerization required would be performed at Salalah, where containers are relatively widely available.

OWNERSHIP

The Shabeel Group understands that fruit investors will need to have stakes in the logistics side of the business to feel fully assured that they will always have access to export markets. The Group is therefore committed to developing cross holdings or other mechanisms to establish that assurance. The Shabeel Group would lead a group of investors in banana production by one or more of the following:

(i) leasing up to 2,000 hectares of ready-for-planting land at Jacaranda in Monapo,
(ii) planting further down the Monapo river in Muchelia, near Ilha de Mocambique, and further down the coast, perhaps as far as Chinde,
(iii) expanding plantings on the Lurio River, and
(iv) acquiring DUATs along the Messalo River near Mocimboa da Praia for planting bananas and promoting expansion of smallholder mango plantings. Being in a presently insecure area, this would also require investment by Shabeel in security to expand the security perimeter around Mocimboa to sites along the Messalo River.

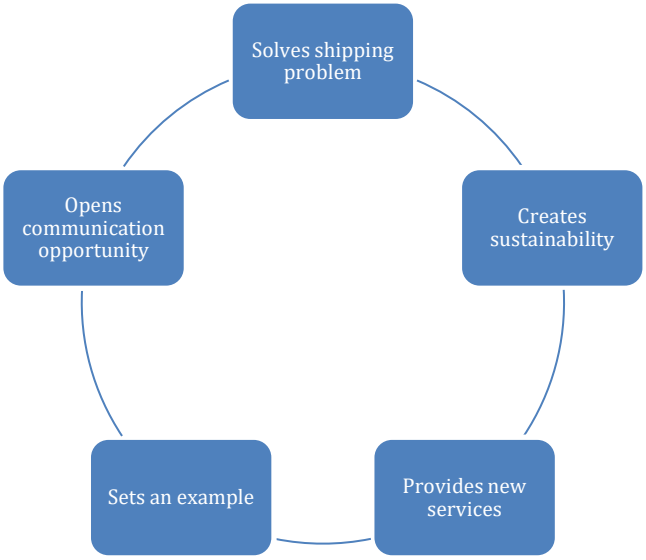
FINANCING

As land cannot be used as collateral in Mozambique, the Shabeel Group suggests that a "Muslim-style" financing vehicle be established by the Group for investors in fruit production that requires no collateral, but rather negotiates with the borrower payments to the lender of a percentage of revenue/turnover, rather than interest on the loan.

DRIVER OF CHANGE

Shabeel's approach has many development impacts and can be a driver of change through the following five fronts:

Figure 14 Five drivers of change of Shabeel's approach



1. Solution to the shipping problem – It solves the shipping problem and at the same time turn it into a business opportunity to become the primary supplier of perishables to the North of Mozambique.
2. Sustainability – It reduces the dependence of EN1 road transport from South Africa. It also grows synergistically as incomes and purchasing power increase in the North.
3. New services – It better meets the needs for perishables of the various megaprojects in the region. It also offers several attractive additional options to new investors, including financing and security.
4. Setting an example – It demonstrates clearly to all Mozambicans, most importantly to populations along the norther coast, that the investments of megaprojects in infrastructure and security (e.g. improvements at Mocimboa) can also drive inclusive economic development and job creation in the region.
5. Opening communication opportunity – It creates a communication opportunity to reinforce the perception among the public nationwide and among government agencies and civil society that it is critical to maintain efficient and low-cost port services. This will attract further investment in the fruit sector and perishables in general.

In summary, investing in bananas in Mozambique can be an attractive opportunity for Shabeel Group because even though the group has invested in banana farms in Somalia, the Shabelle river has chronic water shortages for irrigation purposes and is not as suitable for planting bananas as the North of Mozambique, especially compared to areas near Mocimboa, such as Meangawela on the Messalo River, about 60 km from Mocimboa. Mozambique is a closer, lower-risk option compared to alternatives such as European or Asian growers, and Shabeel can partially retrofit a general cargo ship to carry fruit products out of Mozambique and bring back non-fruit cargo to the country from the Middle East. Shabeel's investment in Mozambique's bananas will also bring more confidence to its customers, given that the fact that the group itself has stakes on Mozambican perishables would serve as a guarantee that it is less likely to breach contracts and run off to other routes.

ASYAD GROUP[54]

Asyad Group is Oman's global integrated logistics service provider. As a USD 4 billion enterprise and backed by an initial USD 20 billion in government infrastructure spending, Asyad is attracting customers keen to leverage the country's integrated logistics facilities and establish manufacturing. The Group offers integrated services and end-to-end logistics solutions to meet market needs and support Oman's economy. The Group is comprised of three deep ports, two free zones and an economic zone supported by Oman's five airports, and a world-class road network. In addition, Asyad operates full maritime services with one of the largest drydock in the middle east and a diversified fleet of 60 vessels, supported by sea transport network that connects Oman to key ports across the region and the globe.

