UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

PRE-FEASIBILITY ANALYSIS OF MEDIUM AND LARGE SCALE INVESTMENT OPPORTUNITIES IN LUXOR

AGRIBUSINESS - WASTE MANAGEMENT - WASTE TO ENERGY

From
the People of Japan

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

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The present Pre-feasibility Analysis was conducted by Chemonics Egypt Consultants for UNIDO in the framework of UNIDO "IMKAN project for youth employability and entrepreneurship in Upper Egypt"

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IMKAN project is funded by the Government of Japan and implemented by UNIDO together with the Ministry of Trade and Industry and the Governorate of Luxor.

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Executive Summary

Luxor governorate has been struggling due to the downturn in tourism which has resulted in high levels of unemployment. Luxor has diverse opportunities in the sustainable agriculture and food production, waste management and sustainable energy sectors.

In the framework of IMKAN project for youth employability and entrepreneurship in Upper Egypt (in short IMKAN) implemented by UNIDO together with the Ministry of Trade and Industry and Luxor Governorate and with funding from the Government of Japan,[1] UNIDO carried out an extensive assessment of the economic texture of Luxor and identified potential clusters in these sectors, that have a high economic and social return, with a positive environmental impact. This uncovered a number of opportunities on multiple scales of capital and value addition that can drive the local economy forward. While startups and MSEs are an important element of a cluster, medium and large firms are crucial to its growth. In addition to supporting to small-scale business activity in these sectors, UNIDO is supporting the creation of larger industrial-scale businesses through medium-to-large sized investments upwards of EGP 20m.

This report shows the pre-feasibility analysis conducted on 6 selected investment opportunities in the aforementioned sectors, as part of the effort to illustrate the untapped potential in Luxor, with the aim of mobilizing public stakeholders in taking concrete action in alleviating barriers to the realization of the highest value-added industrial activities, while simultaneously whetting the appetite of potential investors. It is worth noting that all the opportunities maximize utilization of local agriculture produce or waste and overlap in the three strategic sectors of sustainable agriculture and food production, waste management and renewable energy. The identified opportunities have the potential to create 157 direct local jobs, in addition to 124 seasonal jobs.

They are summarized below.

Investment Opportunity 1 – Tomato and Fruit Concentrate Production Facility

This opportunity initially set out to take advantage of the abundant supply of tomatoes harvested in and around Luxor. Tomatoes are usually harvested and transported outside the governorate as fresh crop, so there was a clear opportunity in establishing a facility that can process some of that supply and add value to the crop locally. This would increase the demand on local tomatoes, bringing more stability to the price over time and help reduce the amount of losses incurred during transportation to the Delta. However, due to seasonality issues and price volatility of tomatoes, it was wise to use another local crop in the off-season to better utilize the facility. Therefore, the facility would produce tomato concentrate during the winter harvest and mango concentrate during the summer harvest. Both products would be targeted for export to the food processing industries in Europe and the Gulf, where Egypt already exports a significant amount with plenty of room left to improve current market shares. The technology used is an industrial standard concentrate production line, which is manufactured and assembled locally.

Investment Opportunity 2 – Black Honey and Date Syrup Production Facility

Similar to IO1, this opportunity set out to take advantage of large production of sugarcane in and around Luxor. Sugarcane is primarily used in raw sugar production but there are also traditional producers of black honey from fresh sugarcane (as opposed to molasses resulting from the process of sugar production). Hence, there was a clear opportunity in establishing a facility to industrialize the process of black honey production, to upgrade both

[1] IMKAN project was implemented from July 2016 to December 2017.

the quality and quantity of current production methods. Sugarcane is only harvested during the winter months, so to account for seasonality and better utilize the facility, dates were selected as a secondary crop. Using the same technology, with slight modifications in how the raw material is handled in the beginning of the process, date can be used to produce date syrup or honey, which is an alternative sweetener like black honey. Both products would be targeted for both local and export markets, sold as 'white label' goods in bulk to companies that specialize in marketing and distribution. The potential lies more in import substitution rather than export, as Egypt imports a significant amount of alternative sweeteners each year. The technology used is an industrial standard syrup production line (similar to the concentrate production line used in IO1), which is manufactured and assembled locally.

Investment Opportunity 3 – Fruit and Vegetable Drying Facility

This opportunity aims to add value to local crops through drying, i.e. the extraction of water from fruit and vegetables using dehydration, which improves its shelf-life while maintaining its nutritional value as much as possible. The selected crops, based on abundance and seasonality, are tomatoes, bananas and mangoes. Dried tomatoes are used mostly for cooking, while banana and mango chips are usually consumed as snacks. Dehydrated fruits and vegetables have major potential in export, as well as growing demand locally. There are food drying operations currently taking place around the country but on a small-scale, usually reliant on traditional sun-drying techniques. Establishing a facility with quick drying technology could produce dried fruits and vegetables on a larger scale suitable for bigger markets. There are many technologies used in food drying that vary according the feedstock, the specifications of the final product, the production capacity, etc. The technology selected for this opportunity is called 'swell-drying' or DIC, which is a French technology that uses heat to dehydrate foods to a quality that is similar to freeze-drying but at much lower capital and running costs. It is versatile enough to accommodate most fruits and vegetables, and even medicinal and aromatic plants.

Investment Opportunity 4 – Fruit and Vegetable Packing Facility

This opportunity aims to add value to local crops through improved packaging, making it more suitable for export and local niche markets. The selected crops, based on abundance and seasonality, are tomatoes, grapes and mangoes. The packing facility receives the fresh harvest that undergoes fumigation and quality packaging, transported in refrigerated trucks to the relevant ports. Egypt already exports a significant amount of its crops, especially to the Gulf and Europe, and this facility will improve access for local farmers to these markets. The technology selected for this packing facility is mainly imported which consists mostly of packaging lines, waxing stations and cooling rooms. Luxor is already home to a packing facility which is not operating at maximum capacity due to a limitation in refrigerated transport from facility to ports (mainly Alexandria), which is addressed in this study.

Investment Opportunity 5 – MDF Production Facility

This opportunity aims to add value to the large amount of agricultural waste generated in and around Luxor. Bagasse, which is the fiber discarded from the process of sugar production from sugarcane, is considered a high-quality material input for the production of medium density fiber board, or MDF. Establishing an MDF production facility in Luxor makes sense to be close to the sugar production facilities in the region and will add significant value to sugarcane bagasse. The potential here lies mainly in the local market as Egypt imports a significant amount of MDF, and wood in general. Export markets do have potential as well since MDF made from bagasse can meet export quality standards. MDF boards are used mainly in furniture and fixtures, and are commonly used as a replacement for natural wood boards. The technology is expensive, and a refurbished production line can be imported from Japan or Italy. However, the return on investment is quite high compared with the other opportunities (see Summary below).

Investment Opportunity 6 – Alternative Fuel Production Facility

This opportunity also takes advantage of local waste streams such as sugarcane bagasse, wood cutting and sawdust, corn stalk, palm tree fronds and banana trees. The final product is high-calorific value biomass pellets that can burned on-site at energy intensive factories such as cement plants. The potential lies in serving the local market such as cement plants in Qena and Assiut, which are preparing to receive all kinds of alternative fuel to meet the energy demands. However, for this opportunity to remain financially sustainable, at least half the production must be aimed towards export because of the discrepancy in selling prices. The technology used is mainly imported from Europe and the USA (or possibly China but at a fraction of the productivity), which is used to shred the agricultural waste, and pelletize it.

Summary of Feasibility Analysis

	IO1	IO2	IO3	IO4	IO5	IO6
Summary	**Concentrate**	**Syrup**	**Drying**	**Packing**	**MDF**	**Fuel**
Capital Expenditures	EGP 16,700	EGP 13,350	EGP 14,100	EGP 14,000	EGP 67,100	EGP 38,070
Working Capital Required	EGP 14,947	EGP 7,707	EGP 5,598	EGP 27,913	EGP 36,266	EGP 8,868
Minimum Investment	EGP 31,647	EGP 21,057	EGP 19,698	EGP 41,913	EGP 103,366	EGP 46,938
Direct Investment (Equity)	EGP 9,494	EGP 6,317	EGP 5,909	EGP 12,574	EGP 31,010	EGP 14,081
Debt Financing	EGP 22,153	EGP 14,740	EGP 13,788	EGP 29,339	EGP 72,356	EGP 32,857
Enterprise Value	EGP 66,730	EGP 42,513	EGP 117,376	EGP 114,898	EGP 917,367	EGP 157,075
Internal Rate of Return	30%	29%	56%	34%	73%	39%
Simple Payback	5.9 years	5.9 years	2.2 years	4.4 years	2.8 years	3.1 years
Discounted Payback	8.3 years	8.0 years	3.4 years	8.0 years	2.3 years	5.4 years
Profitability Index	2.11	2.02	5.96	2.74	8.87	3.35

***Note**: EGP numbers are in thousands.*

1 Background

1.1 Diversifying the Local Economy in Luxor

Luxor governorate has been struggling due to the downturn in tourism which has resulted in high levels of unemployment. On the surface Luxor may seem unready for other economic activities, yet UNIDO on-the-ground work shows otherwise.

Luxor has diverse opportunities in the sustainable agriculture and food production, waste management and sustainable energy sectors. These opportunities are highly profitable and leverage the unique resources of the governorate in sustainable manner. More importantly, Luxor has a local business community that is willing to capture such opportunities.

However, a limited but challenging set of barriers hindering the realization of the highest value-added industrial activities exists. Under the aegis of the Ministry of Trade and Industry and Luxor governorate, UNIDO, in the framework of IMKAN project for youth employability and entrepreneurship in Upper Egypt, brought together both public and private stakeholders to take actions to remove such obstacles and pave the way for local industrial development.

1.2 Laying Seeds of Industrial Clusters

UNIDO, through its IMKAN project, has carried out an extensive mapping of the economic texture of Luxor governorate with the purpose of diversifying the local economy. The mapping aimed at determining potential industrial clusters that can evolve in Luxor and business opportunities within those clusters that can have high economic and social return, and a positive environmental impact.

The clusters aim at leveraging the competitive edge of Luxor and build upon existing activities. Focus was given to clusters in sustainable agriculture and food production, waste management, and sustainable energy. The mapping lead to identifying business opportunities on multiple scales of capital and value addition that can drive the local economy forward. UNIDO proceeded to work on laying the seed of such clusters and supported 22 start-ups and micro and small enterprises (MSEs) to start and grow their business in pre-determined business opportunities.

UNIDO also built the capacity of local service providers and NGOs so they may support the creation of startups in the sector. In addition, UNIDO raised the capacity of local investors and financing institutions to support start-ups and MSEs. The 22 supported enterprises are expected to create 146 direct local jobs within the next two years. These businesses require initial investments of varying scale, from as small as 30,000 up to 1,000,000 EGP per enterprise. In 2014, in Southern Upper Egypt, UNIDO attracted investment locally for startups and micro enterprises in the range of capital investment of 50,000 to 250,000 EGP per enterprise. In that year EGP 1.25m were facilitated in investments in 8 startups and micro enterprises.

1.3 Attracting Larger Investments

While startups and MSEs are an important element of a cluster, medium and large firms are crucial to its growth.

In addition to leveraging investment for start-ups and MSEs, UNIDO is supporting the creation of larger industrial-scale businesses through medium-to-large sized investments upwards of EGP 20m. Opportunities that can absorb such capital have been defined through technical and market experts. More importantly, a group of local investors has already shown interest in such investment opportunities.

The UNIDO approach in attracting investment opportunities is unique in the sense that it:

- leverages existing competitive edge;
- utilizes extended field visits, data collection, stakeholders' discussions, and technical expertise;
- is carried out in consultation of the private sector and in partnership with local investors;
- develops opportunities that have high economic, social and environmental impact.

Pre-feasibility analysis has been prepared for 6 selected investment opportunities to illustrate the untapped potential in Luxor and whet investor appetite.

The investment opportunities are diverse, targeting both local and export markets, feeding into other industries or straight to consumers. They are as follows:

1. tomato and fruit (mango) concentrate production for food processing industries
2. black honey and date syrup production for consumers
3. dried fruit and vegetable production for consumers
4. fresh fruit and vegetable packing for export
5. MDF panels manufacturing for local furniture industry
6. biomass fuel pellets production as alternative fuel for energy-intensive industries

All opportunities maximize utilization of local agriculture produce or waste and overlap in the three strategic sectors of sustainable agriculture and food production, waste management and sustainable energy. The identified opportunities have the potential to create 157 direct local jobs, in addition to 124 seasonal jobs.

1.4 Why Invest in Luxor?

Luxor enjoys a central geographical location amongst the governorates of Southern Upper Egypt and is considered Egypt's southern portal to Africa. It is also the commercial gateway between the Red Sea governorate and Upper Egypt. It already has an active agricultural sector due to its optimum climate, and is specialized in the cultivation of tomatoes, sugarcane, grapes, bananas, mangoes, dates, corn/maize and medical/aromatic plants such as hibiscus.

Luxor is already home to three industrial zones; Boghdadi (311 acres) in the center of the governorate; New Tiba (382.71 acres) to the North; and Armant (1011.73 acres) to the South. These zones are currently under-utilized but are being readied to become more attractive for investment. Furthermore, there are several major industrial activities within proximity that can be clustered around such as the sugar factories in Armant, south of Luxor as well as the sugar processing, paper/cardboard manufacturing and cement plants in neighboring Qena.

Luxor's worldwide reputation as the tourism capital of Egypt has unparalleled brand value. It is known for being the 'world's largest open-air museum' with over a third of the ancient world's ruins located on its grounds. This had mobilized major capital into the creation of local services such as hospitality, conference centers, etc. which can equally serve the business community as it does for tourism.

2 IO1 - Tomato and Fruit Concentrate Production Facility

2.1 Overview

This opportunity aims to add value to local crops by producing concentrates suitable for export to food processing industries in the Gulf and Europe. The crops in focus are tomatoes and mangoes mainly, because of their local abundance and seasonality.

Initially the focus was on tomatoes, which was highlighted as a crop that is widely cultivated yet undergoes little processing locally. The opportunity is to establish a local facility that can take advantage of that supply and produce value-added products such as concentrates, purees and pastes.

Mangoes were later selected as a suitable secondary crop to offset seasonal price volatility in tomatoes during the summer months. This way the facility operates on locally sourced crops only; tomatoes during the winter and mangoes during the summer, using the same technology for both.

2.2 Market Demand

This section provides a description of the products and targeted markets, including a brief analysis on the current market structure, the potential for import substitution and export where applicable.

2.2.1 Product Description

This investment opportunity primarily focuses on producing two products:

Product A: tomato concentrate for the tomato processing industry, such as the production of paste, soups, sauces and ketchup.

Tomato is processed into several forms such as puree, paste, salsa, etc. which are differentiated by the amounts of solids they contain. Concentrate typically has the highest solid content, which is commonly measured using Brix value, which is a measure of Total Soluble Solids (TSS) that are typically sugars. Tomato concentrate is usually around 36-38% TSS, as shown below, which is higher than other forms of processed tomato. Concentrate was selected as it has the highest solid content that makes it suitable feed for a wider range of food industries, which can then take it and dilute accordingly.

For illustrative purposes only.

Table 1 Brix Values for Processed Tomato

Specifications	*Solid Content (Brix)*
Puree	12-15%
Paste	28-30%
Concentrate	**36-38%**

Product B: mango concentrate for the fruit juice manufacturing industry.

The same production line can be used to produce concentrate from other fruits and vegetables. Mango has been identified as a suitable feedstock from which to produce concentrate for the juice making industry to mitigate supply chain risks (explained in more detail in Section 1.3). Mango concentrate typically has a final Brix value of 28-32%.

For illustrative purposes only.

The final product is packaged in industry standard aseptic bags, weighing 200kg each, with a shelf-life of 24 months.

2.2.2 Current Market Structure

According to Trade Map data(International Trade Centre 2017), Egypt ranked 9th in world exports of tomato sauces and ketchup in 2016, but that only presents a 1.9% market share. The global market is dominated by USA, Netherland, Germany, Italy and Belgium. The world market for exports in this category was worth USD 1.6b in 2016. Egypt exports seem to have plateaued the last three years, despite a decent jump in 2013, while imports have remained relatively steady as shown below.

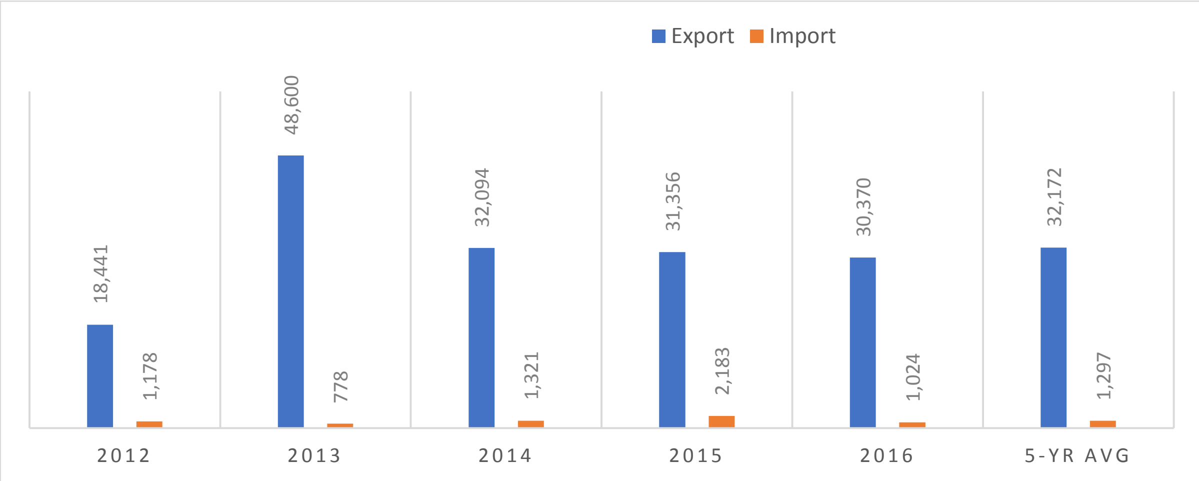


Figure 1 Egypt Export vs Import in USD for years 2012-2016 for Tomato Sauces and Ketchup

Egypt's biggest importers in 2016 are shown in Table 2. Despite ranking high in the respective country's imports, the market shares are considered quite low, except for Sudan. This leaves significant room for improvement in market share for the main markets currently targeted.

Table 2 Egypt's Top Importers of Tomato Sauces and Ketchup in 2016

		Value exported in 2016 (USD thousand)	**Share in Egypt's exports (%)**	**Quantity exported in 2016**	**Share in Country's Imports (%)**	**Rank in Country's Exports**	**Average Price per ton (USD thousand)**
1	Sudan	6,898	22.7	5,501	98.1	1st	1.25
2	Morocco	4,881	16.1	3,893	6.3	5th	1.25
3	Saudi Arabia	3,685	12.1	2,939	13.4	3rd	1.25
4	United Arab Emirates	3,039	10.0	2,424	12.3	2nd	1.25
5	Jordan	2,062	6.8	1,644	13.8	4th	1.25

The stability in import levels also indicates that current local production can satisfy most of the demand from a local market perspective, so the opportunity there may be limited. However, it is important to note that consultations with stakeholders did state that local demand is growing and can easily absorb increases in production.

As for the market for fruit pastes and purees (the data available does not single out mango products), Egypt ranked 21st globally. This accounts for only 1.2% of the global market, which is around USD 3.1 billion, as of 2016. Exports have been erratic in the last 5 years, and Egypt remains a net exporter by almost 2:1. While there is no breakdown of the data available to show how much mango specifically contributes to these numbers, it can be assumed that there is both export growth and import substitution potential when it comes to this category of products. The following figure shows import and export trends for the last 5 years.

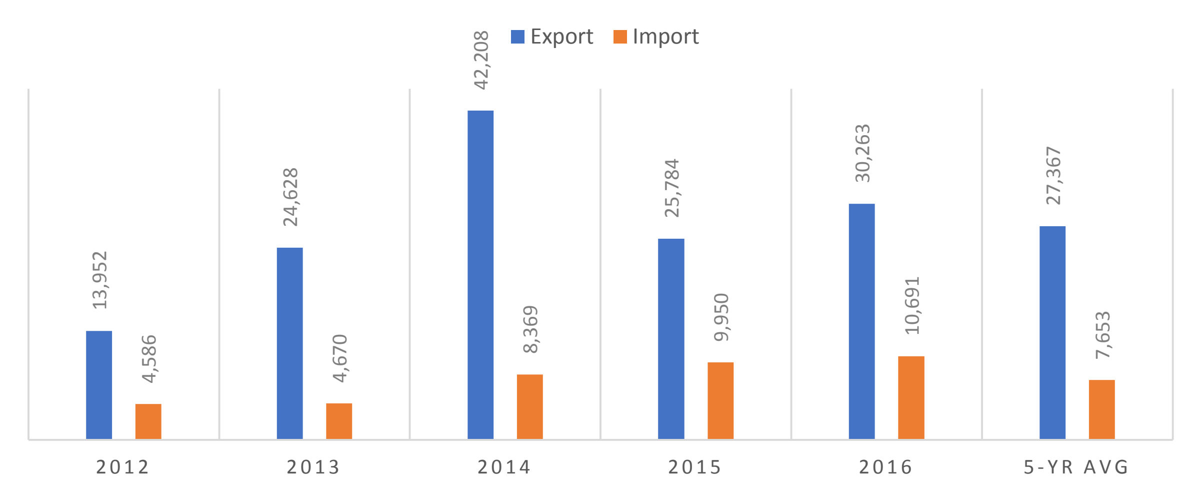


Figure 2 Egypt Export vs Import in USD for years 2012-2016 for Fruit Pastes and Purees

Egypt's biggest importers in this category for 2016 are shown in Table 3. Except for the United States, Egypt ranks quite high on the list of neighboring countries. While it controls a decent market share in both Algeria and Sudan, there is significant improvement to be made in the case of Saudi Arabia and United Arab Emirates.

Table 3 Egypt's Top Importers of Fruit Pastes and Purees in 2016

		Value exported in 2016 (USD thousand)	**Share in Egypt's exports (%)**	**Quantity exported in 2016**	**Share in Country's Imports (%)**	**Rank in Country's Exports**	**Average Price per ton (USD thousand)**
1	Algeria	9,528	31.5	4,364	50.8	1st	2.18
2	United Arab Emirates	3,191	10.5	1,462	11.4	3rd	2.18
3	Saudi Arabia	2,039	6.7	934	73.7	1st	2.18
4	Sudan	2,019	6.7	925	9.4	4th	2.18
5	United States of America	1,912	6.3	876	0.7	25th	2.18

In the fruit paste and purees category (which also includes products like jams and jellies) there is untapped potential in the Gulf countries despite ranking high. From a local perspective, there is measurable demand that relies on importing in this category. However, it is safer to assume that importing concentrates from fruits that are readily harvested in Egypt such as mango accounts for a small portion of the amount imported in this category.