In discussions with the SPEED project team, Asyad Group has shown interest in participating in the logistic solution. Once an investor (such as Shabeel Group) has finalized on the vessels, Asyad Group would be able to collaborate with their partner carriers to provide reefer containers dedicated to the route, so these are repositioned to Pemba and Salalah may be used as a transshipment hub to other final destinations. The services Asyad Group has at the moment are: India Express Service (India to Jebel Ali to Dammam back to India), and Oman Gulf Express (Jebel Ali Sohar, Salalah, and back to Jebel Ali).[55]

KEY RECOMMENDATIONS

ADDRESSING INVESTOR CONCERNS

From conversations carried out through the execution of this study, and from previous personal exchange the team involved in this SPEED project has had with international agricultural investors, common issues have been raised as major concerns for investors before they commit to enter a country. These issues are summarized in the table below.

Table 10 Common concerns raised by investors

Theme	Issues raised
Markets	• Where are the markets and who are the customers? • What fruits do they want, what are the volumes and for what months of the year? • Will the buyers absorb all my first-class production? • What have been the historical prices for these products?
Logistics	• What is the export route to reach the target markets? • Who owns the ships and what is the planned rotation? • What are the possible transshipment ports, destination ports, and how much total transit time is involved? • What are the total port charges per 40 ft. container? • What is the road condition to the ports?
Financial resources	• Is there a ready-made financial package with incentives for new agricultural investors?

[54] https://asyad.om/; main contact person: Hisham Al Maskari (Hisham.almaskari@asyad.om)
[55] https://asyad.om/ports/direct-lines

	• Will other local partners be available to co-invest?[56] • What is the minimum expected equity investment for new agricultural investors to avail of benefits of new investments?
Government support	• Has suitable land for crops been identified by the government already? Which blocks of land are available for agricultural development? • Is data on current crop production available to potential investors? • Do government agencies play a role in land titles and leases, squatter issues, water right, etc.? If yes, what is their role in these specific issues? • Can agricultural project managers and qualified staff be hired locally? • Are there government initiatives to project Mozambique's image as a high-quality agricultural production center, compared to other countries in Africa and elsewhere?

On the other hand, Mozambique's civil society and donor sector would be interested in the following complementary issues:

- How many full-time employees does the company expect to hire?
- What is the expected gender balance of the workforce?
- Are there support plans for smallholders who would partner with larger exporters?
- Can dams made for large agricultural projects also be used by local communities for domestic use?
- Have the new agricultural investors included climate change resilience plans?
- Do the agricultural projects meet the environmental requirements from the government and NGO organizations such as Global Gap and Rainforest Alliance?

In order to create an attractive environment for agriculture investors, Mozambique's civil society, government and donor sector should consider the questions raised above and provide acceptable solutions. One option moving forward is to engage APIEX as a "one stop shop" for new investors.

JOINT PRESSURE TO IMPROVE PORT COSTS AND EFFICIENCY

Much of Mozambique's fruit export strategy is dependent upon the efficient functioning of the output corridors, more specifically of Nacala Corridor for the north. As previous studies have shown, high transport costs along the corridor make it harder for subsistence farmers to access markets, as they are not able to pay for these costs. Commercial farmers interested in Mozambique will also hesitate to invest once they realize the port costs and inefficiencies may eat away any gains at the farm gate.
Table 11 below shows that total costs paid by the exporter at Nacala are approximately USD 1450 per container.

Table 11 Cost per container to export from Nacala

Item	Cost (USD)
Empty container loading	65
Port handling full container	519
Weighing	55

[56] A foreign company must appoint a representative who is a permanent resident in Mozambique and entrust capital to their business in Mozambique, they are also obliged to register their deliberations. (Source: APIEX, Mozambique Investment Guide Part 1)

Scan	50
Farm to port transport (2x110km, Jacaranda)	550
Other non-port costs (customs, certificate of origin, phytosanitary, agency)	210
Total	**1449**

Compared to the port of Guayaquil in Ecuador, where exporting a reefer costs USD400, Mozambique's costs of USD1450 offsets the potential agro-climatic and geographic competitive advantage. For bananas, this additional USD1000 per container is equivalent to a dollar a box that is cut from the producer's margin. All the savings at farm gate are lost due to costs at the port.