2.2.3 Target Market Size

The trailing 5-year average for values exported and imported in tomato sauces and ketchup category and the fruit pastes and purees categories are as follows:

Table 4 Target Market Size for Concentrates

	5-yr trailing average 2012-2016 (USD thousand)				
	Tomato Pastes and Ketchup	Fruit Pastes and Purees	Totals	Target %	Target Value

Export	32,172	27,367	59,539	50%	29,770
Import	1,297	7,653	8,950	10%	895
	USD 33,469	35,020			USD 30,665

The target market size was estimated using the assumption that there is more room for growth from an export market perspective. With aggressive marketing and quality control, total exports in these categories can improve by 50%. From an import substitution perspective, the potential market size is assumed to be 10% of current import levels. This brings the total estimated target market size to USD 31m (EGP 558m)

Expected Selling Prices: The markets to target are export mainly to take advantage of the lucrative pricing post-EGP flotation, followed by local food industry. A ton of tomato concentrate is expected to sell somewhere in the range of USD 900 – 1,500 per ton (EGP 16,000 – 27,000). Mango concentrate is expected to export at prices between USD 2,000 – 2,200 per ton (EGP 36,000 – 40,000). Local prices for these products are expected to be within the same ranges however on the lower side.

Anticipated Competition: There are two neighboring tomato processers already in operation, UEFOCO in Minya (800 ton per day capacity) and El-Wady in Qena (300 ton per day capacity). However, the expected competition is minimal as consultations have indicated that demand for tomato concentrate is not satisfied at a local level, and there is always room for export, especially considering added competitiveness post-EGP flotation.

2.2.4 Estimated Annual Sales and Forecasts

The plant, described in more detail under Project Engineering, is assumed to start operating at 50% capacity in Year 1 and reach around 91% by Year 10 as part of the conservative assumptions resorted to in the present document. Revenue growth forecasts to account for in price inflation and better capacity utilization in subsequent years are assumed, with an aggressive marketing push in the first 5 years, as shown in Annex I:

This translates to estimated production and annual sales for Year 1 as follows:

- 1,429 tons of tomato concentrate, which will bring in EGP 29m in revenue during the winter harvest, which occurs in Upper Egypt. Sourcing tomatoes from the Delta during the summer may be too costly.
- 1,200 tons of mango concentrate, which will bring in an additional EGP 42m in revenue during the summer harvest, also sourced locally.

This brings Year 1 revenues to a total of EGP 71m. This study projects to Year 10 on the above growth and inflation rates. The following graph shows a comparison of the target market and expected revenues in the first five years.

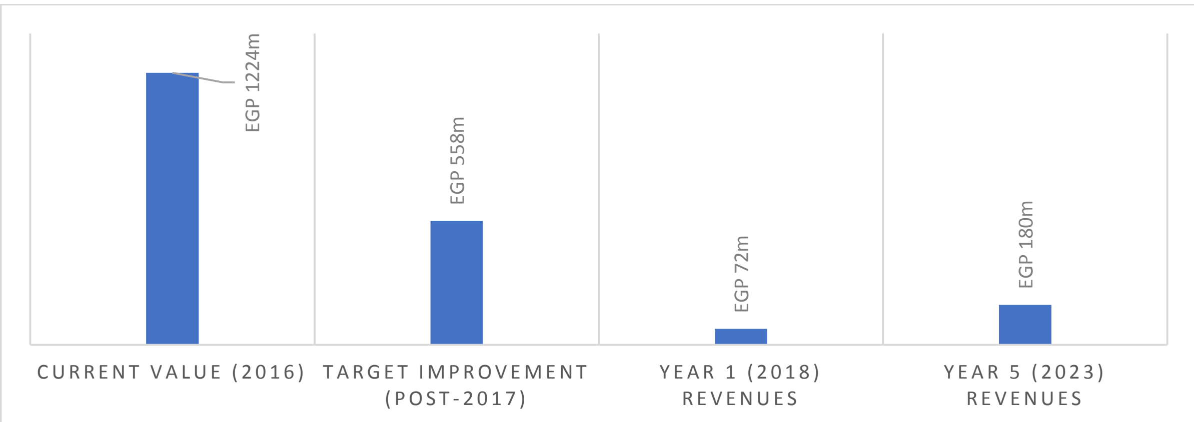


Figure 3 Comparison between Target Market Size and Year 1-5 Revenues for Concentrate

2.2.5 Estimated Marketing Costs

Marketing the product on the global stage will require a considerable budget and it is assumed that the marketing budget will account for around 7.5% of sales targets stated above. These sales targets after all are highly contingent on aggressive marketing before operations. This brings the total marketing budget for Year 1 to over EGP 5m.

2.3 Direct Inputs Required

This section describes the main raw materials required for the process, including other inputs such as additives, etc., as well as the expected costs, their availability (including seasonality when referring to crops) and any risks expected in securing each input and how to mitigate it. It also shows the utilities required, specific consumption benchmarks used, as well as direct labor requirements and any other direct inputs.

2.3.1 Crops Required

The two main crops required for this process are tomatoes and mangoes. Tomatoes are the focus given their abundance in both Luxor and neighboring Qena as well as the significant market demand for tomato-based products. Qena figures were added as they present a valid local source of the required crops. While total feddans cultivated add up to around 16 thousand feddans for 2014-2015, this number could be as high as 20 thousand currently, according to local sources.

While tomato is cultivated all year round across Egypt, it is mainly a winter crop in Upper Egypt, and therefore unavailable in the summer months starting June, only to become available for harvest again in November.

The process required to produce concentrate from tomato can be used to produce concentrates from other fruits and vegetables. To fill the seasonal gap, mango was selected based on its local availability and increasing demand, as well as the fact that it is a summer crop, available from June till August[2].

The following table provides the figures for feddans cultivated and tons produced are according to figures provided by the CAPMAS Annual Bulletin for Statistical Crop Area and Plant Production for the years 2014-2015.

Table 5 Production Schedule according to Seasonality of Tomato and Mango in Luxor and Qena

Crop Name	Luxor		Qena		Seasonality / Production Schedule											
	feddans	Tons	feddans	tons	Jan	Feb	Mar	Apr	Ma	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tomatoes	9,619	184,133	6,718	134,487	x	x	x									x
Mangoes	1,911	6,181	708	2,147						x	x	x				

The market prices for the crops are presented in the following table based on 2016-2017 levels. These prices are based on direct buying from farmers. When buying from traders, around 8% is added as a margin, plus EGP 0.25 per kg for transportation.

Table 6 Prices of Tomato and Mango for 2016-2017

Crop	Price
Tomato	EGP 1-8 per kg
Mango	EGP 6-9 per kg

This study assumes tomatoes are sourced locally only at an average price of EGP 2 per kg, although that can go down to as low as EGP 0.70 per kg when sourcing for factories. Sourcing from the Delta during the summer can

[2] Interviews with local stakeholders indicated that current agricultural production levels have climbed higher than official figures provided by CAPMAS for years 2014-15 as shown in Table 5.

push prices up to EGP 8, which makes tomato concentrate production unfeasible. The mangoes are assumed to be sourced locally at EGP 9 per kg.

2.3.2 Utilities

Assuming today's tariffs for electricity, natural gas and water, the following specific consumption rates were calculated for the two main products, tomato and mango concentrate. The rates change due to different water requirements, thermal energy for heating and technical modifications for handling of feedstock[3].

Table 7 Specific Consumption and Utility Bill for Tomato and Fruit Concentrate for Year 1

	Specific Consumption		***Expected Bill***	
Utilities – Tomato				
Electricity	150	kWh/ton	115.05	EGP/ton
Gas	2,300	kWh/ton	713.00	EGP/ton
Water	230	m3/ton	713.46	EGP/ton
Wastewater	90	m3/ton	240.30	EGP/ton
Utilities – Mango				
Electricity	1,200	kWh/ton	920.40	EGP/ton
Gas	1,900	kWh/ton	589.00	EGP/ton
Water	20	m3/ton	62.04	EGP/ton
Wastewater	20	m3/ton	53.40	EGP/ton

The above tariffs are for the fiscal year 2017/2018 and are assumed to be tied to inflation projections over the consequent years, as shown in Annex I.

2.3.3 Direct Labor

Seasonal labor will be required for each harvest to handle the fresh tomatoes and mangoes coming during production months. The following table shows how many workers will be required for each season of production.

Table 8 Seasonal Labor Required for Tomato and Mango Concentrate

Production – Seasonal	***No. of Workers***	***EGP per ton handled***
Workers – Tomato Season	10	50
Workers – Mango Season	10	50

2.3.4 Packaging

The aseptic bags required for storage are not available locally according to the data gathered and must be imported in bulk. They are widely available as industry standard packaging. These usually carry around 200kg of product each and stored in steel drums for transportation. The expected cost of one aseptic bag ranges between USD 2-3 and are ordered in bulks of 7,000-8,000 bags.

2.3.5 Other Inputs

Tomato and other concentrates require the addition of preservatives when packaged such as ascetic or citric acid. This is normally around 4-5g per ton of product, which is negligible from a cost perspective.

[3] The specific consumption rates were obtained from the European Commission's (EC) Best Available Techniques Reference Documents (BREFs) as well as the SCOoPE project, also funded by the EC, as well as from industry experts and practitioners.

2.4 Project Engineering

This section describes the production process in detail, any specific technologies used, the estimated plant capacity, as well as the main components required along with an estimate for civil engineering works (factory infrastructure, etc.) and the total area required.

2.4.1 Description of Technology

The process selected to produce concentrate from tomatoes and other fruits and vegetables is the industry standard used around the world, using technology that is widely available, mature and available from local manufacturers. Stainless steel structures are fabricated locally and assembled with components such as gauges, motors, etc.

2.4.2 Estimated Plant Capacity

The plant capacity is expected to handle up to 200 tons of tomato per day and 80 tons of mango (or similar fruit) per day. Each feedstock has its own conversion ratio, which is presented in the following table.

Table 9 Conversion Ratio for Tomato and Mango Concentrate

Crop	Input (tons/day)	Conversion Ratio	Max. Output (tons)	Yield
Tomato	200	7:1	29	15%
Mango	80	5:2	32	40%

It is assumed that production will take place in the same months as the harvest and only then. Production can take place in the gap months but will require investment in storage facilities to keep the raw material fresh for months. This will increase initial investment required so it was not taken into account in this study. However, it is safe to assume that these assets can be funded through the company's operating cash flow in future years, increasing productivity beyond this study's projections.

2.4.3 Process Flow

The process is illustrated in the following figure.

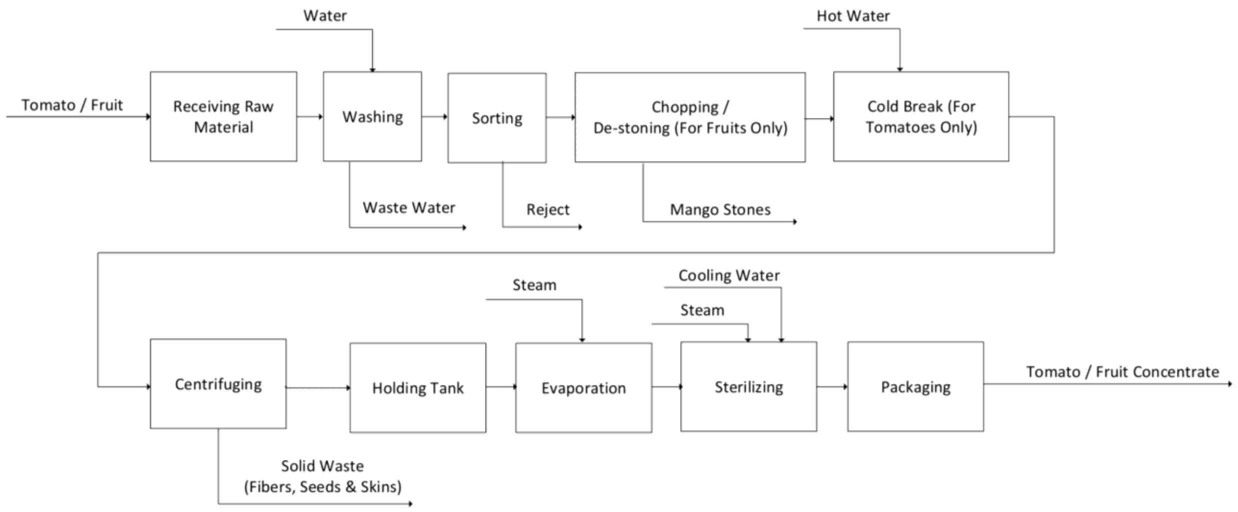


Figure 4 Process Flow Diagram of Concentrate Production

The process steps illustrated in Figure 4 are described in detail in the following table.

Table 10 Step-by-Step Details of Concentrate Production Process

#	Name	Description
Step 1	Receiving raw material	Tomatoes arrive at the plant in trucks, which are directed to the offloading area.
Step 2	Washing	Tomatoes are washed under water streams to eliminate any dirt. Water is continuously pumped into the collection channel. This water carries the tomatoes, rinses them, and conveys them to the sorting station.
Step 3	Sorting	At the sorting station, staff remove material other than tomatoes, as well as the green, damaged and discolored tomatoes. These are placed on a reject conveyor and then collected in a storage unit to be taken away. In some facilities, the sorting process is automated.
Step 4	Chopping / De-Stoning	The tomatoes suitable for processing are pumped to the chopping station where they are chopped. Mangoes are put through a de-stoning machine to separate stones from fruit.
Step 5	Breaking (Tomatoes Only)	There are two types of tomato paste: Hot Break and Cold Break. They are used to make different end products. To make Hot Break paste, the fresh tomatoes heated after chopping to a very high temperature (ranging from 85 to 100°C). Cold Break paste requires the fresh, chopped tomatoes to be heated at a lower temperature (ranging from 65 to 75°C). Hot Break paste is usually used for ketchup and different types of tomato sauce requiring a 28-30° Brix, while Cold Break paste is mainly used for triple concentrate paste at 36-38° Brix.
Step 6	Centrifuging	The pulp (consisting of fiber, juice, skin and seeds) is then pumped through centrifuging system to remove the seeds and skin. Typically, 95% of the pulp is the juice that ends up in the final product. The remaining 5%, comprised of fiber, skin and seeds, considered waste and is transported out of the facility to be sold as cattle feed.
Step 7	Holding tank	At this point the refined juice is collected in a large holding tank, which constantly feeds the evaporator.
Step 8	Evaporation	Evaporation is the most energy-intensive step of the whole process – this is where the water is extracted, and the juice that is still only 5% solid reaches a Brix value of 36% tomato concentrate. The evaporator automatically regulates juice intake and finished concentrate output; the operator only must set the Brix value on the evaporator's control panel to determine the level of concentration. As the juice inside the evaporator passes through different stages, its concentration gradually increases until the required density is obtained in the final "finisher" stage. The entire concentration/evaporation process takes place under vacuum conditions, at temperatures significantly below 100°C.
Step 9	Sterilizing	Sterilization and pasteurization occurs before it is packed; the paste is pumped to a deposit tank and from there to a heat exchanger where pasteurization takes place at 110°C for 2 min or at 96°C for 3 min. After the thermal treatment, the product is cooled at 30°C to conserve its color, aroma, and taste qualities.
Step 10	Packaging	Most facilities package the finished product using aseptic bags, so that the product in the evaporator never comes into contact with air until it reaches the customer. Once packaged, the concentrate can be kept up to 24 months. Some facilities choose to package their finished product under non-aseptic conditions. This paste must go through an additional step after packaging, it is heated to pasteurize the paste, and then kept under observation for 14 days before being released to the customer.

Alternative Feedstock: As mentioned before, this process can be easily adjusted to account for other fruits and vegetables, as well as changing the specifications for the tomato concentrate itself. As mangoes have been selected as the most suitable complimentary feedstock to keep this production line in operation for most of the year, it will require minimal adjustments to how the raw material is received and changing the evaporator settings to achieve the required Brix value of the mango concentrate, as demanded by the market. For example, mango will require a de-stoner to remove the stones at the chopping/crushing stage. The production line needs to be properly cleaned and washed before switching raw materials.

2.4.4 Main Components and Equipment

The following is a list of the main components of the production line:

- Lift/Elevator
- De-stoner (for fruits such as mango)
- Washer
- Crusher
- Pre-Heating Machine
- Pulping/Refining Machine
- Holding Tank
- Juice Extractor
- Vacuum Concentrator
- Tube-in-tube sterilizer
- Bulk Aseptic Filler

This production line can be manufactured locally from start to finish. Separate prices for the components were unavailable, but the local manufacturer provided the following lump-sum quotations:

Table 11 Lump-sum Price Estimate for Concentrate Production Line

Maximum Capacity	Total Lump-Sum Price in EGP
Handles 200 ton of tomato per day	EGP 10m
Handles 300 ton of tomato per day	EGP 13m

The estimated useful life of this production line, assuming proper maintenance and care, can go up to 30 years.

Important Note: This study explores the first option as it assumes initial actual operating capacity at only 50%, which does not justify a higher initial nominal capacity for the production line and the additional capital expenditure associated with it.

2.4.5 Civil Engineering Works

In addition to the production line, there are key components of the factory's infrastructure that need to be considered, such as:

- Boiler for steam generation
- Electrical Generator
- Piping etc.

Total infrastructure costs are estimated to be around EGP 3 million for a factory of this size.

2.4.6 Area Required

The area required for this production line is estimated to be around 1,000 m^2. The land is assumed to cost around EGP 3,000 per m^2, which amounts to EGP 3m for land acquisition. Building structure and office space is estimated to cost an additional EGP 700,000.

Important Note: Land is expected to be given for free in the Boghdadi industrial zone (IDA jurisdiction) by Luxor governorate. However, it is sold against a fee in New Tiba (NUCA jurisdiction). To be conservative, land was assumed to be bought against a fee.

2.5 Selling, General and Administrative Expenses (SG&A)

This section provides details on the selling, general and administrative expenses associated with the facility, otherwise known as overhead costs.

2.5.1 Salaries and Wages

This opportunity is expected to employ around 25 permanent staff plus an additional 20 seasonal workers (10 for each of the two harvest seasons). They are summarized below:

Table 12 List of Staff and Monthly Salaries for Concentrate Production Line

Position	*Staff*	*Monthly*
Management		
CEO	1	15.000
…		
Production - Permanent		
Plant Manager	1	10.000
Quality Control	2	6.000
Hall Supervisors	2	6.000
Engineering	1	5.000
Workers	4	3.000
…		
Sales, General and Administration		
Procurement	2	5.000
Sales Manager	1	8.000
Sales	2	5.000
Marketing	2	5.000
Finance & Accounting	2	5.000
HR Manager	1	10.000
Maintenance	4	3.000
Security	2	2.000
…		
Total	**27**	staff

Salaries for permanent staff amount to EGP 86,000 per month in Year 1, which is EGP 1.6m total for the year. That is only 2% of total revenue for Year 1.

Wages for seasonal workers amount to EGP 500,000 for the tomato harvest and EGP 150,000 for the mango harvest. This assumes 10 workers per harvest season, getting paid EGP 50 per ton of feedstock handled.

2.5.2 Factory

Factory overheads that fall outside human resource expenses and production costs are expected to be at a minimum. Maintenance and storage costs are estimated to be around EGP 10,000 and EGP 2,000 per month respectively.

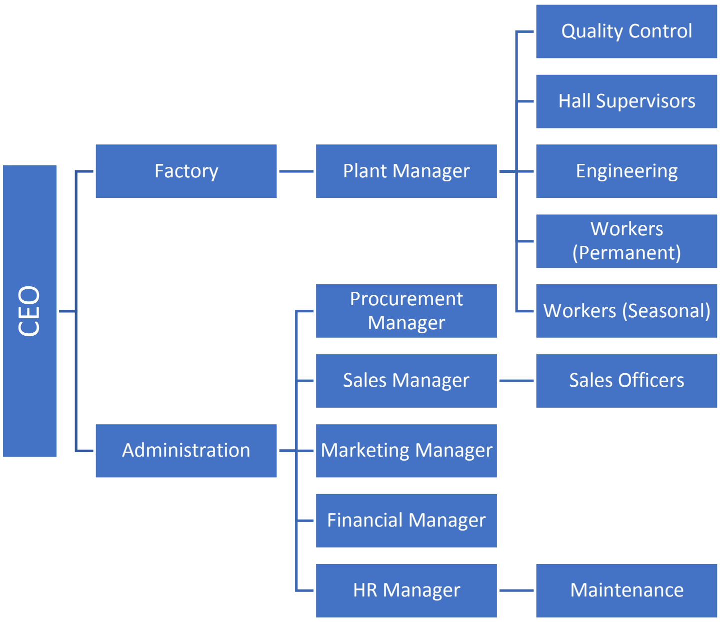
2.5.3 Other Selling, General and Administrative

The main line item in this category is the marketing budget, which is determined as 7.5% of expected sales. This amounts to EGP 5.3m for Year 1.

Utilities associated with administrative office space are expected to be around EGP 4,000 per month.

2.6 Organizational Structure

2.6.1 Organizational Chart



2.7 Financial Analysis and Investment

This section provides details of revenues, cost of goods sold (variable costs), margin analysis by product, selling, general and administrative (SG&A) expenses (aka overheads), fixed assets (initial capital expenditures) for the first year. The total initial investment is provided, and a 10-year projection of the income statements and statements of cash flow are calculated. Finally, the results of the feasibility and sensitivity analyses are provided as a summary of the key findings of the financial model.

2.7.1 Revenues

The estimated revenues for Year 1 are summarized below:

Product	**Months of Production**	**Total Tons Produced**	**Selling Price (EGP/ton)**	**Revenue (EGP 000s)**
Tomato Concentrate	Dec – Mar	1,429 tons	20,000	28,571
Mango Concentrate	Jun - Aug	1,200 tons	35,000	42,000
Total				**EGP 70,571**

2.7.2 Cost of Goods Sold

The estimated total COGS for Year 1 are summarized below:

Inputs	Quantity	Units
Fresh Tomatoes		
Tons bought	10,000	*tons*
Cost per ton	2,000	*EGP/ton*
Cost per month	**20,000**	*EGP 000s*
Fresh Mangoes		
Tons bought	3,000	*tons*
Cost per ton	9,000	*EGP/ton*
Cost per month	**27,000**	*EGP 000s*
Seasonal Labor		
Workers – Tomatoes	**500**	*EGP 000s*
Workers – Mangoes	**150**	*EGP 000s*
Packaging - Aseptic Bags		
Number of bags used	11,948	*bags*
Cost per year	**478**	*EGP 000s*
Utilities		
Electricity	**1,269**	*EGP 000s*
Gas	**1,725**	*EGP 000s*
Water	**1,094**	*EGP 000s*
Wastewater	**407**	*EGP 000s*
Total Utilities	**4,495**	*EGP 000s*
Total COGS	**52,623**	*EGP 000s*

2.7.3 Gross Margin Analysis by Product

Looking at each product's line items separately, gross margin can be calculated to show how profitable each product is and how much it contributes in covering overheads, ultimately increasing bottom line figures.

	Tomato Concentrate	Mango Concentrate
	EGP 000s	*EGP 000s*
Revenues	28,571	50,400
Raw Material	20,000	27,000
Seasonal Labor	500	150
Packaging	260	218
Electricity	164	1,104
Gas	1,019	707
Water	1,019	74
Wastewater	343	64
Total COGS	23,305	29,318
Gross Margin	**18.4%**	**30.2%**
(-) Overheads	**10.2%**	**10.2%**
Operating Margin	**8.3%**	**20.0%**

2.7.4 Selling, General and Administrative Expenses

SG&A for Year 1 is summarized below:

Human Resources	*EGP 000s*
Total Permanent Staff Salaries	1,680
Overheads	
Factory	
Maintenance	120
Storage	24
General & Administrative	-
Marketing (7.5% of Sales)	5,293
Utilities	48
Total Overheads	**5,485**
Total SG&A	**7,165**

2.7.5 Fixed Assets

The following table summarized the fixed assets (aka Property, Plant and Equipment) required for operation of the facility, along with the associated yearly depreciation expense.

Fixed Assets	**Cost**	**Dep. Life**	**Yearly Dep. Exp.**
	EGP 000s		*EGP 000s*
Production Line	10,000	10 yrs.	1,000
Infrastructure	3,000	15 yrs.	200
Building	500	30 yrs.	17
Office	200	10 yrs.	20
Land	3,000	0 yrs.	N/A
Total CAPEX	**16,700**		**1,237**

2.7.6 Minimum Investment Required

The minimum investment required will be the total fixed asset purchases required for operation plus 3-months' worth of working capital.

	EGP 000s
Initial Capital Expenditures on Fixed Assets	16,700
Working Capital for 3 months	14,947
Total Investment Required	**31,647**

Important Note: A general assumption was made in all studies that at least 3 months of working capital be covered in the initial investment. This clearly pushes up the initial ask in this particular case and can be reviewed at the feasibility study stage.

2.7.7 Projected Income Statements

The following is the projected income statements for the first 10 years of operation:

Table 13 Projected Income Statements for Concentrate Production Line (EGP thousands)

Income Statement	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Sales	70,571	98,800	128,440	154,128	177,247	189,655	202,930	217,135	232,335	248,598
COGS	(52,623)	(73,672)	(95,774)	(114,929)	(132,168)	(141,420)	(151,320)	(161,912)	(173,246)	(185,373)
Gross Profit	**17,948**	**25,128**	**32,666**	**39,199**	**45,079**	**48,234**	**51,611**	**55,224**	**59,089**	**63,225**
SG&A	(7,165)	(10,031)	(13,040)	(15,648)	(17,995)	(19,255)	(20,603)	(22,045)	(23,588)	(25,239)
EBITDA	**10,783**	**15,097**	**19,626**	**23,551**	**27,084**	**28,979**	**31,008**	**33,179**	**35,501**	**37,986**
Depreciation	(1,237)	(1,237)	(1,237)	(1,237)	(1,237)	(1,237)	(1,237)	(1,237)	(1,237)	(1,237)
EBIT	**9,547**	**13,860**	**18,389**	**22,314**	**25,847**	**27,743**	**29,771**	**31,942**	**34,264**	**36,749**
Interest Expense	(3,756)	(3,395)	(2,965)	(2,453)	(1,841)	(1,112)	(242)	-	-	-
Earnings before Tax	**5,791**	**10,465**	**15,424**	**19,862**	**24,006**	**26,631**	**29,529**	**31,942**	**34,264**	**36,749**
Loss Carry Forward	*5,791*	*16,256*	*31,679*	*51,541*	*75,547*	*96,387*	*115,451*	*131,969*	*146,372*	*159,116*
Taxes	(1,303)	(2,355)	(3,470)	(4,469)	(5,401)	(5,992)	(6,644)	(7,187)	(7,709)	(8,269)
Net Income	**4,488**	**8,110**	**11,953**	**15,393**	**18,604**	**20,639**	**22,885**	**24,755**	**26,555**	**28,481**
%Growth		*81%*	*47%*	*29%*	*21%*	*11%*	*11%*	*8%*	*7%*	*7%*
%NetMargin	*6%*	*8%*	*9%*	*10%*	*10%*	*11%*	*11%*	*11%*	*11%*	*11%*

2.7.8 Projected Cash Flow Statements

The following is the projected cash flow statements for the first 10 years of operation:

Table 14 Projected Cash Flow Statement for Concentrate Production Line (EGP thousands)

Cash Flow Statement	1	2	3	4	5	6	7	8	9	10
Net Income	4,488	8,110	11,953	15,393	18,604	20,639	22,885	24,755	26,555	28,481
(+) Depreciation	1,237	1,237	1,237	1,237	1,237	1,237	1,237	1,237	1,237	1,237
(+) Changes in Working Capital	(13,763)	(5,505)	(5,781)	(5,010)	(4,509)	(2,420)	(2,589)	(2,770)	(2,964)	(3,172)
Operating Cash Flow	**(8,039)**	**3,842**	**7,409**	**11,620**	**15,332**	**19,456**	**21,532**	**23,221**	**24,827**	**26,546**
(-) Capital Expenditures	(16,700)	-	-	-	-	-	-	-	-	-
Investing Cash Flow	**(16,700)**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
(+) Direct Equity	9,494									
(+) Debt Financing	22,153									
(-) Dividends	(1,346)	(2,433)	(3,586)	(4,618)	(5,581)	(6,192)	(6,865)	(7,426)	(7,966)	(8,544)
(-) Loan Principal	(1,873)	(2,233)	(2,663)	(3,176)	(3,788)	(4,517)	(5,386)	-	-	-
Financing Cash Flow	**28,428**	**(4,666)**	**(6,249)**	**(7,794)**	**(9,369)**	**(10,708)**	**(12,252)**	**(7,426)**	**(7,966)**	**(8,544)**
Cash Balance										
Begin of Period	-	3,689	2,864	4,024	7,850	13,813	22,561	31,841	47,636	64,497
Net Change	3,689	(825)	1,160	3,826	5,963	8,747	9,281	15,795	16,861	18,001
End of Period	**3,689**	**2,864**	**4,024**	**7,850**	**13,813**	**22,561**	**31,841**	**47,636**	**64,497**	**82,498**

2.7.9 Feasibility Analysis

The following table summarizes the key findings from the feasibility analysis:

Key Metric (based on 10-yr projections)	Result (EGP 000s)
Capital Expenditures Required	EGP 16,700
Working Capital Required for first 3 months	EGP 14,947
Minimum Investment Required	EGP 31,647
Direct Investment (Equity)	EGP 9,494
Debt Financing	EGP 22,153
Enterprise Value	EGP 66,730
Internal Rate of Return	30%
Simple Payback	5.9 years
Discounted Payback	8.3 years
Profitability Index	2.11

2.7.10 Sensitivity Analysis

The feasibility of this opportunity is most sensitive to fluctuations in crop prices, which are compounded by the low yields, especially in the case of tomatoes. A calculation was made to see how far up prices can go before gross margins reach 0%, while holding selling prices at current global prices for tomato and fruit concentrates. The results were as follows:

- Tomatoes can only go up as high as EGP 2.53 per kg. This study assumes an average price of EGP 2.00 per kg. A change of EGP 0.50 can change the gross margin on tomato concentrate by 15%.
- Mango prices have more room to move and go up as high as EGP 13.23 before erasing gross margins. This model assumes mangoes will sourced at EGP 9.00 per kg.

The idea of adding a second feedstock such as mango to this production line is essential not just for seasonality issues, but for the better margins and less risk of price fluctuations. The yield from mangoes is better than tomatoes and this affects how sensitive the margins are to changes in the feed prices.

In addition, selling prices of mango concentrate are higher, which improves margins further. While the seasonality gaps in tomato supplies can be remedied by sourcing feedstock from the Delta during off-season, the cost per kg can be as high as EGP 8.00 per kg, which would render this business model unfeasible.

2.8 Impact

Economic - Value added to local crops such as tomato and mango is quite significant. Based on this study's assumptions, before deducting other COGS and overheads:

- 7 kg of tomatoes cost EGP 14, to produce 1 kg of concentrate selling at EGP 20 – that is 30% value added to the crop.
- 2.5 kg of mangoes cost EGP 22.5, to produce 1 kg of concentrate selling at EGP 35 – that is 36% value added to the crop.

Social - Direct jobs created by this facility will include 27 permanent plant staff plus another 20-30 seasonal workers. Indirect jobs created will be mainly in logistics, marketing and distribution, and increased dedicated farming to supply the plant over time.

Environmental – This opportunity helps decrease losses of fresh produce, specifically tomatoes, during transportation over long distances to processing in other regions, as well as poor post-harvest handling. This is currently estimated to be around 25-30% and can exceed 60% in the case of tomatoes.

3 IO2 - Black Honey and Date Syrup Production Facility

3.1 Overview

This opportunity aims to add value to local crops by producing syrups suitable for both export and local consumption as alternative sweeteners. The crops in focus are sugarcane and dates mainly, because of their local abundance and seasonality.

Initially the focus was on sugarcane, which was highlighted as a crop that is widely cultivated locally. It is mainly used for sugar processing in several factories in the region, such as Armant and Qus. It is also used to produce black honey but through rudimentary techniques that affect quality and capacity. This opportunity aims to upgrade both the quality and quantity of black honey being produced in Luxor.

Dates were later selected as a suitable secondary crop to better utilize the facility. This way the facility operates on locally sourced crops only; sugarcane during the winter and dates during the summer, using the same technology for both.

3.2 Market Demand

This section provides a description of the products and targeted markets, including a brief analysis on the current market structure, the potential for import substitution and export where applicable.

3.2.1 Product Description

This investment opportunity primarily focuses on producing two products:

Product A: black honey extracted from fresh sugarcane for retail consumption, both local and export.

For illustrative purposes only.

Black honey is a black and highly viscous syrup with a high nutritional value, produced from sugarcane with a sugar concentration of at least 70%. It can also be produced from molasses, which is a byproduct of the sugar refining process. It contains vitamins, protein and beneficial salts such as calcium, iron, phosphors, etc. Black honey is a good source of energy as it contains carbohydrates and sugars, while low in both fat content and fiber.

It is a nourishing sweetener which contains a considerable amount of nutrients that are essential for the functioning of the body, unlike refined white sugar, which only contains simple carbohydrates and other components like aspartame, which is not very healthful for the body.

One of the reasons for the popularity of "black honey" is the many health benefits that eating it provides. It is said to be a digestive, an antidote for anxiety, an energy booster, and studies have proven that it is an anti-oxidant and good source of iron. It is beneficial in anemia and acidity to the high iron content. It is rich in vitamins, especially folic acid and vitamin B1; contains manganese which helps release energy; calms nerves and relieves throat infections and improves circulatory performance; eases coughing and disinfects lungs; used as a source of sugar for the food industry.

Product B: date syrup extracted from palm dates, also for retail consumption, both local and export.

Like black honey, date syrup (also known as date honey or silan, or *dibs balah* in Arabic) is a thick brown, very sweet fruit syrup extracted from palm dates and is widely used in Middle Eastern and North African cooking. It is rich in the monosaccharides glucose and fructose, and so most of its sugar content is absorbed into the bloodstream in the mouth, meaning that it raises the blood glucose levels more efficiently and immediately than other syrups. It also contains minerals such as potassium and calcium, that are abundant in whole dates. It is therefore highly suitable for people suffering from hypoglycemia, or for those with sucrose intolerance or those with pancreatic problems who have difficulty absorbing disaccharides.

The final products will be packaged in standard 450g 'white label' jars (i.e. to be marketed by different distribution companies, either locally or internationally).

3.2.2 Current Market Structure

According to Trade Map (International Trade Centre 2017), Egypt ranked 7th in world exports of cane molasses (the category which includes black honey for human consumption) in 2016, which represents a 4.6% market share. The global market is dominated by USA, China, Netherlands, Canada and Germany. The world market for exports in this category was worth USD 500m in 2016. Egypt exports seem to have plateaued the last three years, despite a decent jump in 2013, while imports have remained relatively steady as shown in the following figure.

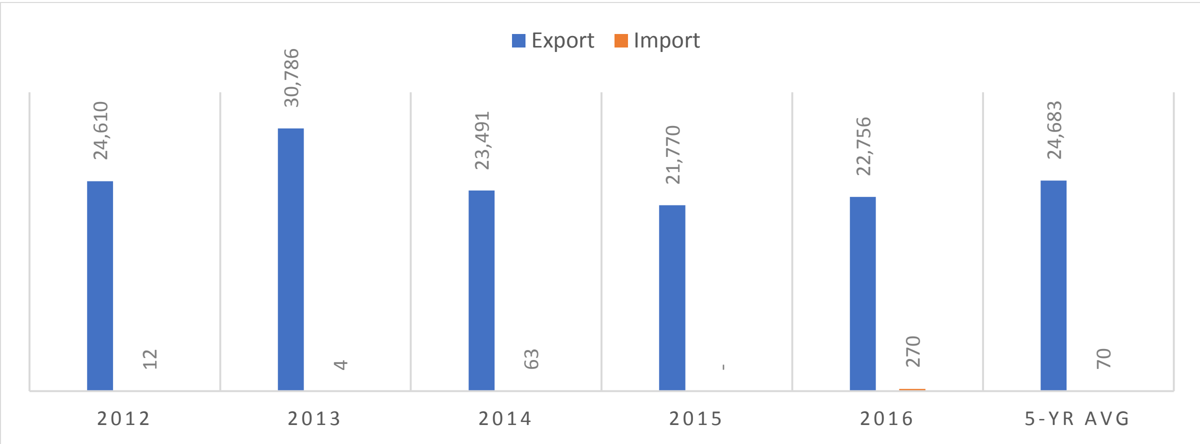


Figure 5 Egypt Export vs Import in USD for years 2012-2016 for Cane Molasses

Egypt's biggest importers in 2016 are shown in Table 15. Despite ranking high in the respective country's imports, the market shares are considered quite low for markets such as Italy and Spain. This leaves significant room for improvement in market share for the main markets currently targeted.

Table 15 Egypt's Top Importers of Cane Molasses in 2016

		Value exported in 2016 (USD thousand)	Share in Egypt's exports (%)	Quantity exported in 2016	Share in Country's Imports (%)	Rank in Country's Exports	Average Price per ton (USD thousand)
1	Italy	8,147	35.8	46,718	8.1	2nd	0.17
2	Turkey	3,840	16.9	22,021	38.9	1st	0.17
3	Portugal	3,371	14.8	19,332	51.2	1st	0.17
4	Spain	3,281	14.4	18,816	1.6	6th	0.17
5	Tunisia	846	3.7	4,849	100.0	1st	0.17

The low import values also indicate that current local production can satisfy most of the demand from a local market perspective. The local market size is difficult to determine because of limited data on local consumption patterns for this product.

As for date syrup, the specific data available is limited. Looking at the general category for other sugars – which includes chemically pure lactose, maltose, glucose and fructose, in solid form; sugar syrups not containing added flavoring or coloring matter; artificial honey, whether mixed with natural honey; caramel – Egypt ranked 45th globally. This accounts for only 0.11% of the global market, which is around USD 5.4 billion, as of 2016. It can be assumed that there is both export growth and import substitution potential when it comes to this category of products. The following figure shows import and export trends for the last 5 years.

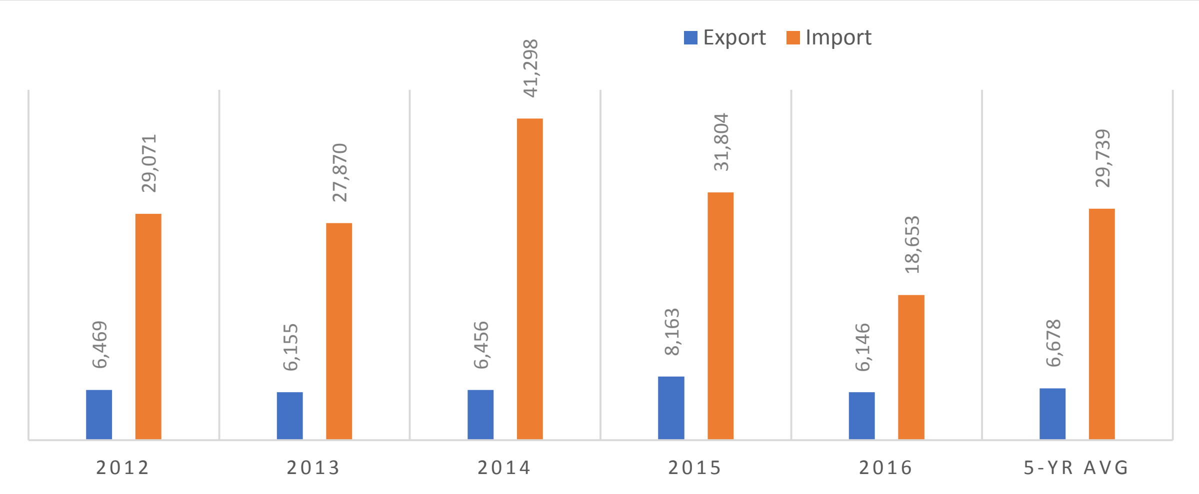


Figure 6 Egypt Export vs Import in USD for years 2012-2016 for Other Sugars

Egypt's biggest importers in this category for 2016 are shown in Table 16. While it controls a decent market share in Syria, there is significant improvement to be made in the rest of the countries shown in the table.

Table 16 Egypt's Top Importers of Other Sugars in 2016

		Value exported in 2016 (USD thousand)	Share in Egypt's exports (%)	Quantity exported in 2016	Share in Country's Imports (%)	Rank in Country's Exports	Average Price per ton (USD thousand)
1	Syria	3,031	49.3	7,910	34.0	1st	0.38
2	Algeria	1,021	16.6	2,638	5.7	6th	0.39
3	Tunisia	630	10.3	N/A	10.3	5th	N/A
4	Saudi Arabia	504	8.2	N/A	1.4	13th	N/A
5	Sudan	235	3.8	547	2.5	4th	0.43

Other Sugars is a large category and it is difficult to estimate what the actual values that are specific to date syrup are. The data does suggest that the potential for this product is more from an import substitution perspective, than export.

3.2.3 Target Market Size

The trailing 5-year average for values exported and imported in the two categories are as follows:

Table 17 Target Market Size for Syrups

	5-yr trailing average 2012-2016 (USD thousand)				
	Cane Molasses	Fructose Syrup	Totals	Target %	Target Value
Export	24,683	6,678	31,360	20%	6,272

Import	70	29,739	29,809	10%	2,981
	USD 24,752	USD 36,417			USD 9,253

The target market size was estimated using the assumption that there is more room for growth from an export market perspective for the black honey and more room from an import perspective for the date syrup. However, since the data provided by Trade Map where for wider categories, the assumption was a conservative 10% improvement on current export levels and only 5% for imports. This brings the total estimated target market size to USD 9.25m (EGP 167m).

Expected Selling Prices: The markets to target are export mainly to take advantage of the lucrative pricing post-EGP flotation, followed by local retail. A ton of black honey or date honey (packaged in white label jars for retail) is expected to sell somewhere in the range of USD 1,000 – 1,350 per ton (EGP 18,000 – 22,000). Local prices for these products are expected to be within the same ranges however on the lower side.

Anticipated Competition: There is around 70 producers using traditional methods in Qena and Menia. According to data gathered from interviews on the ground in Luxor, they reportedly sell white label products to local markets as they cannot get product quality up for export standards. There are a handful of factories around the country that produce export quality product but export little compared to global demand.

3.2.4 Estimated Annual Sales and Forecasts

The plant, described in more detail under Project Engineering, is assumed to start operating at 50% capacity in Year 1 and reach around 91% by Year 10 as part of the conservative assumptions typical resorted to in the present document. Revenue growth forecasts to account for in price inflation and better capacity utilization in subsequent years are assumed, with an aggressive marketing push in the first 5 years, as shown in Annex I.

This translates to estimated production and annual sales for Year 1 as follows:

- 300 tons of black honey, which will bring in EGP 7.5m in revenue during the winter harvest.
- 1,200 tons of date syrup, which bring in EGP 30m in revenue during the summer harvest.

This brings Year 1 revenues to a total of EGP 40m. The following graph shows a comparison of the target market and expected revenues in the first five years.

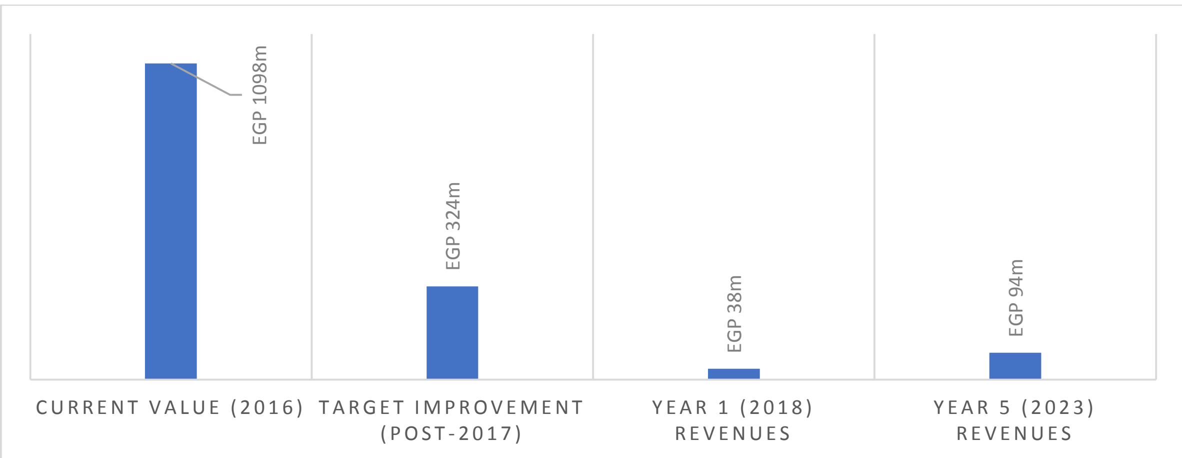


Figure 7 Comparison between Target Market Size and Year 1-5 Revenues for Syrup Production Line

3.2.5 Estimated Marketing Costs

Marketing the product on the global stage will require a considerable budget and it is assumed that the marketing budget will account for around 7.5% of sales targets stated above. These sales targets after all are highly contingent on aggressive marketing before operations. This brings the total marketing budget for Year 1 to EGP 2.8m.