Table 12 below shows that total costs paid by the exporter at Santa Marta, Colombia, are approximately USD 1110 per container.

Table 12 Cost per container to export from Santa Marta in Colombia

Item	Cost (USD)
Empty container loading	121
Port handling full container	243
Cost of container leaving and entering port	72
Scan[57]	17
Farm to port transport (2x87km)	594
Other non-port costs (customs, certificate of origin, phytosanitary)	60
Total	**1107**

While one may say Guayaquil is not comparable to Nacala because it is the largest port in the world dedicated to exporting bananas and hence has economies of scale, the Port of Santa Marta in Colombia exports both banana and other cargo, and its region's banana potential is comparable to that of Nacala's. Even when compared to Santa Marta, exporters from Nacala have to pay more for both port and non-port related costs. Disregarding farm to port transport cost, the other export costs such as phytosanitary and customs add up to 12% of total export costs in Santa Marta, while in Nacala these corresponding fees total 23% of total export costs.

In order to improve port conditions, joint action from several stakeholders will be required to create enough civil society pressure and competition among the various ports along the coast.

(i) Private sector investors could choose to have their own shipping solution so that they become less dependent on the port conditions. In case a port proves inefficient or too expensive, or there are too many port call cancellations by major shipping lines, owning a shipping solution will allow producers to find alternative routes faster and more flexibly.
(ii) When port costs go up, smallholders get a cut on their income as traders pay them less for their products. Additionally, an increase or decrease of exported containers directly impacts the creation or loss of permanent jobs in the country. Therefore, it is of the interest of the civil society and the donor sector to create pressure for the government to keep port costs down.
(iii) With more mining and other extractive companies in Cabo Delgado, the Port of Pemba has garnered more visibility and importance in recent years. Its location is also nearer to

[57] The first container scan cost is covered by the port, but around 20% of the containers may require additional scan, at the cost of USD 85 to the exporter, an antinarcotic police requirement.

destinations in the Middle East for fruit exporters. These factors could contribute to the rise of Pemba as an alternate port to Nacala.

However, given that CFM (Portos e Caminhos de Ferro de Moçambique) manages both Pemba and Nacala and determine port tariffs, there might not be a strong opportunity for the ports to compete among themselves and bring down their fees. Stronger pressure to keep costs low would rely mainly on pressure exerted from the civil society, donor and private sectors on the government.

Additionally, while many studies and reports have been written about the three main export corridors of Mozambique, less literature can be found regarding Mozambique's smaller ports such as Pemba. Improving their conditions and competitiveness could also benefit the development of a fruit strategy in Mozambique in the long term.

"LAND GRANT" UNIVERSITIES

The United States has a system of Land Grant universities, which are required by law to conduct experiments on locally grown crops and provide that information at no cost to growers. There are several potential crops for Mozambique that could develop to help meet global needs due Mozambique's Southern Hemisphere crop seasonality, but there is little or no information on how these crops would perform locally or what the cost to produce them would be under local conditions. This means extra risks for investors who are considering developing an operation in Mozambique for a new crop. It also means that there aren't likely local agronomists that have the knowledge to develop and operate a farm in that crop which means that the investor would need to bring in likely more expensive foreign managers. If trials are conducted on new crops locally under the supervision of a local agricultural university, information on cost, productivity, quality and seasonality of harvest could make the decision to invest easier and provide management positions to local agronomists who had experience with the trials, as it does with US Land Grant Universities.

Mozambique could leverage its existing research organizations UEM, IIAM and others, as well as collaborate with international institutions e.g. Earth University to develop its own 3-pillar system of teaching-research-extension.

GLOBAL GAP CERTIFICATION

More and more agricultural operations are required to have certifications in environment and food safety before they can register to operate in a country. It would be a good idea for the government of Mozambique to require, initially, any new agricultural operation to meet certain environmental standards, such as no forest being cut down to plant crops or limiting the products that can be used to treat plant diseases or insect damages. Some of these environmental requirements could include data on CO2 impact of the project. Likely there are environmental laws for agricultural operations already but these could be even more strict for new operations with existing operators moving to compliance over a reasonable timeframe. For crops that will be exported, obtaining a globally recognized certification on the use of good agricultural practices helps local producers access foreign markets.

Global GAP (Generally Accepted Practices) is a common certification that is very well recognized by customers in world markets. Most new and existing farms exporting fruits already have or are at least aiming for Global GAP certification which has become almost a minimum standard in Europe and US for market acceptance.