3.3 Direct Inputs Required

This section describes the main raw materials required for the process, including other inputs such as additives, etc., as well as the expected costs, their availability (including seasonality when referring to crops) and any risks expected in securing each input and how to mitigate it. It also shows the utilities required, specific consumption benchmarks used, as well as direct labor requirements and any other direct inputs.

3.3.1 Crops Required

The two main crops required for this process are sugarcane and dates. Qena figures were added as they present a valid local source of the required crops.

Sugarcane is a winter crop and is harvested during the months starting January until April and is only cultivated in Upper Egypt. It is not available to source all year round. Dates provide a suitable alternative feedstock to utilize during the summer harvest, which is usually harvested between July and September.

The following table provides the figures for feddans cultivated and tons produced are according to figures provided by the CAPMAS Annual Bulletin for Statistical Crop Area and Plant Production for the years 2014-2015.

Table 18 Production Schedule according to Seasonality of Sugarcane and Dates in Luxor and Qena

Crop Name	Luxor		Qena		Seasonality / Production Schedule											
	feddans	Tons	feddans	tons	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sugarcane	67,422	3,257,224	118,089	5,690,000	x	x	x	x								
Dates	552	11,040	1,039	20,780							x	x	x			

The market prices for the crops are presented in the following table based on 2016-2017 levels. These prices are based on direct buying from farmers. When buying from traders, around 8% is added as a margin, plus EGP 0.25 per kg for transportation.

Table 19 Prices of Sugarcane and Dates for 2016-2017

Crop	Price
Sugarcane	EGP 0.70-1.0 per kg
Dates	EGP 5-6 per kg

This study assumes sugarcane is sourced locally at an average price of EGP 1 per kg, although that can go down to as low as EGP 0.62 per kg. Dates are assumed to be sourced locally at EGP 6 per kg.

3.3.2 Utilities

Assuming today's tariffs for electricity, natural gas and water, the following specific consumption rates were calculated for the two main products, black honey and date syrup. The rates for both were assumed to be the same[4].

Table 20 Specific Consumption for each product and Expected EGP per ton for Year 1

	Specific Consumption		***Expected Bill***	
Utilities – Black Honey & Date Syrup				
Electricity	1,200	kWh/ton	920.40	EGP/ton
Gas	1,900	kWh/ton	589.00	EGP/ton
Water	20	m3/ton	62.04	EGP/ton
Wastewater	20	m3/ton	53.40	EGP/ton

The above tariffs are for the fiscal year 2017/2018 and are assumed to be tied to inflation projections over the consequent years, as shown in Annex I.

3.3.3 Direct Labor

Seasonal labor will be required for each harvest to handle the fresh tomatoes and mangoes coming during production months. The following table shows how many workers will be required for each season of production.

Table 21 Seasonal Labor Required for Black Honey and Date Syrup

Production – Seasonal	***No. of Workers***	***EGP per ton handled***
Workers – Sugarcane Season	5	50
Workers – Date Season	5	50

3.3.4 Packaging

The final product will be packaged in white label jars. The standard size is 450g, which is equivalent to 1 lb., which is the size most used for this kind of product. The customer, which will be mainly marketing and distribution companies, will simply package their jars in their branding, ready to be placed on supermarket shelves. These jars can be sourced from local manufacturers. They are expected to cost EGP 2 per jar when ordered in bulks of 5,000 or more.

3.4 Project Engineering

This section describes the production process in detail, any specific technologies used, the estimated plant capacity, as well as the main components required along with an estimate for civil engineering works (factory infrastructure, etc.) and the total area required.

3.4.1 Description of Technology

The process selected to produce syrups from sugarcane and dates is the industry standard used around the world, using technology that is widely available, mature and available from local manufacturers. Stainless steel structures are fabricated locally and assembled with components such as gauges, motors, etc.

[4] The specific consumption rates were obtained from the European Commission's (EC) Best Available Techniques Reference Documents (BREFs) as well as the SCOoPE project, also funded by the EC, as well as from industry experts and practitioners.

3.4.2 Estimated Plant Capacity

The plant capacity is expected to handle up to 200 tons of tomato per day and 80 tons of mango (or similar fruit) per day. Each feedstock has its own conversion ratio, which is presented in the following table.

Table 22 Conversion Ratio for Sugarcane and Date into Syrup

Crop	Input (tons/day)	Conversion Ratio	Max. Output (tons)	Yield
Sugarcane	48	8:1	6	13%
Dates	48	2:1	24	50%

It is assumed that production will take place in the same months as the harvest and only then. Production can take place in the gap months but will require investment in storage facilities to keep the raw material fresh for months. This will increase initial investment required so it was not taken into account in this study. However, it is safe to assume that these assets can be funded through the company's operating cash flow in future years, increasing productivity beyond this study's projections.

3.4.3 Process Flow

The process is illustrated in the following figure.

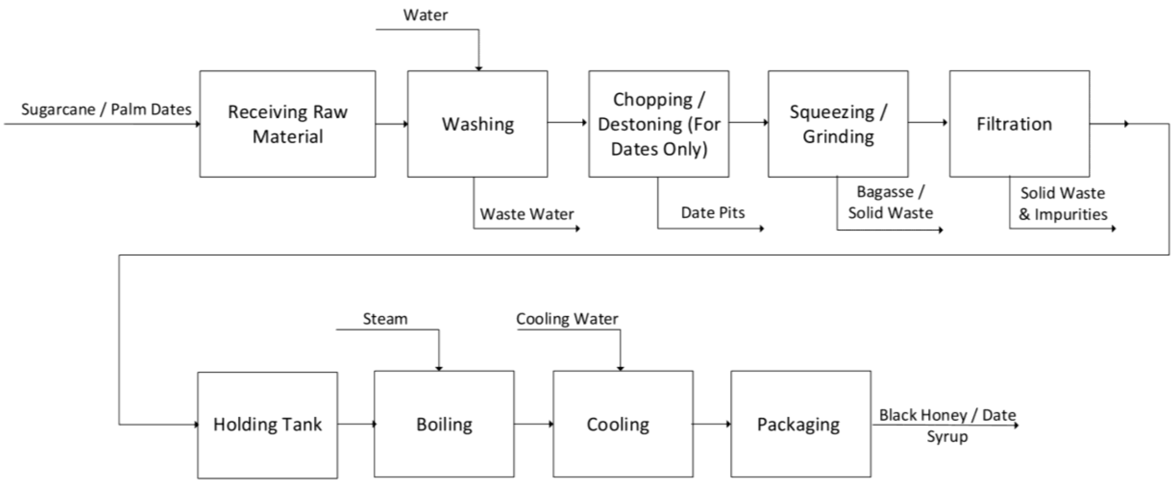


Figure 8 Process Flow Diagram of Syrup Production

The process steps illustrated in Figure 4 are described in detail in the following table.

Table 23 Step-by-Step Details of Syrup Production Process

#	Name	Description
Step 1	Receiving raw material	Sugarcane/Dates arrive at the plant in trucks, which are directed to the offloading area.
Step 2	Washing	Sugarcane/Dates are washed under water streams to eliminate any dirt. Water is continuously pumped through water channels and material is conveyed to chopping/de-stoning station.
Step 3	Chopping / De-Stoning	Sugarcane is chopped and readied to be fed into special squeezer. Dates are fed into special de-stoning machine to remove pits.
Step 4	Squeezing / Grinding	Sugarcane is fed into squeezer to be crushed to extract the juice. The crushing process must break up the hard nodes of the cane and flatten the stems. Sugarcane bagasse is the byproduct in this step, which can be sold to MDF manufacturers as well as animal feed and compost producers.

		Dates with pits removed are grinded to extract juice. Pre-soaking helps moisten the dates and extract more juice.
Step 5	Filtration	The amount of non-sugars and other particulates in the juice will affect its purity, resulting in discoloration and reduced sweetness. Therefore, filtration is essential and if done with care can remove up to 60% of non-sugars from the juice. A filter press, if available, will give the best results but can be expensive for small-scale operations. However, reasonable levels of filtration can be achieved by allowing the juice to stand for a few hours to allow particulates to precipitate out. The tanks should be fitted with a fine mesh lid, through which the juice is poured to filter out large particles of bagasse and other foreign bodies
Step 6	Holding tank	At this point the refined juice is collected in a large holding tank, which constantly feeds the evaporator.
Step 7	Boiling	For syrup production, the juice is boiled until the required concentration is reached and the strike is made at around 105ºC when most of the moisture has been boiled off and just before crystallization occurs. If the juice is over-boiled, then crystals may be present which may cause discoloration. If under-boiled, too much moisture will remain in the syrup which may, with time, cause cloudiness and shorten its shelf life.
Step 8	Cooling	The syrup is then poured or ladled from the boiling pan into containers where it is allowed to cool.
Step 9	Packaging	Cooled syrup is then fed into jar packing machine. Jars carry around 450g of syrup, equivalent to 1 lb., and then stored in a cool dry place. Shelf life for jars is around 48 months.

3.4.4 Main Components and Equipment

The following is a list of the main components of the production line:

- Washer
- De-pitter for dates
- Crusher/Squeezer
- Holding Tank
- Pulping/Refining Machine
- Juice Extractor
- Tube-in-tube sterilizer
- Cooling Stations
- Jar Packaging Machine

This production line can be manufactured locally from start to finish. Separate prices for the components were unavailable, but the local manufacturer provided the following lump-sum quotations:

Table 24 Lump-sum Price Estimate for Syrup Production Line

Maximum Capacity	**Total Lump-Sum Price in EGP**
Handles 48 ton of feedstock per day	EGP 8m

The estimated useful life of this production line, assuming proper maintenance and care, can go up to 30 years.

3.4.5 Civil Engineering Works

In addition to the production line, there are key components of the factory's infrastructure that need to be considered, such as:

- Boiler for steam generation
- Electrical Generator
- Piping etc.

Total infrastructure costs are estimated to be around EGP 2 million for a factory of this size.

3.4.6 Area Required

The area required for this production line is estimated to be around 1,000 m^2. The land is assumed to cost around EGP 3,000 per m^2, which amounts to EGP 3m for land acquisition. Building structure and office space is estimated to cost an additional EGP 700,000.

Important Note: Land is expected to be given for free in the Boghdadi industrial zone (IDA jurisdiction) by Luxor governorate. However, it is sold against a fee in New Tiba (NUCA jurisdiction). To be conservative, land was assumed to be bought against a fee.

3.5 Selling, General and Administrative Expenses (SG&A)

This section provides details on the selling, general and administrative expenses associated with the facility, otherwise known as overhead costs.

3.5.1 Salaries and Wages

This opportunity is expected to employ around 25 permanent staff plus an additional 10 seasonal workers (5 for each of the two harvest seasons). They are summarized below:

Table 25 List of Staff and Monthly Salaries for Concentrate Production Line

Position	*Staff*	*Monthly*
Management		
CEO	1	15.000
…		
Production - Permanent		
Plant Manager	1	10.000
Quality Control	2	6.000
Hall Supervisors	2	6.000
Engineering	1	5.000
Workers	4	3.000
…		
Sales, General and Administration		
Procurement	2	5.000
Sales Manager	1	8.000
Sales	2	5.000
Marketing	2	5.000
Finance & Accounting	2	5.000
HR Manager	1	10.000
Maintenance	4	3.000
Security	2	2.000
…		
Total	**27**	**staff**

Salaries for permanent staff amount to EGP 140,000 per month in Year 1, which is EGP 1.7m total for the year. That is only 4% of total revenue for Year 1.

Wages for seasonal workers amount to EGP 120,000 for each of the sugarcane and date harvests. This assumes 5 workers per harvest season, getting paid EGP 50 per ton of feedstock handled.

3.5.2 Factory

Factory overheads that fall outside human resource expenses and production costs are expected to be at a minimum. Maintenance and storage costs are estimated to be around EGP 10,000 and EGP 2,000 per month respectively.

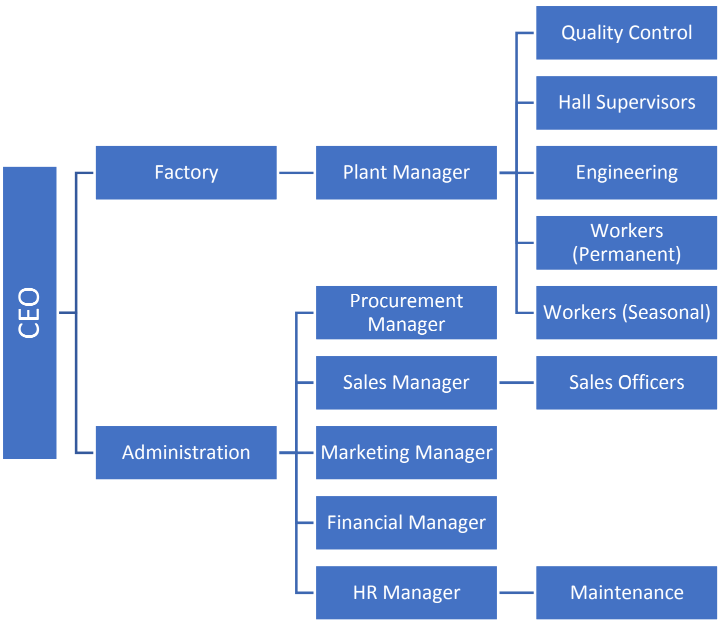
3.5.3 Other Selling, General and Administrative

The main line item in this category is the marketing budget, which is determined as 7.5% of expected sales. This amounts to EGP 2.8m for Year 1.

Utilities associated with administrative office space are expected to be around EGP 4,000 per month.

3.6 Organizational Structure

3.6.1 Organizational Chart



3.7 Financial Analysis and Investment

This section provides details of revenues, cost of goods sold (variable costs), margin analysis by product, selling, general and administrative (SG&A) expenses (aka overheads), fixed assets (initial capital expenditures) for the first year. The total initial investment is provided, and a 10-year projection of the income statements and statements of cash flow are calculated. Finally, the results of the feasibility and sensitivity analyses are provided as a summary of the key findings of the financial model.

3.7.1 Revenues

The estimated revenues for Year 1 are summarized below:

Product	Months of Production	Total Tons Produced	Selling Price (EGP/ton)	Revenue (EGP 000s)
Black Honey	Jan - Apr	300 tons	25,000	7,500
Date Syrup	Jul - Oct	1,200 tons	25,000	30,000
Total				**EGP 37,500**

3.7.2 Cost of Goods Sold

The estimated total COGS for Year 1 are summarized below:

Inputs	Quantity	Units
Sugarcane		
Tons bought	2,400	*tons*
Cost per ton	1,000	*EGP/ton*
Cost per month	**2,400**	*EGP 000s*
Dates		
Tons bought	2,400	*tons*
Cost per ton	6,000	*EGP/ton*
Cost per month	**14,400**	*EGP 000s*
Seasonal Labor		
Workers – Sugarcane	**120**	*EGP 000s*
Workers – Dates	**120**	*EGP 000s*
Packaging – 450g Jars		
Number of jars used	3,333,333	*jars*
Cost per year	**6,667**	*EGP 000s*
Utilities		
Electricity	**1,381**	*EGP 000s*
Gas	**884**	*EGP 000s*
Water	**93**	*EGP 000s*
Wastewater	**80**	*EGP 000s*
Total Utilities	**2,437**	*EGP 000s*
Total COGS	**26,144**	*EGP 000s*

3.7.3 Gross Margin Analysis by Product

Looking at each product's line items separately, gross margin can be calculated to show how profitable each product is and how much it contributes in covering overheads, ultimately increasing bottom line figures.

	Black Honey	Date Syrup
	EGP 000s	*EGP 000s*
Revenues	**7,500**	**30,000**
Raw Material	2,400	14,400
Seasonal Labor	120	120
Packaging	1,333	5,333
Electricity	276	1,104
Gas	177	707

Water	19	74
Wastewater	16	64
Total COGS	**4,341**	**21,803**
Gross Margin	**42.1%**	**27.3%**
(-) Overheads	12.5%	12.5%
Operating Margin	**29.6%**	**14.8%**

3.7.4 Selling, General and Administrative Expenses

SG&A for Year 1 is summarized below:

Human Resources	*EGP 000s*
Total Permanent Staff Salaries	1,680
Overheads	
Factory	
Maintenance	120
Storage	24
General & Administrative	-
Marketing (7.5% of Sales)	2,813
Utilities	48
Total Overheads	**3,005**
Total SG&A	**4,685**

3.7.5 Fixed Assets

The following table summarized the fixed assets (aka Property, Plant and Equipment) required for operation of the facility, along with the associated yearly depreciation expense.

Fixed Assets	**Cost**	**Dep. Life**	**Yearly Dep. Exp.**
	EGP 000s		*EGP 000s*
Production Line	8,000	10 yrs.	800
Infrastructure	2,000	15 yrs.	133
Building	250	30 yrs.	8
Office	100	10 yrs.	10
Land	3,000	0 yrs.	N/A
Total CAPEX	**13,350**		**1,237**

3.7.6 Minimum Investment Required

The minimum investment required will be the total fixed asset purchases required for operation plus 3-months' worth of working capital.

	EGP 000s
Initial Capital Expenditures on Fixed Assets	13,350
Working Capital for 3 months	7,707
Total Investment Required	**21,057**

3.7.7 Projected Income Statements

The following is the projected income statements for the first 10 years of operation:

Table 26 Projected Income Statements for Syrup Production Line (EGP thousands)

Income Statement	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Sales	37,500	52,500	68,250	81,900	94,185	100,778	107,832	115,381	123,457	132,099
COGS	(26,144)	(36,601)	(47,582)	(57,098)	(65,663)	(70,260)	(75,178)	(80,440)	(86,071)	(92,096)
Gross Profit	**11,356**	**15,899**	**20,668**	**24,802**	**28,522**	**30,518**	**32,655**	**34,941**	**37,386**	**40,003**
SG&A	(4,685)	(6,558)	(8,526)	(10,231)	(11,766)	(12,589)	(13,470)	(14,413)	(15,422)	(16,502)
EBITDA	**6,672**	**9,340**	**12,142**	**14,571**	**16,756**	**17,929**	**19,184**	**20,527**	**21,964**	**23,502**
Depreciation	(952)	(952)	(952)	(952)	(952)	(952)	(952)	(952)	(952)	(952)
EBIT	**5,720**	**8,389**	**11,191**	**13,619**	**15,805**	**16,978**	**18,233**	**19,576**	**21,012**	**22,550**
Interest Expense	(2,499)	(2,259)	(1,973)	(1,632)	(1,225)	(740)	(161)	-	-	-
Earnings before Tax	**3,221**	**6,129**	**9,218**	**11,987**	**14,580**	**16,238**	**18,071**	**19,576**	**21,012**	**22,550**
Loss Carry Forward	*3,221*	*9,350*	*18,568*	*30,555*	*45,135*	*58,151*	*70,093*	*80,451*	*89,477*	*97,447*
Taxes	(725)	(1,379)	(2,074)	(2,697)	(3,280)	(3,653)	(4,066)	(4,404)	(4,728)	(5,074)
Net Income	**2,496**	**4,750**	**7,144**	**9,290**	**11,299**	**12,584**	**14,005**	**15,171**	**16,285**	**17,476**
%Growth		*90%*	*50%*	*30%*	*22%*	*11%*	*11%*	*8%*	*7%*	*7%*
%NetMargin	*7%*	*9%*	*10%*	*11%*	*12%*	*12%*	*13%*	*13%*	*13%*	*13%*

3.7.8 Projected Cash Flow Statements

The following is the projected cash flow statements for the first 10 years of operation:

Table 27 Projected Cash Flow Statement for Syrup Production Line (EGP thousands)

Cash Flow Statement	1	2	3	4	5	6	7	8	9	10
Net Income	2,496	4,750	7,144	9,290	11,299	12,584	14,005	15,171	16,285	17,476
(+) Depreciation	952	952	952	952	952	952	952	952	952	952
(+) Changes in Working Capital	(7,239)	(2,896)	(3,040)	(2,635)	(2,371)	(1,273)	(1,362)	(1,457)	(1,559)	(1,668)
Operating Cash Flow	**(3,791)**	**2,806**	**5,055**	**7,607**	**9,879**	**12,263**	**13,595**	**14,666**	**15,677**	**16,760**
(-) Capital Expenditures	(13,350)	-	-	-	-	-	-	-	-	-
Investing Cash Flow	**(13,350)**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
(+) Direct Equity	6,317									
(+) Debt Financing	14,740									
(-) Dividends	(749)	(1,425)	(2,143)	(2,787)	(3,390)	(3,775)	(4,202)	(4,551)	(4,885)	(5,243)
(-) Loan Principal	(1,246)	(1,486)	(1,772)	(2,113)	(2,520)	(3,005)	(3,584)	-	-	-
Financing Cash Flow	**19,062**	**(2,911)**	**(3,915)**	**(4,900)**	**(5,910)**	**(6,781)**	**(7,785)**	**(4,551)**	**(4,885)**	**(5,243)**
Cash Balance										
Begin of Period	-	1,921	1,816	2,956	5,663	9,632	15,115	20,925	31,039	41,831
Net Change	1,921	(105)	1,140	2,706	3,970	5,483	5,810	10,114	10,792	11,517
End of Period	**1,921**	**1,816**	**2,956**	**5,663**	**9,632**	**15,115**	**20,925**	**31,039**	**41,831**	**53,348**

3.7.9 Feasibility Analysis

The following table summarizes the key findings from the feasibility analysis:

Key Metric (based on 10-yr projections)	Result (EGP 000s)
Capital Expenditures Required	EGP 13,350
Working Capital Required for first 3 months	EGP 7,707
Minimum Investment Required	EGP 21,057
Direct Investment (Equity)	EGP 6,317
Debt Financing	EGP 14,740
Enterprise Value	EGP 42,513
Internal Rate of Return	29%
Simple Payback	5.9 years
Discounted Payback	8.0 years
Profitability Index	2.02

3.7.10 Sensitivity Analysis

The feasibility of this opportunity is most sensitive to fluctuations in crop prices, which are compounded by the low yields, especially in the case of sugarcane. However, the price of the sugarcane is low enough to allow room for future price increases with minimal risk. While dates have less room to move up in price, the feasibility of date syrup is less sensitive to price fluctuations due to higher yields.

A calculation was made to see how far up prices can go before gross margins reach 0%, while holding selling prices at current global prices for black honey and date syrup. The results were as follows:

- Sugarcane can go up as high as EGP 1.93 per kg. This study assumes an average price of EGP 1.00 per kg. A change of EGP 0.50 can change the gross margin by 13%.
- Date prices have slightly less room to move and can go up as high as EGP 7.85 before erasing gross margins. This model assumes dates will sourced at EGP 6.00 per kg. A change of EGP 0.50 can change the gross margin by only 4%.

The idea of adding a second feedstock such as dates to this production line is essential not just for seasonality issues, but for the better margins and less risk of price fluctuations. The yield from dates is better than sugarcane and this affects how sensitive the margins are to changes in the feed prices.

However, it’s important that despite the price sensitivity in sugarcane and the lower yields, the value added (operating margin) is much higher than dates (29.6% vs. 14.8%), so there is clear tradeoff between low risk and high returns.

3.8 Impact

Economic - Value added to local crops such as sugarcane and dates is quite significant. Based on this study’s assumptions, before deducting other COGS and overheads:

- 8 kg of sugarcane cost EGP 8 to produce 1 kg of black honey selling at EGP 25 – that is 68% value added to the crop.
- 2 kg of dates cost EGP 6, to produce 1 kg of syrup selling at EGP 25 – that is 52% value added to the crop.

Social - Direct jobs created by this facility will include 27 permanent plant staff plus another 10-15 seasonal workers. Indirect jobs created will be mainly in logistics, marketing and distribution, and increased dedicated farming to supply the plant over time.

Environmental – This opportunity will help decrease post-harvest losses as demand for second grade dates, which are suitable for date syrup production, increases. Sugarcane bagasse will be generated in larger concentrated quantities in an industrial facility, as opposed to traditional production methods, which can be sold directly as raw material to paper, medium density fiberboard (MDF) manufacturers for extra revenue.

4 IO3 - Fruit and Vegetable Drying Facility

4.1 Overview

This opportunity aims to add value to local crops by producing dehydrated fruits and vegetables suitable for both export and local consumption as either snacks or cooking ingredients. Dehydrated foods have a longer shelf-life and maintain nutritional value, and add significant economic value to crops, while solving issues such as oversupply and the spoilage associated with it. The crops in focus are tomato, banana, grapes and mango because of their local abundance and compatible seasonality.

Food dehydration is a vast field that involves diverse technologies, each with its own advantages and disadvantages that vary according to the feedstock and final product specifications. Therefore, it was important to select a technology that can accommodate as many different fruits and vegetables as possible throughout the year. The selected technology uses a process called swell-drying, which can dehydrate most fruits and vegetables, as well as medicinal and aromatic plants.

4.2 Market Demand

This section provides a description of the products and targeted markets, including a brief analysis on the current market structure, the potential for import substitution and export where applicable.

4.2.1 Product Description

By removing moisture content in fruits and vegetables, the shelf-life is extended dramatically while maintaining flavor and nutritional value. While there are simpler, cheaper drying techniques, this opportunity looks at producing dried fruit and vegetables on an industrial scale, using state of the art technology for niche and high-end markets, including export.

This investment opportunity primarily focuses on producing three main products, which are anchored on local supply:

Product A: Dried tomato slices, mainly for cooking, as a substitute for sun-dried tomatoes.

Product B: Dried banana chips, mainly consumed as a healthy snack.

Product C: Dried mango chips, mainly consumed as a healthy snack.

The following table shows the target final moisture content of the three selected crops:

For illustrative purposes only.

Table 28 Initial and Final Moisture Content of Dried Products

Crop	Initial MC	Final MC
Tomato	92%	18%
Banana	74%	18%
Mango	87%	18%

All products are aimed at different segments such as hotels, confectionaries, restaurants, high-end supermarkets – both local and export, and therefore will be sold and distributed through different channels. They will be packaged in 50kg sealed bags for possible re-packaging later.

4.2.2 Current Market Structure

Important Note: the following statistics include quantities for fresh and dried products, as data available did not differentiate between them. An assumption was made that the dried component does not exceed 5% of the total traded, and this is reflected in the Target Market calculations.

According to Trade Map (International Trade Centre 2017), Egypt ranked 16th in world exports of fresh and dried tomatoes in 2016, which represents a 0.8% market share. The global market is dominated by Mexico, Spain, Netherlands, Canada and Morocco. The world market for exports in this category was worth USD 7.9b in 2016. Egypt exports seem to have plateaued the last three years, despite a decent jump in 2013, while imports have remained relatively steady as shown in Figure 5.

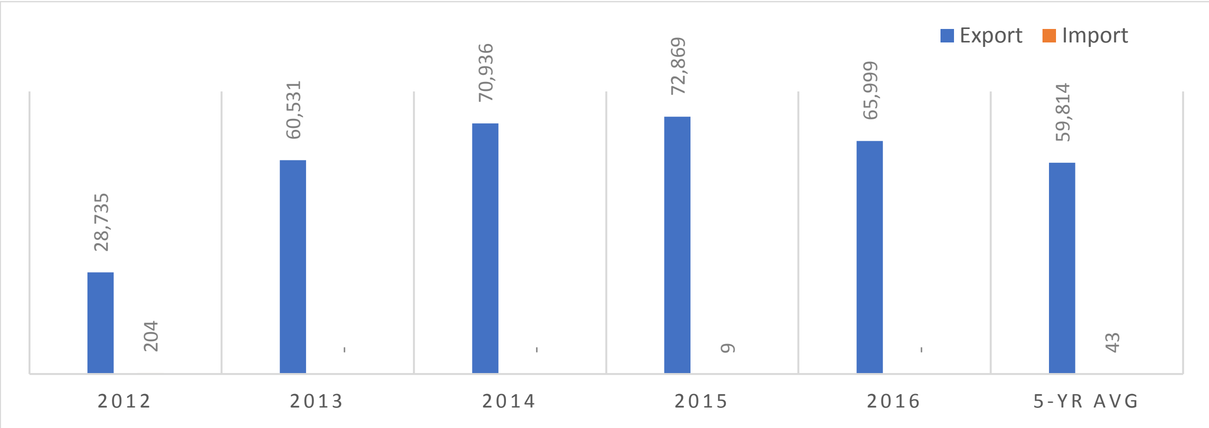


Figure 9 Egypt Export vs Import in USD for years 2012-2016 for Fresh and Dried Tomatoes

Egypt's biggest importers in 2016 are shown in Table 29. Despite ranking high in the respective country's imports, the market shares are considered quite low for markets such as Turkey and UAE. This leaves significant room for improvement in market share for the main markets currently targeted.

Table 29 Egypt's Top Importers of Fresh and Dried Tomatoes in 2016

		Value exported in 2016 (USD thousand)	Share in Egypt's exports (%)	Quantity exported in 2016	Share in Country's Imports (%)	Rank in Country's Exports	Average Price per ton (USD thousand)
1	Saudi Arabia	35,923	54.4	34,082	35.4	2nd	1.05
2	United Arab Emirates	9,912	15.0	9,404	7.9	5th	1.05
3	Turkey	5,701	8.6	5,409	8.6	2nd	1.05
4	Kuwait	4,038	6.1	3,831	17.4	2nd	1.05
5	Russia	2,976	4.5	2,824	1.1	9th	1.05

As for bananas, Egypt ranked 48th globally. This accounts for only 0.1% of the global export market, which is around USD 10.9 billion, as of 2016. However, Egypt imports a significant amount of bananas and there could be an important substitution potential for this product. The following figure shows import and export trends for the last 5 years for bananas.

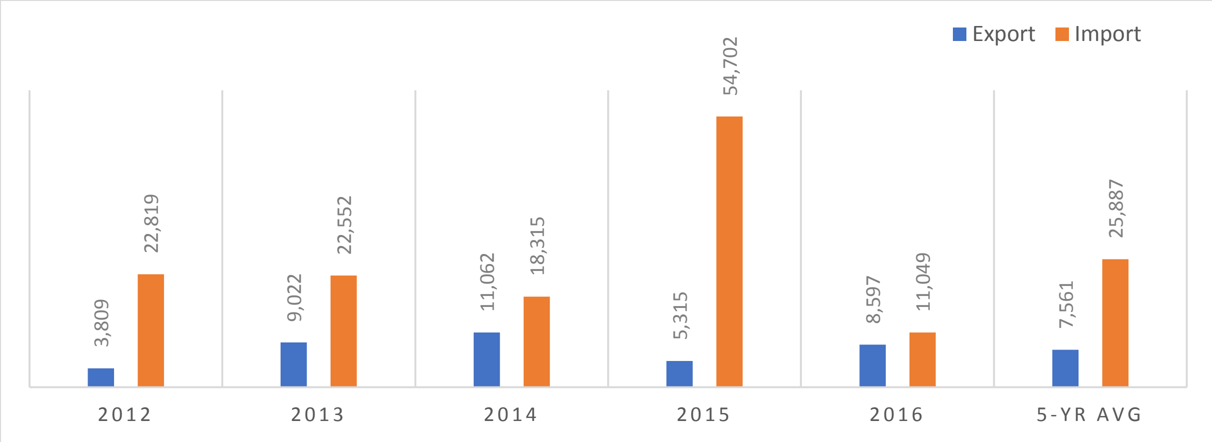


Figure 10 Egypt Export vs Import in USD for years 2012-2016 for Fresh and Dried Bananas

Egypt's biggest importers in this category for 2016 are shown in Table 30, which indicates Jordan as a top importer. However the trade data for other countries seems to be missing or incomplete.

Table 30 Egypt's Top Importers of Fresh and Dried Bananas in 2016

		Value exported in 2016 (USD thousand)	**Share in Egypt's exports (%)**	**Quantity exported in 2016**	**Share in Country's Imports (%)**	**Rank in Country's Exports**	**Average Price per ton (USD thousand)**
1	Jordan	8,500	98.9	11,655	30.0	1st	0.73
2	Kuwait	55	Negligible	75	Negligible	Negligible	0.73
3	Saudi Arabia	42	Negligible	58	Negligible	Negligible	0.72

The above data suggests that despite abundance of bananas in Upper Egypt, there is trouble accessing export markets, or even markets in the Delta. Dried bananas could therefore offer a way around logistical challenges, due to increased shelf-life and easier transportation, and increase access to the local crop.

For mangoes, Egypt ranks 12th in the global export market, but only represents 2.3% of the USD 5.4b market, as of 2016. The following figure shows import and export trends for the last 5 years for fresh and dried mangoes.

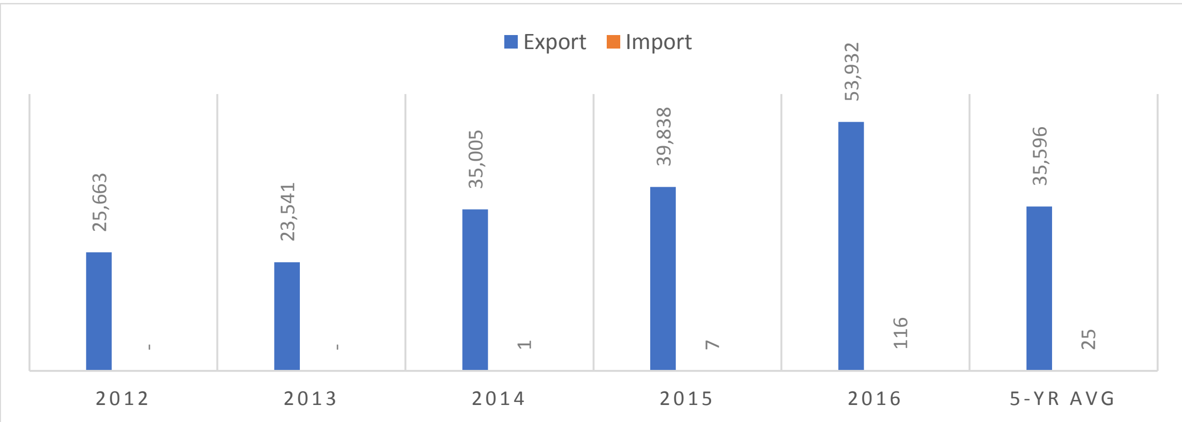


Figure 11 Egypt Export vs Import in USD for years 2012-2016 for Fresh and Dried Mangoes

Egypt's biggest importers in this category for 2016 are shown in Table 31. Middle Eastern markets dominate the table, and while market share is already quite high in Lebanon and Saudi Arabia, there is room for improvement in the United Arab Emirates and Jordan.

Table 31 Egypt's Top Importers of Fresh and Dried Mangoes in 2016

		Value exported in 2016 (USD thousand)	Share in Egypt's exports (%)	Quantity exported in 2016	Share in Country's Imports (%)	Rank in Country's Exports	Average Price per ton (USD thousand)
1	Saudi Arabia	17,576	32.6	11,717	42.0	1st	1.50
2	United Arab Emirates	8,143	15.1	5,429	9.5	3rd	1.50
3	Lebanon	7,622	14.1	5,081	73.1	1st	1.50
4	Jordan	5,940	11.0	3,960	10.2	4th	1.50
5	Kuwait	5,356	9.9	3,571	32.6	2nd	1.50

The above data suggests that while neighboring countries account for the lion's share of Egypt's mango exports, it is worth exploring new markets in Europe, which seem to favor importing their mangoes from South America and Southeast Asia.

4.2.3 Target Market Size

The trailing 5-year average for values exported and imported in the two categories are as follows:

Table 32 Target Market Size for Dried Fruit and Vegetables

	5-yr trailing average 2012-2016 (USD thousand)						
	Tomatoes	Bananas	Mangoes	Total (Fresh +Dried)	Total (Dried)	Target %	Target Value
Export	59,814	7,561	35,596	102,971	5,149	200%	10,297
Import	43	25,887	25	25,955	1,298	200%	2,595
	USD 59,857	USD 33,448	USD 35,621	USD 128,926	USD 6,446		USD 12,893

The target market size was estimated using the assumption that 5% of the total traded crops are dried, since the data available from Trade Map include both fresh and dried. Egypt already exports significantly when it comes to fresh tomatoes and fresh mangoes, compared to bananas. While demand for dried products is difficult to gauge from the above data, there is huge interest in this field. Investor sentiment indicates that at least a 200% improvement in export levels and import substitution can be made. This brings the total estimated target market size to USD 12.89m (EGP 232m).

Expected Selling Prices: The markets to target are export mainly to take advantage of the lucrative pricing post-EGP flotation, followed by local niche retail. Expected selling prices for the products are:

- 1 kg of dried tomato is expected to sell between USD 2-5 per kg. That is EGP 54-90 wholesale.
- 1 kg of dried banana chips is expected to sell between USD 3-20 per kg. That is EGP 50-180 wholesale.
- 1 kg of dried mango chips is expected to sell between USD 5-30 per kg. That is EGP 90-540 wholesale.

Local prices for these products are expected to be within the same ranges however on the lower side. The lowest of these ranges were considered for feasibility analysis.

4.2.4 Estimated Annual Sales and Forecasts

The plant, described in more detail under Project Engineering, is assumed to start operating at 50% capacity in Year 1 and reach around 91% by Year 10 as part of the conservative assumptions typical resorted to in the present document. Revenue growth forecasts to account for in price inflation and better capacity utilization in subsequent years are assumed, with an aggressive marketing push in the first 5 years, as shown in Annex I.

This translates to estimated production and annual sales for Year 1 as follows:

- 111 tons of dried tomatoes, bringing in EGP 4.4m
- 236 tons of dried banana, bringing in EGP 14.2m
- 129 tons of dried mango, bringing in EGP 16.8m

This brings Year 1 revenues to a total of EGP 35.3m. The following graph shows a comparison of the target market and expected revenues in the first five years.

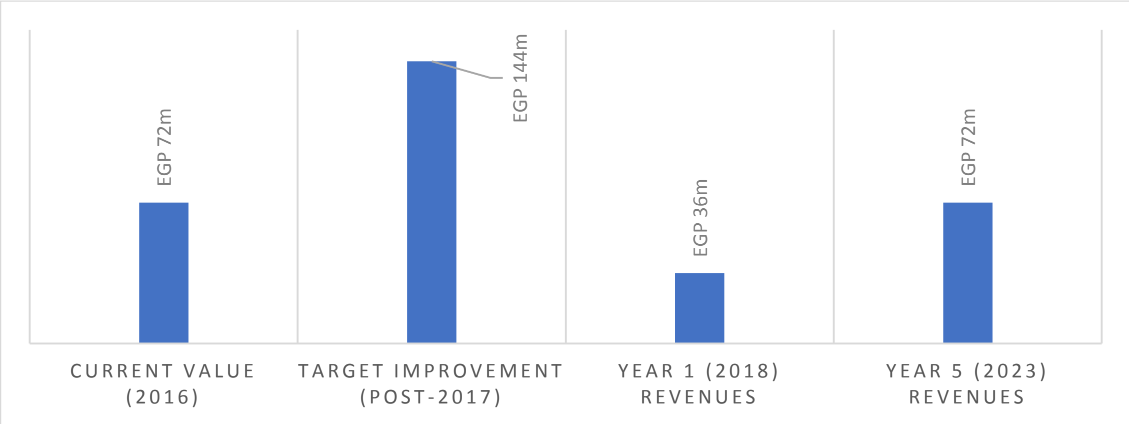


Figure 12 Comparison between Target Market Size and Year 1-5 Revenues for Dried Fruits and Vegetable Production Line

4.2.5 Estimated Marketing Costs

Marketing the product on the global stage will require a considerable budget and it is assumed that the marketing budget will account for around 7.5% of sales targets stated above. These sales targets after all are highly contingent on aggressive marketing before operations. This brings the total marketing budget for Year 1 to EGP 2.6m.

4.3 Direct Inputs Required

This section describes the main raw materials required for the process, including other inputs such as additives, etc., as well as the expected costs, their availability (including seasonality when referring to crops) and any risks expected in securing each input and how to mitigate it. It also shows the utilities required, specific consumption benchmarks used, as well as direct labor requirements and any other direct inputs.

4.3.1 Crops Required

The three main crops required for this process are tomatoes, bananas and mangoes. Qena figures were added as they present a valid local source of the required crops. The three crops complement each other in terms of seasonality, and all are cultivated locally and therefore abundant.

The following table provides the figures for feddans cultivated and tons produced are according to figures provided by the CAPMAS Annual Bulletin for Statistical Crop Area and Plant Production for the years 2014-2015.

Table 33 Production Schedule according to Seasonality of Tomatoes, Bananas and Mangoes in Luxor and Qena

Crop Name	Luxor		Qena		Seasonality / Production Schedule											
	feddans	tons	feddans	Tons	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tomatoes	9,619	184,133	6,718	134,487	x	x	x									
Bananas	6,012	66,638	5,838	88,752									x	x	x	x

Mangoes	1,911	6,181	708	2,147						x	x	x				

The market prices for the crops are presented in the following table based on 2016-2017 levels. These prices are based on direct buying from farmers. When buying from traders, around 8% is added as a margin, plus EGP 0.25 per kg for transportation.

Table 34 Prices of Fresh Tomatoes, Bananas and Mangoes for 2016-2017

Crop	**Price**
Tomatoes	EGP 1 – 8 per kg
Bananas	EGP 6 – 10 per kg
Mangoes	EGP 6 – 16 per kg

This study assumes tomatoes are sourced locally only at an average price of EGP 4 per kg, to ensure higher quality tomatoes needed for this kind of product. Higher quality bananas and mangoes are also sourced at the higher end of the range, at EGP 10 and EGP 16 per kg respectively.

4.3.2 Utilities

Assuming today's tariffs for electricity, natural gas and water, the following specific consumption rates were calculated for the three main products. Taking into account the different thermal requirements to reduce moisture content in each, depending on initial and final moisture content, an average rate was taken for all three products[5].

Table 35 Specific Consumption and Expected Cost per ton for Year 1

	Specific Consumption		***Expected Bill***	
Utilities – Black Honey & Date Syrup				
Electricity	800	kWh/ton	613.60	EGP/ton
Gas	7,200	kWh/ton	2,232.00	EGP/ton
Water	20	m3/ton	62.04	EGP/ton
Wastewater	20	m3/ton	53.40	EGP/ton

The above tariffs are for the fiscal year 2017/2018 and are assumed to be tied to inflation projections over the consequent years, as shown in Annex I.

4.3.3 Direct Labor

Seasonal labor will be required for each harvest to handle the fresh tomatoes and mangoes coming during production months. The following table shows how many workers will be required for each season of production.

Table 36 Seasonal Labor Required for Fruit and Vegetable Drying

Production – Seasonal	***No. of Workers***	***EGP per ton handled***
Workers – Tomatoes Season	5	50
Workers – Bananas Season	5	50
Workers – Mangoes Season	5	50

[5] The specific consumption rates were obtained from the European Commission's (EC) Best Available Techniques Reference Documents (BREFs) as well as the SCOoPE project, also funded by the EC, as well as from industry experts and practitioners.

4.3.4 Packaging

The final product will be packaged in vacuum sealed bags, to avoid rehydration and spoilage. The standard size is 50kg, which is the size most used for this kind of product. They are expected to cost USD4-5, or EGP 75 per bag, and are usually ordered in bulks.

4.4 Project Engineering

This section describes the production process in detail, any specific technologies used, the estimated plant capacity, as well as the main components required along with an estimate for civil engineering works (factory infrastructure, etc.) and the total area required.

4.4.1 Description of Technology

The technology selected for the process of food dehydration is called DIC, which uses instant controlled pressure drop treatment to improve the drying process of organic materials. It is considered a relatively new technology in the field of food dehydration, but has been successfully commercialized and considered a decent economical alternative to more traditional and expensive methods. In this study, it is combined with industry standard batch convectional hot-air dryers that can be locally manufactured. The DIC reactor can be imported from ABCAR-DIC Process in France.

4.4.2 Estimated Plant Capacity

The plant capacity is expected to handle up to 12 tons of fresh fruit and vegetable per day. Each feedstock has its own conversion ratio, which has been calculated according to initial and final moisture contents and is presented in the following table.

Table 37 Conversion Ratio for Dried Products

Crop	Input (tons/day)	Conversion Ratio	Max. Output (tons)	Yield
Tomatoes	12	4:1	2.9	25%
Bananas	12	5:2	4.7	39%
Mangoes	12	7:2	3.4	29%

It is assumed that production will take place in the same months as the harvest and only then. Production can take place in the gap months but will require investment in storage facilities to keep the raw material fresh for months. This will increase initial investment required so it was not taken into account in this study. However, it is safe to assume that these assets can be funded through the company’s operating cash flow in future years, increasing productivity beyond this study’s projections.

4.4.3 Process Flow

The process is illustrated in the following figure.

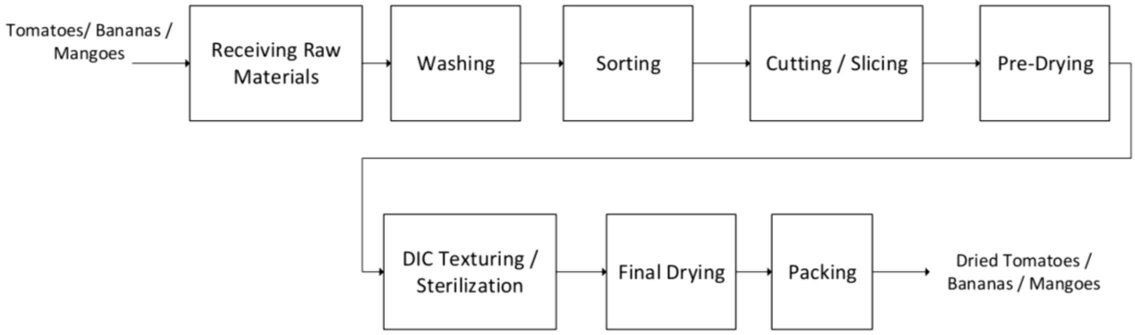


Figure 13 Process Flow Diagram of Fruit and Vegetable Drying

The process steps illustrated above are described in detail in the following table.