There is a plethora of agricultural certifications, some of which are required by retailers, mainly in Europe, but also by some customers in US and Asia. Standards vary for different programs, so a new operation should look at what environmental and social responsibility certifications they would want to target, usually based on demands from their future likely market buyers, before doing anything on the land that they plan to use for the farm, to ensure that no requirements are violated before the farm is planted. As an example, RSPO is a Singapore based organization certifying oil palm growers and attempting to prevent rainforest destruction by growers in order to plant palm oil. RSPO requires current pictures of the land where the oil palm farm will be planted, before any clearing or planting of oil palm begins.

IMPROVED TRADE AGREEMENTS WITH INDIA AND CHINA

India and China are huge Asian markets that appreciate Mozambican fruits, vegetables and nuts. However, trade agreements between the governments are required. For example, an increase in the import tax on cashew kernels from 45% to 70% imposed by India in July 2019, forced those who buy the product from Mozambique to reduce quantities.

While Mozambique's Southern Hemisphere harvest season complements China's Northern Hemisphere harvest season, currently Mozambique cannot export bananas to China, as it has not been previously agreed between the governments. China has been importing bananas from the Philippines, Mexico and Cambodia.

In order to gain access to the Indian and Chinese markets, a specific roadmap would need to be developed[58], which would include:

- Clear understanding of market requirements for imports in India and China, and the required steps to gain access to these markets.
- Identification of the constraints these impose on exports, based on previous and current SPEED+ studies of the ports and discussions with exporters,
- Presentation of these constraints to government partners.
- Establishment of a monitoring role to ensure actions are being taken and that there is steady progress against the roadmap.

For example, China and Cambodia officially signed the Free Trade Agreement between the Governments of the People's Republic of China and the Kingdom of Cambodia in October 2020. China and Cambodia entered into talks regarding the free trade agreement in January 2020, and the conclusion of the talks was announced on July 20 after three rounds of negotiations lasting a total of seven months. The agreement covers 340 different products, of which 95% are tax free, including chili peppers, pineapples, vegetables, fruit (including mangos), fish, meat, grains, seafood and a variety of canned goods. In 2019, bilateral trade between China and Cambodia reached a value of over $9 billion. China was Cambodia's largest source of imported goods last year, with Chinese goods representing 37.2% of Cambodia's total imports at a value of $8.3 billion. Meanwhile, Cambodia exported approximately $900 million worth of goods to China, representing 5% of Cambodia's total export value.[59]

[58] Consultant Timothy Born had shown interested in undertaking this work at the start of this SPEED project.
[59] https://www.producereport.com/article/china-cambodia-officially-sign-free-trade-agreement

MINIMUM PRICE POLICY FOR CASHEWS

A Guaranteed Minimum Price Policy's purpose is to reduce output price risk to farmers, providing them with minimum revenue per unit of output, which induces investment and production, and thereby seeks also to ensure food security. From the standpoint of the producer, the minimum price acts as insurance, guaranteeing a minimum income for its production. The government acts as price regulator systematically intervening at times when the market points to unprofitable agriculture output prices. It should be noted that the effectiveness of policy depends on the value of the price fixed by the government, the availability of resources and volume of product operationalized relative to total production.[60]

Mozambique could consider setting a minimum cashew price to allow for growers to cover their costs and to discourage buyer collusion and unfair trade. The price should also encourage growers to improve their productivity.

Other countries that set minimum prices for specific crops include Brazil (corn, beans, fibers such as cotton and jute, milk, cassava. rubber in nature, and cultivated cocoa) and Ecuador (rice, banana, maize, soya, plantain, sugarcane, wheat, and cotton).

TECHNOLOGIES FOR ADAPTION TO CLIMATE CHANGE

One constraint to agricultural production in future will be the competition for water between agriculture and domestic use. While Jacaranda was built near a dam that was specifically constructed locally for the purpose of being able to irrigate the banana operation, there are opportunities to develop a network of dams across agricultural areas of production in Mozambique so that both domestic and agricultural demands are met. For example, there is a prevalence of boils in the local population in the North of Mozambique due to the inability to stay clean given the lack of access to a water source. The water from the dams constructed could be diverted for domestic use in nearby communities while at the same time supplying the farm that is being irrigated. There is a talent pool of dam constructors for this kind of infrastructure in Mozambique and neighboring Zimbabwe.

Figure 15 Example of local dam in a Chinese banana farm in Cambodia using solar power[61]

Some farm locations may be off power grids. Mozambique has plenty of solar energy potential and its use should be encouraged to power irrigation systems, refrigeration, processing and other

[60] Carlos Augusto M. Santana, Public Policies and Agricultural Investment in Brazil, Final Report, August 2012.
[61] Image source: Buck Keiser

operations. For example, a US Trade and Development Agency project in Sierra Leone found opportunities for using solar energy in irrigating and processing rice and other crops, as well as in refrigeration to preserve ocean fish catch for transport farther inland without spoilage. Nairobi based Go Solar Systems Ltd.[62] is able to provide this kind of service. Another example are the Chinese built irrigation systems in Cambodian banana farms powered by solar operations.