Table 38 Step-by-Step Details of Fruit and Vegetable Drying Process

#	Name	Description
Step 1	Receiving raw material	Tomatoes/Bananas/Mangoes arrive at the plant in trucks, which are directed to the offloading area.
Step 2	Washing	Tomatoes/Mangoes are washed to remove any dirt. Bananas skip this step and go straight to sorting.
Step 3	Sorting	All raw material is sorted to remove any off-specification items before moving onto cutting and slicing. Tomatoes should be unblemished, firm, red and ripe. Bananas/mangoes should be ripe and sweet but not soft and brown.
Step 5	Cutting/ Slicing	Tomato stalks are removed, then sliced into quarters or eighths, removing seeds. Bananas should be peeled and cut into thin slices (5-7mm thick). Mangoes should be peeled and cut into thin slices (6-8mm thick).
Step	Pre-Drying	Freshly cut slices are then subjected to a stream of hot-air at 50 degrees Celsius until they reach around 25% residual moisture content.
Step 7	DIC texturing/ sterilization	The DIC process has been defined as two main stages of: (1) thermal treatment carried out under a high saturated steam pressure, which allows the temperature of the product to attain between 100 and 160 degrees Celsius, for a short duration of 5–60 s followed by: (2) an abrupt pressure drop towards a vacuum with a very high decompression rate, which is generally maintained for 5–20 seconds. During the first stage, steam condensation on the surface of the product helps heat it. This superficial moisture requires time to diffuse down to the core and reach homogeneous moisture and temperature levels before the pressure drops. This step helps to de-bacterize and stop enzymatic processes (same effect as blanching) to help preserve texture (instant cooling prevents structure from collapsing), flavor, and color, before undergoing finally drying. It also reduces final drying time required.
Step 8	Final drying	The product is placed in static bed air-dryers for the final drying stage, which is when the product loses most of its moisture content. The target final moisture content for these products is 18%.
Step 9	Packaging	Using a vacuum sealing machine, the final product is packed into polythene bags and sealed to prevent contamination and rehydration. This can be stored for up to one year.

4.4.4 Main Components and Equipment

The following is a list of the main components of the production line:

- Washer

- Cutting / De-stoning machine
- DIC reactor
- Hot-air convectional batch driers
- Vacuum sealing and packing machine

The DIC reactor needs to be imported from France. Other parts can be sourced locally. The prices for the main components are below:

Table 39 Price Estimate for Fruit and Vegetable Drying Line

Component	Price
Pre-Driers – manufactured locally	EGP 500,000
DIC Reactor + Post-Driers • Imported from France • Handles 48 tons of feedstock per day	EUR 310,000 (EGP 6.2m)
Vacuum Sealing Machine	USD 30,000 (EGP 600,000)
Total	**EGP 7,300,000**

The estimated useful life of this production line, assuming proper maintenance and care, can go up to 15 years.

4.4.5 Civil Engineering Works

In addition to the production line, there are key components of the factory's infrastructure that need to be considered, such as:

- Boiler for steam generation
- Electrical Generator
- Air compression system
- Cooling system
- Piping etc.

Total infrastructure costs are estimated to be around EGP 2 million for a factory of this size.

4.4.6 Area Required

The area required for this production line is estimated to be around 1,200 m^2. The land is assumed to cost around EGP 3,000 per m^2, which amounts to EGP 3.6m for land acquisition. Building structure and office space is estimated to cost an additional EGP 1.2m.

Important Note: Land is expected to be given for free in the Boghdadi industrial zone (IDA jurisdiction) by Luxor governorate. However, it is sold against a fee in New Tiba (NUCA jurisdiction). To be conservative, land was assumed to be bought against a fee.

4.5 Selling, General and Administrative Expenses (SG&A)

This section provides details on the selling, general and administrative expenses associated with the facility, otherwise known as overhead costs.

4.5.1 Salaries and Wages

This opportunity is expected to employ around 22 permanent staff plus an additional 15 seasonal workers (5 for each harvest season). They are summarized below:

Table 40 List of Staff and Monthly Salaries for Concentrate Production Line

Position	*Staff*	*Monthly*
Management		
CEO	1	15.000
…		
Production - Permanent		
Plant Manager	1	10.000
Quality Control	1	6.000
Hall Supervisors	1	6.000
Engineering	1	5.000
Workers	2	3.000
…		
Sales, General and Administration		
Procurement	2	5.000
Sales Manager	1	8.000
Sales	2	5.000
Marketing	2	5.000
Finance & Accounting	1	5.000
HR Manager	1	10.000
Maintenance	4	3.000
Security	2	2.000
…		
Total	**22**	**staff**

Salaries for permanent staff amount to EGP 140,000 per month in Year 1, which is EGP 1.4m total for the year. That is only 4% of total revenue for Year 1.

Wages for seasonal workers amount to around EGP 30,000 for each harvest. This assumes 5 workers per harvest season, getting paid EGP 50 per ton of feedstock handled.

4.5.2 Factory

Factory overheads that fall outside human resource expenses and production costs are expected to be at a minimum. Maintenance and storage costs are estimated to be around EGP 7,500 and EGP 10,000 per month respectively.

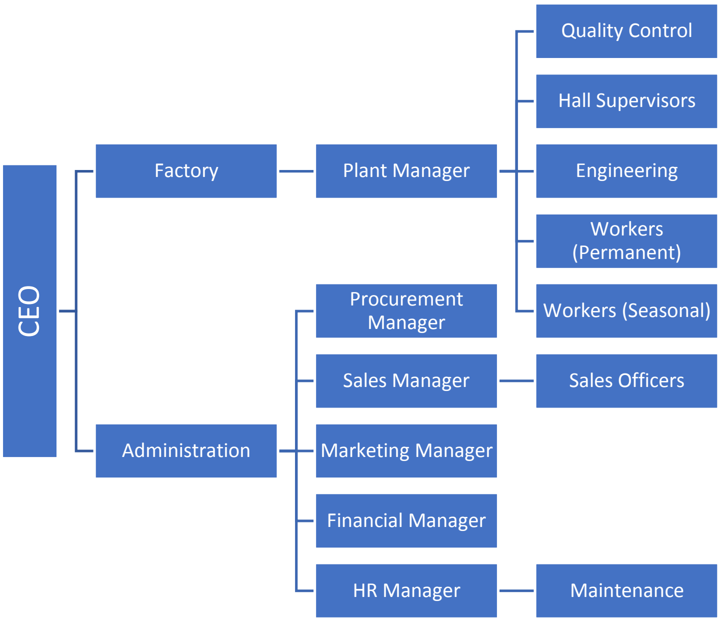
4.5.3 Other Selling, General and Administrative

The main line item in this category is the marketing budget, which is determined as 7.5% of expected sales. This amounts to EGP 2.8m for Year 1.

Utilities associated with administrative office space are expected to be around EGP 4,000 per month.

4.6 Organizational Structure

4.6.1 Organizational Chart



4.7 Financial Analysis and Investment

This section provides details of revenues, cost of goods sold (variable costs), margin analysis by product, selling, general and administrative (SG&A) expenses (aka overheads), fixed assets (initial capital expenditures) for the first year. The total initial investment is provided, and a 10-year projection of the income statements and statements of cash flow are calculated. Finally, the results of the feasibility and sensitivity analyses are provided as a summary of the key findings of the financial model.

4.7.1 Revenues

The estimated revenues for Year 1 are summarized below:

Product	**Months of Production**	**Total Tons Produced**	**Selling Price (EGP/ton)**	**Revenue (EGP 000s)**
Dried Tomatoes	Jan - Apr	147 tons	40,000	5,894
Dried Bananas	Sep - Dec	236 tons	60,000	14,155
Dried Mangoes	Jun - Aug	129 tons	130,000	16,766
Total				**EGP 36,816**

4.7.2 Cost of Goods Sold

The estimated total COGS for Year 1 are summarized below:

Inputs	**Quantity**	**Units**
Tomatoes		
Tons bought	600	*tons*
Cost per ton	4	*EGP 000s/ton*
Cost per month	2,400	*EGP 000s*

Bananas		
Tons bought	600	*tons*
Cost per ton	10	*EGP 000s/ton*
Cost per month	6,000	*EGP 000s*
Mangoes		
Tons bought	450	*tons*
Cost per ton	16	*EGP 000s/ton*
Cost per month	7,200	*EGP 000s*
Seasonal Labor		
Workers – Tomatoes	**30**	*EGP*
Workers – Bananas	**30**	*EGP*
Workers - Mangoes	**23**	*EGP*
Packaging – 50k polythene bags		
Number of bags used	10,245	*bags*
Cost per year	**768**	*EGP 000s*
Utilities		
Electricity	**314**	*EGP 000s*
Gas	**1,143**	*EGP 000s*
Water	**32**	*EGP 000s*
Wastewater	**27**	*EGP 000s*
Total Utilities	**1,517**	*EGP 000s*
Total COGS	**17,968**	*EGP 000s*

4.7.3 Gross Margin Analysis by Product

Looking at each product's line items separately, gross margin can be calculated to show how profitable each product is and how much it contributes in covering overheads, ultimately increasing bottom line figures.

	Dried Tomato	**Dried Banana**	**Dried Mango**
	EGP 000s	*EGP 000s*	*EGP 000s*
Revenues	**5,894**	**14,155**	**16,766**
Raw Material	2,400	6,000	7,200
Seasonal Labor	30	30	23
Packaging	221	354	193
Electricity	90	145	79
Gas	329	527	288
Water	9	15	8
Wastewater	8	13	7
Total COGS	**3,087**	**7,082**	**7,798**
Gross Margin	**47.6%**	**50.0%**	**53.5%**
(-) Overheads	12.0%	12.0%	12.0%
Operating Margin	**35.6%**	**38.0%**	**41.5%**

4.7.4 Selling, General and Administrative Expenses

SG&A for Year 1 is summarized below:

Human Resources	*EGP 000s*
Total Permanent Staff Salaries	1,404
Overheads	
Factory	
Maintenance	90
Storage	120
General & Administrative	-
Marketing (7.5% of Sales)	2,761
Utilities	48
Total Overheads	**3,019**
Total SG&A	**4,423**

4.7.5 Fixed Assets

The following table summarized the fixed assets (aka Property, Plant and Equipment) required for operation of the facility, along with the associated yearly depreciation expense.

Fixed Assets	Cost	Dep. Life	Yearly Dep. Exp.
	EGP 000s		*EGP 000s*
Production Line	7,300	10 yrs.	730
Infrastructure	2,000	15 yrs.	133
Building	1,000	30 yrs.	33
Office	200	10 yrs.	20
Land	3,600	0 yrs.	N/A
Total CAPEX	**14,100**		**917**

4.7.6 Minimum Investment Required

The minimum investment required will be the total fixed asset purchases required for operation plus 3-months' worth of working capital.

	EGP 000s
Initial Capital Expenditures on Fixed Assets	14,100
Working Capital for 3 months	5,598
Total Investment Required	**19,698**

4.7.7 Projected Income Statements

The following is the projected income statements for the first 10 years of operation:

Table 41 Projected Income Statements for Fruit and Vegetable Drying Line (EGP thousands)

Income Statement	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Sales	36,816	51,542	67,005	80,405	92,466	98,939	105,865	113,275	121,204	129,689
COGS	(17,968)	(25,155)	(32,701)	(39,241)	(45,128)	(48,287)	(51,667)	(55,283)	(59,153)	(63,294)
Gross Profit	**18,848**	**26,387**	**34,303**	**41,164**	**47,339**	**50,652**	**54,198**	**57,992**	**62,051**	**66,395**
SG&A	(4,423)	(6,192)	(8,050)	(9,660)	(11,109)	(11,887)	(12,719)	(13,609)	(14,562)	(15,581)
EBITDA	**14,425**	**20,195**	**26,253**	**31,504**	**36,229**	**38,766**	**41,479**	**44,383**	**47,489**	**50,814**
Depreciation	(917)	(917)	(917)	(917)	(917)	(917)	(917)	(917)	(917)	(917)
EBIT	**13,508**	**19,278**	**25,337**	**30,587**	**35,313**	**37,849**	**40,562**	**43,466**	**46,573**	**49,897**
Interest Expense	(2,338)	(2,113)	(1,846)	(1,527)	(1,146)	(692)	(151)	-	-	-
Earnings before Tax	**11,170**	**17,165**	**23,491**	**29,061**	**34,167**	**37,157**	**40,412**	**43,466**	**46,573**	**49,897**
Loss Carry Forward	*11,170*	*28,335*	*51,826*	*80,887*	*115,054*	*141,040*	*164,287*	*184,262*	*201,774*	*217,504*
Taxes	(2,513)	(3,862)	(5,285)	(6,539)	(7,688)	(8,360)	(9,093)	(9,780)	(10,479)	(11,227)
Net Income	**8,657**	**13,303**	**18,205**	**22,522**	**26,479**	**28,796**	**31,319**	**33,686**	**36,094**	**38,670**
%Growth		*54%*	*37%*	*24%*	*18%*	*9%*	*9%*	*8%*	*7%*	*7%*
%NetMargin	*24%*	*26%*	*27%*	*28%*	*29%*	*29%*	*30%*	*30%*	*30%*	*30%*

4.7.8 Projected Cash Flow Statements

The following is the projected cash flow statements for the first 10 years of operation:

Table 42 Projected Cash Flow Statement for Fruit and Vegetable Drying Line (EGP thousands)

Cash Flow Statement	1	2	3	4	5	6	7	8	9	10
Net Income	8,657	13,303	18,205	22,522	26,479	28,796	31,319	33,686	36,094	38,670
(+) Depreciation	917	917	917	917	917	917	917	917	917	917
(+) Changes in Working Capital	(6,790)	(2,716)	(2,852)	(2,472)	(2,225)	(1,194)	(1,277)	(1,367)	(1,462)	(1,565)
Operating Cash Flow	**2,783**	**11,503**	**16,270**	**20,967**	**25,171**	**28,519**	**30,958**	**33,236**	**35,548**	**38,022**
(-) Capital Expenditures	(14,100)	-	-	-	-	-	-	-	-	-
Investing Cash Flow	**(14,100)**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
(+) Direct Equity	5,909									
(+) Debt Financing	13,788									
(-) Dividends	(2,597)	(3,991)	(5,462)	(6,757)	(7,944)	(8,639)	(9,396)	(10,106)	(10,828)	(11,601)
(-) Loan Principal	(1,166)	(1,390)	(1,658)	(1,977)	(2,357)	(2,811)	(3,353)	-	-	-
Financing Cash Flow	**15,935**	**(5,381)**	**(7,119)**	**(8,733)**	**(10,301)**	**(11,450)**	**(12,748)**	**(10,106)**	**(10,828)**	**(11,601)**
Cash Balance										
Begin of Period	-	4,618	10,741	19,892	32,125	46,995	64,064	82,274	105,405	130,125
Net Change	4,618	6,122	9,151	12,234	14,870	17,069	18,210	23,130	24,720	26,421
End of Period	**4,618**	**10,741**	**19,892**	**32,125**	**46,995**	**64,064**	**82,274**	**105,405**	**130,125**	**156,546**

4.7.9 Feasibility Analysis

The following table summarizes the key findings from the feasibility analysis:

Key Metric (based on 10-yr projections)	**Result (EGP 000s)**
Capital Expenditures Required	EGP 14,100
Working Capital Required for first 3 months	EGP 5,598
Minimum Investment Required	EGP 19,698
Direct Investment (Equity)	EGP 5,909
Debt Financing	EGP 13,788
Enterprise Value	EGP 117,376
Internal Rate of Return	56%
Simple Payback	2.2 years
Discounted Payback	3.4 years
Profitability Index	5.96

4.7.10 Sensitivity Analysis

The feasibility of this opportunity is most sensitive to fluctuations in crop prices, which are compounded by conversion factors, as all crops lose weight due to moisture loss. However, since the value added (around 57-59%) to these crops is quite high, the risk exposure to crop price fluctuations is minimal.

A calculation was made to see how far up prices can go before operating margins reach 0%, while holding selling prices at current global prices for these dried products. The results were as follows:

- Tomatoes can go up as high as EGP 7.50 per kg. This study assumes an average price of EGP 4.00 per kg. A change of EGP 0.50 can change the gross margin by only 5%.
- Bananas can go up as high as EGP 18.95 per kg. This study assumes an average price of EGP 10.00 per kg. A change of EGP 0.50 can change the gross margin by only 3%.
- Bananas can go up as high as EGP 31.45 per kg. This study assumes an average price of EGP 10.00 per kg. A change of EGP 0.50 can change the gross margin by only 3%.

The analysis above shows that all three products have decent operating margins and have room to withstand increases in crop prices without increasing selling prices. This means these are high value-added products that take advantage of low local crop prices and are able to compete with global selling prices.

4.8 Impact

Economic - Value added to local crops such as tomato and mango is quite significant. Based on this study's assumptions, before deducting other COGS and overheads:

- 4 kg of fresh tomatoes cost EGP 20 to produce 1 kg of dried tomatoes selling at EGP 40 – that is 50% value added to the crop.
- 2.5kg of fresh bananas cost EGP 30 to produce 1kg of dried banana chips selling at EGP 60 – that is 50% value added to the crop.
- 3.5kg of fresh mangoes cost EGP 70 to produce 1kg of dried mango chips selling at EGP 140 – that is 50% value added to the crop.

Social - Direct jobs created by this facility will include 22 permanent plant staff plus another 15-20 seasonal workers. Indirect jobs created will be mainly in logistics, marketing and distribution, and increased dedicated farming to supply the plant over time.

Environmental – This opportunity will help decrease post-harvest losses as demand for raw materials for dehydration can reduce oversupply. Dehydrated foods are more easily transported and stored due to decreased weight, increased shelf-life, which curbs overall carbon emissions.

5 IO4 - Fruit and Vegetable Packing Facility

5.1 Overview

This opportunity aims to add value to local crops through improved packaging, making it more suitable for export and local niche markets. The selected crops, based on abundance and seasonality, are tomatoes, grapes and mangoes.

The packing facility receives the fresh harvest that undergoes fumigation and quality packaging, transported in refrigerated trucks to the relevant ports. Egypt already exports a significant amount of its crops, especially to the Gulf and Europe, and this facility will improve access for local farmers to these markets, and possibly open new markets in Africa. The technology selected for this packing facility is mainly imported which consists mostly of packaging lines, waxing stations and cooling rooms. Luxor is already home to a packing facility which is not operating at maximum capacity due to limitations in refrigerated transport from facility to ports (mainly Alexandria).

5.2 Market Demand

This section provides a description of the products and targeted markets, including a brief analysis on the current market structure, the potential for import substitution and export where applicable.

5.2.1 Product Description

Product A: Fresh tomatoes, packaged according to destination market specifications.

Product B: Fresh grapes, packaged according to destination market specifications.

Product C: Fresh mangoes, packaged according to destination market specifications.

The fresh produce undergoes little processing such as washing, fumigation and refrigeration, and is finally packaged in export grade containers, ready for shipment.

For illustrative purposes only.

5.2.2 Current Market Structure

According to Trade Map (International Trade Centre 2017), Egypt ranked 16th in world exports of fresh and dried tomatoes in 2016, which represents a 0.8% market share. The global market is dominated by Mexico, Spain, Netherlands, Canada and Morocco. The world market for exports in this category was worth USD 7.9b in 2016. Egypt exports seem to have plateaued the last three years, despite a decent jump in 2013, while imports have remained relatively steady as shown in the following figure.

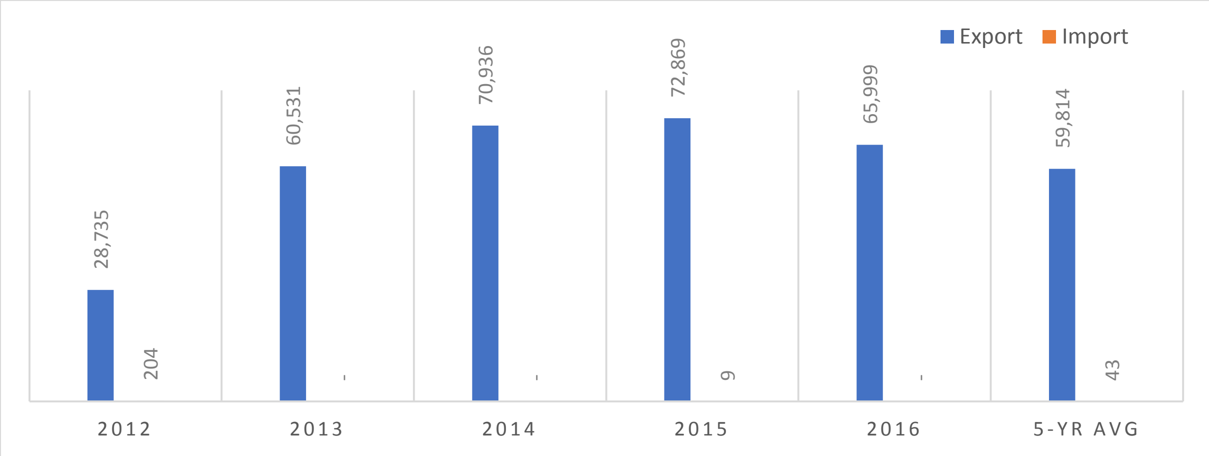


Figure 14 Egypt Export vs Import in USD for years 2012-2016 for Fresh and Dried Tomatoes

Egypt's biggest importers in 2016 are shown in Table 43. Despite ranking high in the respective country's imports, the market shares are considered quite low for markets such as Turkey and UAE. This leaves significant room for improvement in market share for the main markets currently targeted.

Table 43 Egypt's Top Importers of Fresh and Dried Tomatoes in 2016

		Value exported in 2016 (USD thousand)	**Share in Egypt's exports (%)**	**Quantity exported in 2016**	**Share in Country's Imports (%)**	**Rank in Country's Exports**	**Average Price per ton (USD thousand)**
1	Saudi Arabia	35,923	54.4	34,082	35.4	2nd	1.05
2	United Arab Emirates	9,912	15.0	9,404	7.9	5th	1.05
3	Turkey	5,701	8.6	5,409	8.6	2nd	1.05
4	Kuwait	4,038	6.1	3,831	17.4	2nd	1.05
5	Russia	2,976	4.5	2,824	1.1	9th	1.05

As for grapes, Egypt ranked 13th globally. This accounts for 2.2% of the global export market, which is around USD 9.5 billion, as of 2016. Figure 2 shows import and export trends for the last 5 years for grapes.

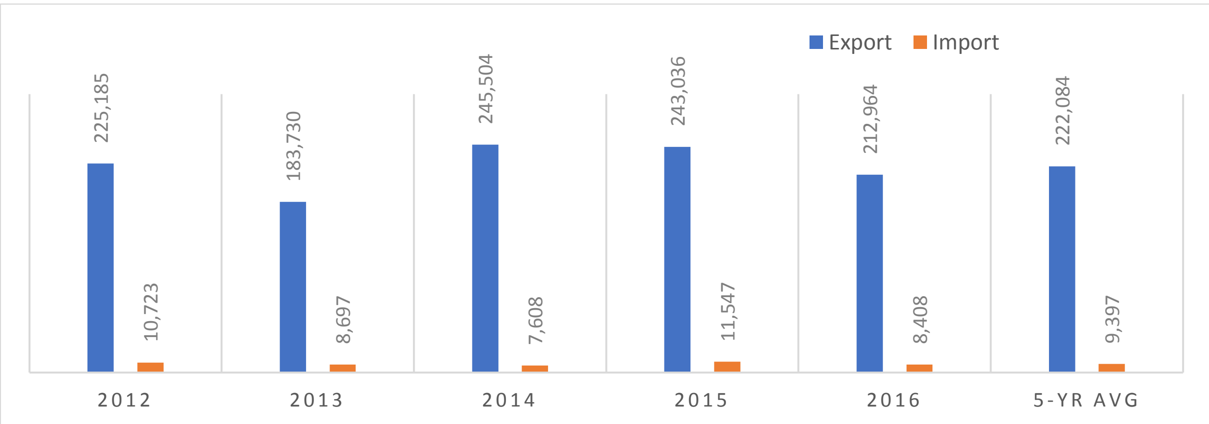


Figure 15 Egypt Export vs Import in USD for years 2012-2016 for Fresh and Dried Grapes

Egypt's biggest importers in this category for 2016 are shown in Table 44. It is clear that the main market is Europe. However, there remains significant room for improvement in market share.

Table 44 Egypt's Top Importers of Fresh and Dried Grapes in 2016

		Value exported in 2016 (USD thousand)	Share in Egypt's exports (%)	Quantity exported in 2016	Share in Country's Imports (%)	Rank in Country's Exports	Average Price per ton (USD thousand)
1	United Kingdom	72,501	34.0	38,549	6.3	5th	1.88
2	Netherlands	46,010	21.6	24,464	5.0	7th	1.88
3	Germany	17,470	8.2	9,289	4.1	8th	1.88
4	Russia	16,331	7.7	8,683	7.2	8th	1.88
5	Saudi Arabia	8,357	3.9	4,437	11.1	4th	1.88

The above data suggests that Egypt already does well on the global stage in terms of exporting grapes and could benefit from increasing its market share in Europe and the Gulf by producing more export-grade grapes for these markets.

For mangoes, Egypt ranks 12th in the global export market, but only represents 2.3% of the USD 5.4b market, as of 2016. The following figure shows import and export trends for the last 5 years for fresh and dried mangoes.

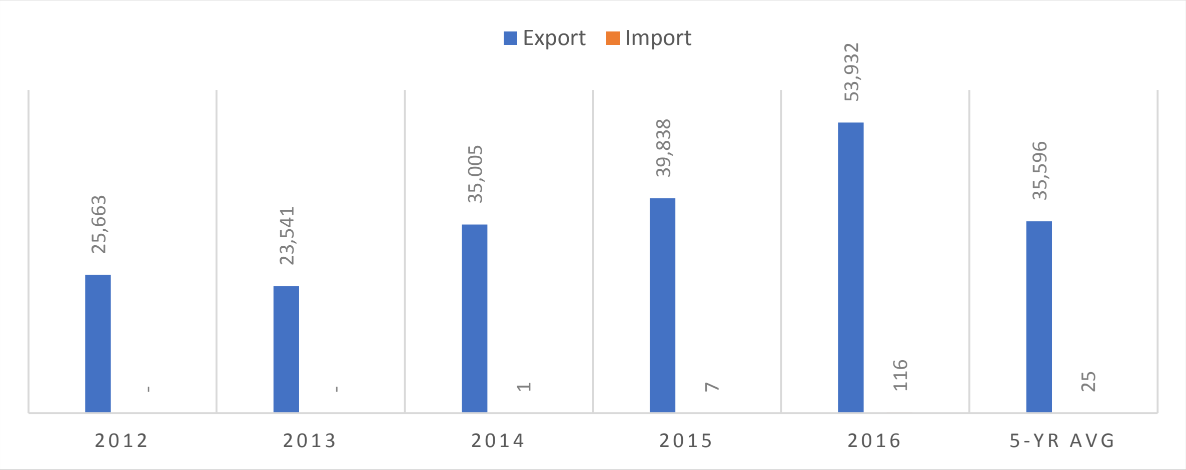


Figure 16 Egypt Export vs Import in USD for years 2012-2016 for Fresh and Dried Mangoes

Egypt's biggest importers in this category for 2016 are shown in Table 45. Middle Eastern markets dominate the table, and while market share is already quite high in Lebanon and Saudi Arabia, there is room for improvement to be done in the United Arab Emirates and Jordan.

Table 45 Egypt's Top Importers of Fresh and Dried Mangoes in 2016

		Value exported in 2016 (USD thousand)	Share in Egypt's exports (%)	Quantity exported in 2016	Share in Country's Imports (%)	Rank in Country's Exports	Average Price per ton (USD thousand)
1	Saudi Arabia	17,576	32.6	11,717	42.0	1st	1.50
2	United Arab Emirates	8,143	15.1	5,429	9.5	3rd	1.50
3	Lebanon	7,622	14.1	5,081	73.1	1st	1.50
4	Jordan	5,940	11.0	3,960	10.2	4th	1.50
5	Kuwait	5,356	9.9	3,571	32.6	2nd	1.50

The above data suggests that while neighboring countries account for the lion's share of Egypt's mango exports, it is worth exploring new markets in Europe, which seem to favor importing their mangoes from South America and Southeast Asia.

5.2.3 Target Market Size

The trailing 5-year average for values exported and imported in the two categories are as follows:

Table 46 Target Market Size for Packed Fruit and Vegetables

	5-yr trailing average 2012-2016 (USD thousand)					
	Tomatoes	Mangoes	Grapes	Totals	Target %	Target Value
Export	59,814	35,596	222,084	317,494	50%	158,747
Import	43	25	9,397	9,464	0%	-
	USD 59,857	USD 35,621	USD 231,480	USD 326,958		USD 158,747

Egypt already exports significantly when it comes to the selected crops, especially grapes. While there are companies already active and dedicated to exporting fresh produce, demand in export is still unsatisfied and there remains decent potential for Egypt to compete, especially in Europe. A 50% improvement in export levels (import substitution potential is limited). This brings the total estimated target market size to USD 158.75m (EGP 2.86bn).

Expected Selling Prices: The markets to target are export mainly to take advantage of the lucrative pricing post-EGP flotation. Expected selling prices for the products are:

- 1 kg of fresh tomato is expected to sell around USD 1.0 per kg (EGP 18 per kg).
- 1 kg of fresh grapes is expected to sell around USD 1.8 per kg (EGP 32 per kg).
- 1 kg of fresh mangoes is expected to sell around USD 1.7 per kg (EGP 30 per kg).

5.2.4 Estimated Annual Sales and Forecasts

The plant, described in more detail under Project Engineering, is assumed to start operating at 50% capacity in Year 1 and reach around 91% by Year 10 as part of the conservative assumptions typical resorted to in the present document. Revenue growth forecasts to account for in price inflation and better capacity utilization in subsequent years are assumed, with an aggressive marketing push in the first 5 years, as shown in Annex I.

This translates to estimated production and annual sales for Year 1 as follows:

- 2,500 tons of fresh tomatoes, bringing in EGP 40.0m
- 1,250 tons of fresh grapes, bringing in EGP 37.5m
- 1,875 tons of fresh mango, bringing in EGP 52.5m

This brings Year 1 revenues to a total of EGP 130.0m. The following graph shows a comparison of the target market and expected revenues in the first five years.

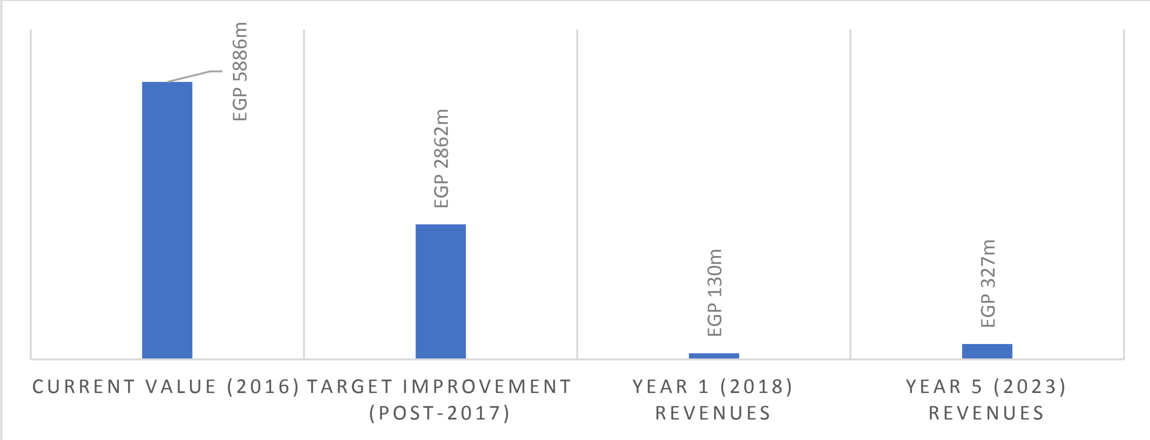


Figure 17 Comparison between Target Market Size and Year 1-5 Revenues for Fresh Fruits and Vegetable Packing Line

5.2.5 Estimated Marketing Costs

Marketing the product on the global stage will require a considerable budget and it is assumed that the marketing budget will account for around 7.5% of sales targets stated above. These sales targets after all are highly contingent on aggressive marketing before operations. This brings the total marketing budget for Year 1 to EGP 9.8m.

5.3 Direct Inputs Required

This section describes the main raw materials required for the process, including other inputs such as additives, etc., as well as the expected costs, their availability (including seasonality when referring to crops) and any risks expected in securing each input and how to mitigate it. It also shows the utilities required, specific consumption benchmarks used, as well as direct labor requirements and any other direct inputs.

5.3.1 Crops Required

The three main crops required for this process are tomatoes, grapes and mangoes. Qena figures were added as they present a valid local source of the required crops. The three crops complement each other in terms of seasonality, and all are cultivated locally and therefore abundant.

The following table provides the figures for feddans cultivated and tons produced are according to figures provided by the CAPMAS Annual Bulletin for Statistical Crop Area and Plant Production for the years 2014-2015.

Table 47 Production Schedule according to Seasonality of Tomatoes, Grapes and Mangoes in Luxor and Qena

Crop Name	Luxor		Qena		Seasonality / Production Schedule											
	feddans	tons	feddans	tons	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tomatoes	9,619	184,133	6,718	134,487	x	x	x									x
Grapes	799	5,114	349	2,017				x	x							
Mangoes	1,911	6,181	708	2,147						X	x	x				

The market prices for the crops are presented in the following table based on 2016-2017 levels. These prices are based on direct buying from farmers. When buying from traders, around 8% is added as a margin, plus EGP 0.25 per kg for transportation.

Table 48 Prices of Fresh Tomatoes, Grapes and Mangoes for 2016-2017

Crop	Price
Tomatoes	EGP 1 – 8 per kg
Grapes	EGP 4 – 10 per kg
Mangoes	EGP 6 – 16 per kg

This study assumes tomatoes are sourced locally only at an average price of EGP 4 per kg, to ensure higher quality tomatoes needed for this kind of product. Higher quality grapes and mangoes are also sourced at the higher end of the range, at EGP 10 and EGP 16 per kg respectively.

5.3.2 Utilities

Assuming today's tariffs for electricity, natural gas and water, the following specific consumption rates were calculated for the three main products. The main utilities are electrical for cooling, and water/wastewater for washing, while no thermal energy is required in the process[6].

Table 49 Specific Consumption and Expected Cost per ton for Year 1

	Specific Consumption		***Expected Bill***	
Utilities				
Electricity	150	kWh/ton	115.05	EGP/ton
Gas	0	kWh/ton	0.00	EGP/ton
Water	20	m3/ton	62.04	EGP/ton
Wastewater	20	m3/ton	53.40	EGP/ton

The above tariffs are for the fiscal year 2017/2018 and are assumed to be tied to inflation projections over the consequent years.

5.3.3 Direct Labor

Seasonal labor will be required for each harvest to handle the fresh tomatoes and mangoes coming during production months. The following table shows how many workers will be required for each season of production.

Table 50 Seasonal Labor Required for Fruit and Vegetable Packing

Production – Seasonal	***No. of Workers***	***EGP per ton handled***
Workers – Tomatoes Season	10	180
Workers – Bananas Season	10	240
Workers – Mangoes Season	10	180

5.3.4 Other Inputs

The final packaging for each product will differ according to market requirements. Additional inputs such as sulphur dioxide (required for fumigation with grapes), ethylene (required for ripening of tomatoes) waxing emulsion, special pallets, etc. are required before final packaging.

An estimate was calculated and an average of EGP 800 per 100 kg was determined.

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[6] The specific consumption rates were obtained from the European Commission's (EC) Best Available Techniques Reference Documents (BREFs) as well as the SCOoPE project, also funded by the EC, as well as from industry experts and practitioners.

5.4 Project Engineering

This section describes the production process in detail, any specific technologies used, the estimated plant capacity, as well as the main components required along with an estimate for civil engineering works (factory infrastructure, etc.) and the total area required.

5.4.1 Description of Technology

The facility uses industry standard pack house equipment to receive fresh produce for quality inspection, washed, sorted, treated and packed in different ways according to client/market needs.

5.4.2 Estimated Plant Capacity

The plant capacity is expected to handle up to 50 tons of fresh fruit and vegetable per day. Since this is a packing facility, there is no processing done to the fresh produce, i.e. there are no conversion ratios/yields to account for, losses from off-specification items notwithstanding.

It is assumed that production will take place in the same months as the harvest as shown in Table 33 and only then.

5.4.3 Process Flow

The process is illustrated in the following figure.

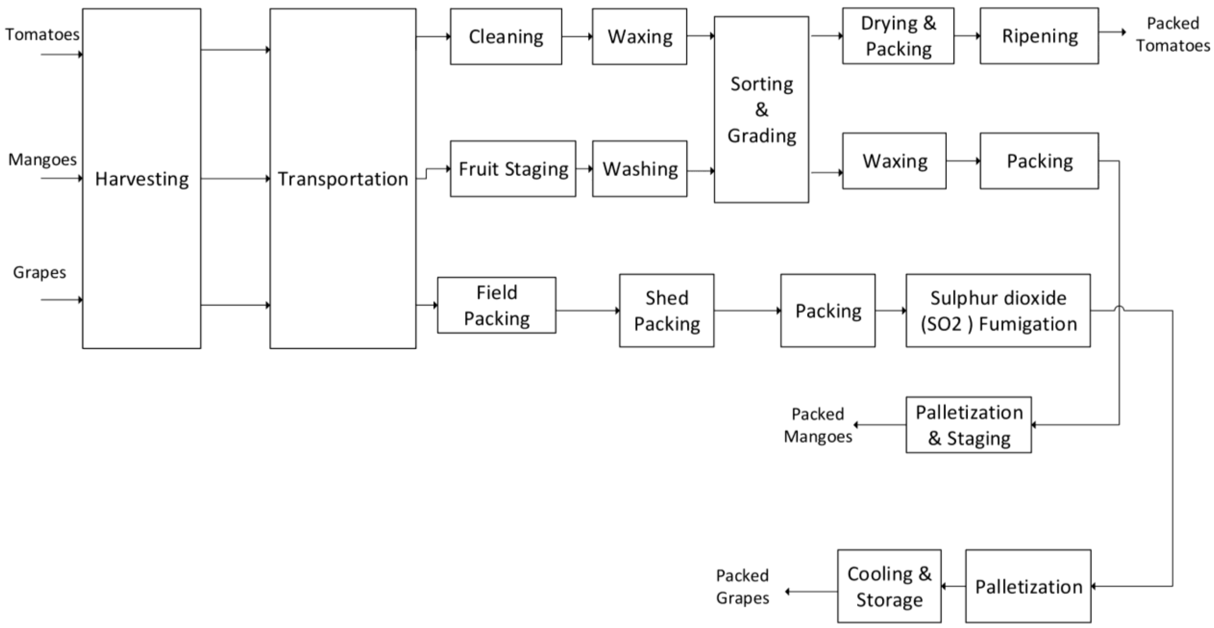


Figure 18 Process Flow Diagram of Fruit and Vegetable Packing

The process steps illustrated are described in detail in the following tables. Each table shows the steps required for each crop separately, since there are major variations in post-harvest handling that is key for producing a final product of export standards.

Table 51 Step-by-Step Details of Fresh Tomato Packing Process

#	Name	Description
Step 1	Harvest	Tomatoes should be removed from the plant by gently twisting or rotating them in order to cleanly remove the stem from the fruit. The stems in most field-type tomato cultivars release at the point of attachment to the fruit.

		Tomatoes should be picked during the coolest part of the day, such as early morning or late afternoon. If they are picked in the morning, harvest should be delayed until the moisture has dried off the fruit surface. Tomatoes should never be picked in the rain or when they are wet.
Step 2	Preparation for Market	The harvested tomatoes should be taken to the packing area soon after picking to begin the process of cleaning, grading, and packing. During all operations, from harvest through packing, the fruit should be handled carefully to avoid bruising and injury to the tissue.
Step 3	Cleaning	The initial step in preparing tomatoes for market is to clean the surface of the fruit and remove any dirt, surface stains, or adhering leaf tissue.
Step 5	Waxing	A thin water-wax emulsion spray coating can also be applied to the fruit as the final step in the cleaning process. Waxing the fruit will enhance its appearance and make it glossier. Waxing can reduce fruit shriveling and increase market life.
Step 6	Grading	All tomatoes must be sorted and graded before packing for market. The main fruit characteristics used to grade tomatoes are size, color, shape, appearance, and firmness. The fruit should also have a well-formed uniform shape typical of the cultivar. Deformed or cat faced fruit should be culled out and not be packed for market.
Step 7	Packing	The fruit surface must be free of moisture before packing in order to reduce storage rots. The type of container used for packing tomatoes depends on the market destination.
Step 8	Ripening	Ripening of tomatoes is initiated by ethylene, a natural ripening hormone produced by the tomato fruit. Application of additional external ethylene may be used to promote faster and more uniform ripening of mature-green tomatoes. Fruit beyond the breaker stage do not benefit from supplemental ethylene because their ripening processes already have been initiated by their own ethylene.

Table 52 Step-by-Step Details of Fresh Grapes Packing Process

#	Name	Description
Step 1	Harvest	Once the decision to harvest grape has been made based on maturity index interpretation, harvest crews should follow recommended picking and field accumulation procedures. Harvested grapes should be protected from exposure to direct sunlight while they await transport to the packing house.
Step 2	Transport to Packing houses	If fruit transport requires traveling lengthy distances, producers should observe the considerations below to minimize the adverse effects on quality that transport to the packinghouse might cause to the fruit.
Step 3	Field packing	The picker usually trims the fruit to remove defective berries and obtain a better bunch shape and size. Bunches are then placed carefully into field crates ('lugs') or baskets which are made from plastic. The picking lugs are then transferred a short distance to the packer, who works at a small, shaded portable stand in the avenue between vineyard blocks.
Step 5	Shed packing	Shed-packed fruit is harvested by pickers and placed in field lugs. These are then moved into the shade of the vines to await transport to the shed. At the packing shed the field lugs are distributed to packers who select, trim and pack the fruit. In some operations, trimming, color sorting, and a first quality sorting may have occurred in the field.
Step 6	Packing	Whether field or shed packed, grapes are nearly always packed on a scale to facilitate packing to a precise net weight. Both forms of packaging provide consumer-sized units and reduce the drop of loose berries.
Step 7	Sulphur dioxide (SO_2) fumigation	After packing the grapes, SO_2 generator sheets were added to each carton on the top of grapes.
Step 8	Palletization	After packing with grapes, cartons are palletized on disposable or recycled pallets. These pallet loads are unitized, usually by strapping or netting. In shed-packing

		operations, some palletizing glue is used to bond the corrugated containers vertically on the pallet so that only horizontal strapping is required.
Step 9	Cooling and storage	After palletization is completed, the pallets are moved to a pre-cooling room. In any case, pre-cooling must start as soon as possible. After pre-cooling is completed, the pallets are moved to a storage room to await transport.

Table 53 Step-by-Step Details of Fresh Mangoes Packing Process

#	Name	Description
Step 1	Harvest	When to harvest is one of the most important decisions a grower faces when it comes to providing the marketplace with superior-quality fruit. Once the decision to harvest mangos has been made based on maturity index interpretation, harvest crews should follow recommended picking and field accumulation procedures. Harvested mangos should be protected from exposure to direct sunlight while they await transport to the packinghouse.
Step 2	Transport to Packinghouses	If fruit transport requires traveling lengthy distances, producers should observe the considerations below to minimize the adverse effects on quality that transport to the packing house might cause to the mango fruit.
Step 3	Fruit Staging at Packinghouses Prior to Packing	Most of the mangos wait inside transport trucks for unloading. Unloaded fruit are almost immediately dumped on the reception line. This system optimizes the use of space in the packinghouse and also the efficiency of resources on the reception line. The down side is that mangos wait for unloading under adverse conditions inside transport trucks. The second type of mango staging system involves a large unloading area, where fruit are unloaded from trucks and clearly identified as lots to be processed in the reception line once quality-control and quarantine inspections have been conducted. Large, open unloading areas protect mangos awaiting reception from sunlight, provide appropriate ventilation, and permit a more representative sampling of mangos for both quarantine and quality-control purposes.
Step 5	Washing	Upon arrival at the packing house, mangos should be processed as soon as possible unless they are being rested to avoid potential latex problems. Mangos are normally transferred into a water flume system (dump tank) at reception for gentle transfer to the sizing line. This transfer may be done manually or automatically. After the fruit leave the dump tank, it is advisable to use a spray and brush operation to remove soil, latex, and other materials that may adhere to the fruit.
Step 6	Grading, Sizing and Sorting	Fruit grading at the packinghouse is done to remove unmarketable fruits. This eliminates the waste of time, money, and energy that accompanies shipping unmarketable fruit to the exported country that must eventually be removed from palletized cartons and discarded. Sizing Mangos for hot water treatment may be accomplished manually or automatically by weight or dimension. If dimensional sizing is used, fruit weights must be checked frequently to ensure that the proper fruit weight classifications are being achieved.
Step 7	Waxing	Waxing mango fruit, usually with carnauba-based formulations, improves its appearance by increasing the natural fruit gloss and reducing water loss, which causes mango fruit to appear dull. Brushing during wax application helps to obtain uniform wax distribution on the fruit. Water-soluble coatings should be avoided because they can be dissolved during later handling when condensation occurs on fruit surfaces, such as when cold fruit is transferred to warmer temperatures.
Step 8	Packing	It is important to train packing line workers to pack mango cartons without injuring the fruit. While mango cartons should be packed tightly in order to immobilize the fruit during transit to avoid vibration injury (surface abrasion), the fruit should not be forced into the cartons by pounding, etc.