One crop common in West Africa and South East Asia is oil palm. Oil palm can be processed into palm oil for human consumption by using the branches of the palm oil stems so that no incremental energy for operating the mill is required, reducing the carbon footprint. Oil palm, native to West Africa, should do well in sections of Mozambique. It can be a small farmer crop and is ready to harvest in about two years.

IMPROVING GENDER EQUALITY IN AGRICULTURAL INVESTMENTS

"Investment in agriculture and gender equality in development countries" by A. Giroud and J. Huaman[63] provides a good overview and suggestions on improving gender equality in investments in agriculture.

Strengthening the role of women in agriculture could boost agricultural productivity and income, and closing the gender gap by ensuring gender equality in access to productive resources would raise agricultural output in developing countries and help reduce hunger.

Giroud and Huaman's study observed that women's formal employment in agriculture is highest in certain sectors. Women represent half or more of employees in export-oriented, high-value agriculture in countries such as Chile, Ecuador, Guatemala, Kenya, India and South Africa. For instance, the female workforce represents between 60 and 80 per cent of the workforce in the flower industry of Colombia. In Senegal, women are found in modern horticulture segments such as French beans and tomatoes. Artichoke production and processing in Peru generates significant employment opportunities for women. In Brazil, 90 per cent of poultry workers are women. In India, women comprise the majority of the labor force in cereal production. Aquaculture is a highly female-dominated sector in India, Viet Nam, and Thailand. In Central Asian countries, women are mainly responsible for activities such as livestock grazing, mixed cropping, horticulture, olive farming and household food production.

While most crops that require post harvesting processing and packing would be women friendly, it is not always the case that women are the majority of the workforce. For example, most of the packing station work in bananas in the Philippines is done by women, while the same task in Costa Rica is done mostly by men. Most of the work done on farms in Sierra Leone such as palm oil harvesting and processing was done by women, while in Costa Rica the same kind of work was done mainly by male counterparts. This shows gender balance in agricultural operations is affected to some extent by local culture. In general, heavy field work such as drainage maintenance is usually done by males, and depending on the crop, harvesting is done by both sexes while fruit selecting, and packaging is done primarily by women. There are also cases where women workers are paid lower wages for the same work as men or required to work longer hours than men.

Large-scale investments in agriculture have an economic impact on women stakeholders, notably through their direct employment on the farm, value chain participation and local farms' development,

[62] https://www.gosolarltd.co.ke/about.html
[63] Axèle Giroud and Jacqueline Salguero Huaman, Investment in agriculture and gender equality in developing countries, Transnational corporations Volume 26, 2019, Number 3.

technology transfer and skills development, opportunities and challenges for decent employment creation and income generation, changes in land access, use and control of own financial resources. With regard to facilitating women's employment, Giroud and Huaman's study suggests adapting working hours (so that women can both work and carry out household and childcare responsibilities); sharing workloads (e.g. a mixed team of some women with children and some single women) to ensure a good job distribution among employees; providing training on discrimination against women and sexual harassment; and establishing gender networks to share experiences and to identify role models. Investors could also set up systems to encourage women in higher value-added activities, or establish preferential training and internal promotion programs.

Attracting foreign investment can contribute to the development of the agricultural sector of a country, but before the investment takes place, governments and investors could:

- Conduct gender impact assessments, establish baseline, engage in consultations with stakeholders, or conduct gender-based benefit-sharing arrangements.
- Refine existing incentives to attract foreign investment by incorporating gender considerations in terms of employment generation, working conditions and equal pay for a comparable job, as well as gender-sensitive schemes along the supply chain.
- Promote investments that have demonstrated positive economic and social impact on women.

In the post-investment phase, a number of policy interventions can take place:

- Monitoring schemes can be developed to assess investors' actions towards improving gender equality across all tasks and activities.
- Governments can invest in infrastructure to facilitate women's participation in agriculture and related industries. Engaging with women in the negotiation process would help in taking decisions upon locally appropriate gender-sensitive infrastructural investments. These may include childcare centers, health and education infrastructure, and the development of market areas oriented towards advancing women suppliers.
- Investors and government or donor programs can provide opportunities for women to diversify their livelihoods to avoid community dependence on the investor as the sole agricultural employer.