Step 9	Palletization and Staging for Cooling/Storage/Shipping	Palletization facilitates handling efficiency and reduces physical injury to mangos by reducing handling of individual cartons.

5.4.4 Main Components and Equipment

The following is a list of the main components of the production line:

- 1 Packing and sizing line
- 2 Cooling stations
- Pre-cooling stations
- Washing stations (basins, etc.)
- Waxing stations
- Storage

Some components must be imported while others can be acquired locally. The prices for the main components are below:

Table 54 Price Estimate for Fruit and Vegetable Packing Line

Component	Price
Packing Sizing Line x1	USD 300,000 (EGP 5.4m)
Cooling Stations x2	EGP 1.3m
Pre-cooling Station	EGP 1.0m
Total	**EGP 7,700,000**

The estimated useful life of this production line, assuming proper maintenance and care, can go up to 15 years.

5.4.5 Civil Engineering Works

In addition to the production line, there are key components of the factory's infrastructure that need to be considered, such as:

- Electrical Generator
- Air compression system
- Cooling system
- Piping etc.

Total infrastructure costs are estimated to be around EGP 1.5 million for a facility of this size.

5.4.6 Area Required

The area required for this production line is estimated to be around 1,200 m^2. The land is assumed to cost around EGP 3,000 per m^2, which amounts to EGP 3.6m for land acquisition. Building structure and office space is estimated to cost an additional EGP 1.2m.

Important Note: Land is expected to be given for free in the Boghdadi industrial zone (IDA jurisdiction) by Luxor governorate. However, it is sold against a fee in New Tiba (NUCA jurisdiction). To be conservative, land was assumed to be bought against a fee.

5.5 Selling, General and Administrative Expenses (SG&A)

This section provides details on the selling, general and administrative expenses associated with the facility, otherwise known as overhead costs.

5.5.1 Salaries and Wages

This opportunity is expected to employ around 25 permanent staff plus an additional 30 seasonal workers (10 for each harvest season). They are summarized below:

Table 55 List of Staff and Monthly Salaries for Fruit and Vegetable Packing Line

Position	*Staff*	*Monthly*
Management		
CEO	1	15.000
…		
Production - Permanent		
Plant Manager	1	10.000
Quality Control	2	6.000
Hall Supervisors	2	6.000
Engineering	2	5.000
Workers	2	3.000
…		
Sales, General and Administration		
Procurement	2	5.000
Sales Manager	1	8.000
Sales	2	5.000
Marketing	2	5.000
Finance & Accounting	1	5.000
HR Manager	1	10.000
Maintenance	4	3.000
Security	2	2.000
…		
Total	**25**	**staff**

Salaries for permanent staff amount to EGP 134,000 per month in Year 1, which is EGP 1.6m total for the year. That is only 4% of total revenue for Year 1.

Wages for seasonal workers amount to range between EGP 300,000 to EGP 450,000 for each harvest. This assumes 10 workers per harvest season, getting paid between EGP 180-240 per ton of feedstock handled.

5.5.2 Factory

Factory overheads that fall outside human resource expenses and production costs are expected to be at a minimum. Maintenance and storage costs are estimated to be around EGP 10,000 and EGP 20,000 per month respectively.

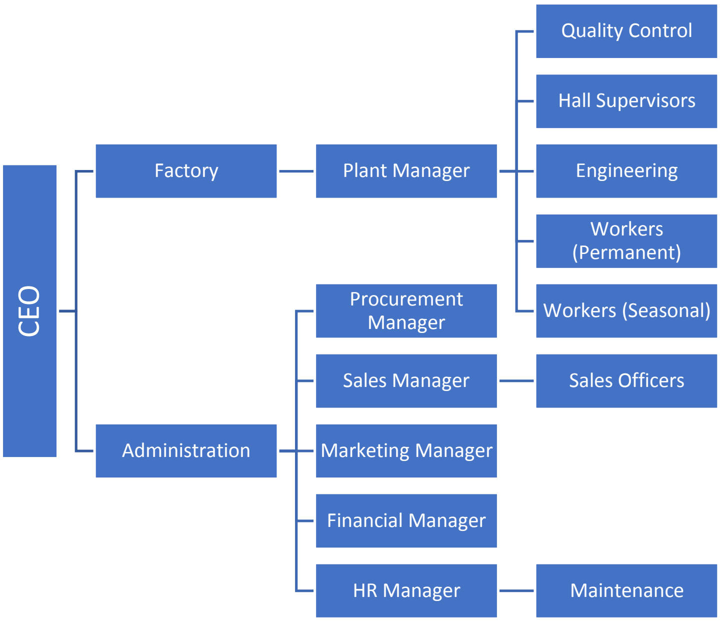
5.5.3 Other Selling, General and Administrative

The main line item in this category is the marketing budget, which is determined as 7.5% of expected sales. This amounts to EGP 9.8m for Year 1.

Utilities associated with administrative office space are expected to be around EGP 4,000 per month.

5.6 Organizational Structure

5.6.1 Organizational Chart



5.7 Financial Analysis and Investment

This section provides details of revenues, cost of goods sold (variable costs), margin analysis by product, selling, general and administrative (SG&A) expenses (aka overheads), fixed assets (initial capital expenditures) for the first year. The total initial investment is provided, and a 10-year projection of the income statements and statements of cash flow are calculated. Finally, the results of the feasibility and sensitivity analyses are provided as a summary of the key findings of the financial model.

5.7.1 Revenues

The estimated revenues for Year 1 are summarized below:

Product	**Months of Production**	**Total Tons Produced**	**Selling Price (EGP/ton)**	**Revenue (EGP 000s)**
Fresh Tomatoes	Jan - Mar	2,500 tons	16,000	40,000
Fresh Grapes	Apr - May	1,250 tons	30,500	37,500
Fresh Mangoes	Jun - Aug	1,875 tons	28,000	52,500
Total				**EGP 130,000**

5.7.2 Cost of Goods Sold

The estimated total COGS for Year 1 are summarized below:

Inputs	**Quantity**	**Units**
Tomatoes		
Tons bought	2,500	*tons*
Cost per ton	16	*EGP 000s/ton*
Cost per month	40,000	*EGP 000s*

Grapes		
Tons bought	1,250	*tons*
Cost per ton	30	*EGP 000s/ton*
Cost per month	37,500	*EGP 000s*
Mangoes		
Tons bought	1,875	*tons*
Cost per ton	28	*EGP 000s/ton*
Cost per month	52,500	*EGP 000s*
Seasonal Labor		
Workers – Tomatoes	**450**	*EGP*
Workers – Grapes	**300**	*EGP*
Workers - Mangoes	**338**	*EGP*
Packaging		
Average of additional inputs (SO2, wax, materials, etc.)	EGP 800 per 100kg	
Cost per year	**45,000**	*EGP 000s*
Utilities		
Electricity	**647**	*EGP 000s*
Gas	**-**	*EGP 000s*
Water	**349**	*EGP 000s*
Wastewater	**300**	*EGP 000s*
Total Utilities	**1,297**	*EGP 000s*
Total COGS	**99,884**	*EGP 000s*

5.7.3 Gross Margin Analysis by Product

Looking at each product's line items separately, gross margin can be calculated to show how profitable each product is and how much it contributes in covering overheads, ultimately increasing bottom line figures.

	Packed Tomato	**Packed Grapes**	**Packed Mangoes**
	EGP 000s	*EGP 000s*	*EGP 000s*
Revenues	**40,000**	**37,500**	**52,500**
Raw Material	10,000	12,500	30,000
Seasonal Labor	450	300	338
Packaging	20,000	10,000	15,000
Electricity	288	144	216
Gas	-	-	-
Water	155	78	116
Wastewater	134	67	100
Total COGS	**31,026**	**23,088**	**45,770**
Gross Margin	**22.4%**	**38.4%**	**12.8%**
(-) Overheads	9.1%	9.1%	9.1%
Operating Margin	**13.4%**	**29.4%**	**3.8%**

5.7.4 Selling, General and Administrative Expenses

SG&A for Year 1 is summarized below:

Human Resources	*EGP 000s*
Total Permanent Staff Salaries	1,608
Overheads	
Factory	
Maintenance	120
Storage	240
General & Administrative	-
Marketing (7.5% of Sales)	9,750
Utilities	48
Total Overheads	**10,158**
Total SG&A	**11,766**

5.7.5 Fixed Assets

The following table summarized the fixed assets (aka Property, Plant and Equipment) required for operation of the facility, along with the associated yearly depreciation expense.

Fixed Assets	**Cost**	**Dep. Life**	**Yearly Dep. Exp.**
	EGP 000s		*EGP 000s*
Production Line	7,700	10 yrs.	770
Infrastructure	2,000	15 yrs.	100
Building	1,000	30 yrs.	33
Office	200	10 yrs.	20
Land	3,600	0 yrs.	N/A
Total CAPEX	**14,000**		**923**

5.7.6 Minimum Investment Required

The minimum investment required will be the total fixed asset purchases required for operation plus 6-months' worth of working capital.

	EGP 000s
Initial Capital Expenditures on Fixed Assets	14,000
Working Capital for 3 months	27,913
Total Investment Required	**41,913**

Important Note: A general assumption was made in all studies that at least 3 months of working capital be covered in the initial investment. This clearly pushes up the initial ask in this particular case and can be reviewed at the feasibility study stage.

5.7.7 Projected Income Statements

The following is the projected income statements for the first 10 years of operation:

Table 56 Projected Income Statements for Fruit and Vegetable Packing Line

Income Statement	1	2	3	4	5	6	7	8	9	10
Sales	130,000	182,000	236,600	283,920	326,508	349,364	373,819	399,986	427,985	457,944
COGS	(99,884)	(139,838)	(181,789)	(218,147)	(250,869)	(268,429)	(287,220)	(307,325)	(328,838)	(351,856)
Gross Profit	**30,116**	**42,162**	**54,811**	**65,773**	**75,639**	**80,934**	**86,599**	**92,661**	**99,148**	**106,088**
SG&A	(11,766)	(16,472)	(21,414)	(25,697)	(29,551)	(31,620)	(33,833)	(36,202)	(38,736)	(41,447)
EBITDA	**18,350**	**25,690**	**33,397**	**40,076**	**46,088**	**49,314**	**52,766**	**56,460**	**60,412**	**64,641**
Depreciation	(923)	(923)	(923)	(923)	(923)	(923)	(923)	(923)	(923)	(923)
EBIT	**17,427**	**24,767**	**32,474**	**39,153**	**45,165**	**48,391**	**51,843**	**55,536**	**59,488**	**63,717**
Interest Expense	(4,974)	(4,497)	(3,927)	(3,248)	(2,438)	(1,473)	(321)	-	-	-
Earnings before Tax	**12,453**	**20,270**	**28,546**	**35,905**	**42,726**	**46,918**	**51,522**	**55,536**	**59,488**	**63,717**
Loss Carry Forward	*12,453*	*32,723*	*61,269*	*97,174*	*139,900*	*174,366*	*205,617*	*232,607*	*256,191*	*277,182*
Taxes	(2,802)	(4,561)	(6,423)	(8,079)	(9,613)	(10,557)	(11,592)	(12,496)	(13,385)	(14,336)
Net Income	**9,651**	**15,709**	**22,124**	**27,826**	**33,113**	**36,361**	**39,929**	**43,041**	**46,104**	**49,381**
%Growth		*63%*	*41%*	*26%*	*19%*	*10%*	*10%*	*8%*	*7%*	*7%*
%NetMargin	*7%*	*9%*	*9%*	*10%*	*10%*	*10%*	*11%*	*11%*	*11%*	*11%*

5.7.8 Projected Cash Flow Statements

The following is the projected cash flow statements for the first 10 years of operation:

Table 57 Projected Cash Flow Statement for Fruit and Vegetable Packing Line

Cash Flow Statement	1	2	3	4	5	6	7	8	9	10
Net Income	9,651	15,709	22,124	27,826	33,113	36,361	39,929	43,041	46,104	49,381
(+) Depreciation	923	923	923	923	923	923	923	923	923	923
(+) Changes in Working Capital	(25,475)	(10,190)	(10,699)	(9,273)	(8,346)	(4,479)	(4,792)	(5,128)	(5,487)	(5,871)
Operating Cash Flow	**(14,901)**	**6,443**	**12,347**	**19,477**	**25,691**	**32,806**	**36,060**	**38,836**	**41,540**	**44,433**
(-) Capital Expenditures	(14,000)	-	-	-	-	-	-	-	-	-
Investing Cash Flow	**(14,000)**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
(+) Direct Equity	12,574									
(+) Debt Financing	29,339									
(-) Dividends	(2,895)	(4,713)	(6,637)	(8,348)	(9,934)	(10,908)	(11,979)	(12,912)	(13,831)	(14,814)
(-) Loan Principal	(2,480)	(2,958)	(3,527)	(4,206)	(5,016)	(5,982)	(7,133)	-	-	-
Financing Cash Flow	**36,537**	**(7,671)**	**(10,164)**	**(12,554)**	**(14,950)**	**(16,890)**	**(19,112)**	**(12,912)**	**(13,831)**	**(14,814)**
Cash Balance										
Begin of Period	-	7,636	6,408	8,592	15,514	26,255	42,171	59,119	85,043	112,752
Net Change	7,636	(1,228)	2,183	6,923	10,741	15,916	16,948	25,924	27,709	29,619
End of Period	**7,636**	**6,408**	**8,592**	**15,514**	**26,255**	**42,171**	**59,119**	**85,043**	**112,752**	**142,371**

5.7.9 Feasibility Analysis

The following table summarizes the key findings from the feasibility analysis:

Key Metric (based on 10-yr projections)	Result (EGP 000s)
Capital Expenditures Required	EGP 14,000
Working Capital Required for first 3 months	EGP 27,913
Minimum Investment Required	EGP 41,913
Direct Investment (Equity)	EGP 12,574
Debt Financing	EGP 29,339
Enterprise Value	EGP 114,898
Internal Rate of Return	34%
Simple Payback	4.4 years
Discounted Payback	8.0 years
Profitability Index	2.74

5.7.10 Sensitivity Analysis

The feasibility of this opportunity will be most sensitive to fluctuations in crop prices. However, since the yields are assumed at 100% (losses from off-specifications notwithstanding), as the crop undergoes little processing and value addition is mainly in how it is packaged, there is no compounding effect as seen in other processes with high conversion ratios.

Nonetheless, a calculation was made to see how far up prices can go up for each crop before their corresponding operating margins reach 0%, while holding selling prices at current global prices for these products. The results were as follows:

- Tomatoes can go up as high as EGP 6.14 per kg. This study assumes an average price of EGP 4.00 per kg. A change of EGP 0.50 can change the gross margin by only 3%.
- Grapes can go up as high as EGP 18.81 per kg. This study assumes an average price of EGP 10.00 per kg. A change of EGP 0.50 can change the gross margin by only 2%.
- Mangoes can go up as high as EGP 17.06 per kg. This study assumes an average price of EGP 16.00 per kg. A change of EGP 0.50 can change the gross margin by only 2%.

This analysis shows that the grapes have the most value added out of the three crops, and therefore are less susceptible to price fluctuations. Tomatoes and mangoes however, are already operating at low operating margins (13.4% and 3.8% respectively), so have less room for prices to move before offloading that extra cost down the value chain via higher selling prices.

5.8 Impact

Economic - Value added to local crops such as tomato and mangoes is quite significant. Based on this study's assumptions, before deducting other COGS and overheads:

- 1 kg of export-grade fresh tomatoes cost EGP 4 sold at EGP 18 (USD 1) – that is 78% value added to the crop.
- 1kg of export-grade grapes cost EGP 10 sold at EGP 30 (USD 1.8) – that is 69% value added to the crop.
- 1kg of export-grade mangoes cost EGP 16 sold at EGP 30 (USD 1.7) – that is 47% value added to the crop.

Social - Direct jobs created by this facility will include 25 permanent plant staff plus another 30 seasonal workers. Indirect jobs created will be mainly in logistics, marketing and distribution, and increased dedicated farming to supply the plant over time.

Environmental – This opportunity will help decrease post-harvest losses as demand for raw materials for export can reduce oversupply and improve quality of harvest.

6 IO5 - Medium Density Fiberboard Production Facility

6.1 Overview

This opportunity aims to add value to the large amount of agricultural waste generated in and around Luxor. Bagasse, which is the fiber discarded from the process of sugar production from sugarcane, is considered a high-quality material input for the production of medium density fiberboard, or MDF. Establishing an MDF production facility in Luxor makes sense to be close to the sugar production facilities in the region and will add significant value to sugarcane bagasse.

The potential here lies mainly in the local market as Egypt imports a significant amount of MDF, and wood in general. Export markets do have potential as well since MDF made from bagasse can meet export quality standards. MDF boards are used mainly in furniture and fixtures, and are commonly used as a replacement for natural wood boards.

6.2 Market Demand

This section provides a description of the products and targeted markets, including a brief analysis on the current market structure, the potential for import substitution and export where applicable.

6.2.1 Product Description

This opportunity looks at producing one product only:

Product A: Medium Density Fiberboard (MDF) panels with the following specifications:

- Dimensions of 1220mm x 2440mm – this is the standard area used in the market and most widely circulated. The panels then get modified according to their end use as they move up the value chain to customers.
- Thickness 3mm and 25mm, this study assumes 16mm.
- Density between 600-800 kg/m^3, study assumes 680 kg/m^3, as it is the most common density used.

For illustrative purposes only.

Important Note: It is important to determine the dimensions and density of the final product as it affects conversion ratios of the raw material (sugarcane bagasse, bought in tons) and the final product (MDF panels, sold in m3). The higher the thickness, the lower the output of panels per m3, which lowers yield and revenues. The higher the density, the more raw materials required per m3, which increases input costs.

6.2.2 Current Market Structure

Egypt lacks sources of natural wood and therefore imports all kinds of wood (and paper). Local production has not been able to keep up with local demand for these products. Egypt imported over USD 70m of MDF boards alone in 2016 (last 5-year average is around USD 67m), with negligible exports to offset the balance. The following figure shows import-export trends in the last 5 years.

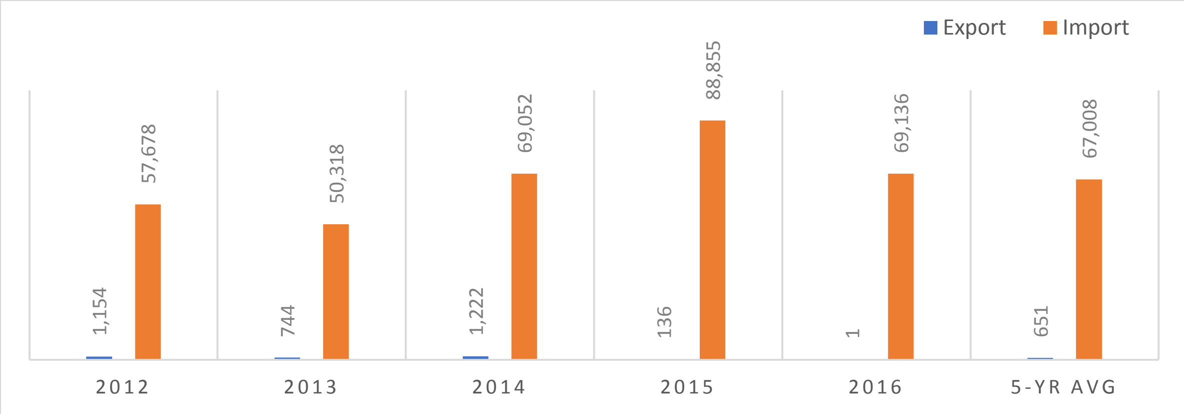


Figure 19 Egypt Export vs Import in USD for years 2012-2016 for MDF

This shows a clear gap in the market. Local production capacity does not satisfy local demand. Hence, local MDF production is a pure import substitution play. This suggests that target market size is at least USD 70m per year, to at least cover local demand and reduce imports. The main suppliers are China, Indonesia and Romania, as shown in the following table.

Table 58 Egypt's Top Exporters of MDF in 2016

		Value imported in 2016 (USD thousands)	Share in Egypt's imports (%)	Quantity imported in 2016	Average Price per ton (USD thousands)
1	China	20,878	30.2	31,361	0.67
2	Indonesia	16,447	23.8	24,707	0.67
3	Romania	11,314	16.4	16,995	0.67
4	Italy	6,376	9.2	9,577	0.67
5	Malaysia	4,354	6.3	6,540	0.67

With growing domestic demand, the gap is expected to become wider. Locally manufactured MDF panels can easily compete with the quality of imported materials. MDF made from sugarcane bagasse is known for its high quality and there is potential to leverage the amounts of bagasse available in Upper Egypt to satisfy local demand for wood and its alternatives.

6.2.3 Target Market Size

The trailing 5-year average for values exported and imported in the two categories are as follows:

Table 59 Target Market Size for MDF

	5-yr trailing average 2012-2016 (USD thousands)		
	MDF	Target %	Target Value
Export	651	0%	0
Import	67,008	100%	67,008
	USD 67,659		USD 67,008

Since this is primarily an import substitution play, the target market should be at least to substitute 100% of import requirements. This brings the total estimated target market size to USD 67.0m (EGP 1.21bn).

Expected Selling Prices: The markets to target are mainly local and compete with imports of similar goods. This makes price competition a key strategy. As shown in the market data for imports, the average price for a ton of

MDF was around USD 670 per ton. Assuming a density of 680 kg/m3, that translates to USD 985 (EGP 17,700) per m3. This number seemed too optimistic however, and primary data collection from the local market suggested that the price is in the EGP 10,000 – 13,000 range per m3. This study assumes the lowest of the range at EGP 10,000 per m3.

6.2.4 Estimated Annual Sales and Forecasts

The plant, described in more detail under Project Engineering, is assumed to start operating at 50% capacity in Year 1 and reach around 91% by Year 10 as part of the conservative assumptions typical resorted to in the present document. Revenue growth forecasts to account for in price inflation and better capacity utilization in subsequent years are assumed, with an aggressive marketing push in the first 5 years, as shown in Annex I.

This translates to estimated production and annual sales for Year 1 as follows:

- 25,500 m3 of MDF panels, bringing in EGP 255m in revenue.

The following graph shows a comparison of the target market and expected revenues in the first five years.

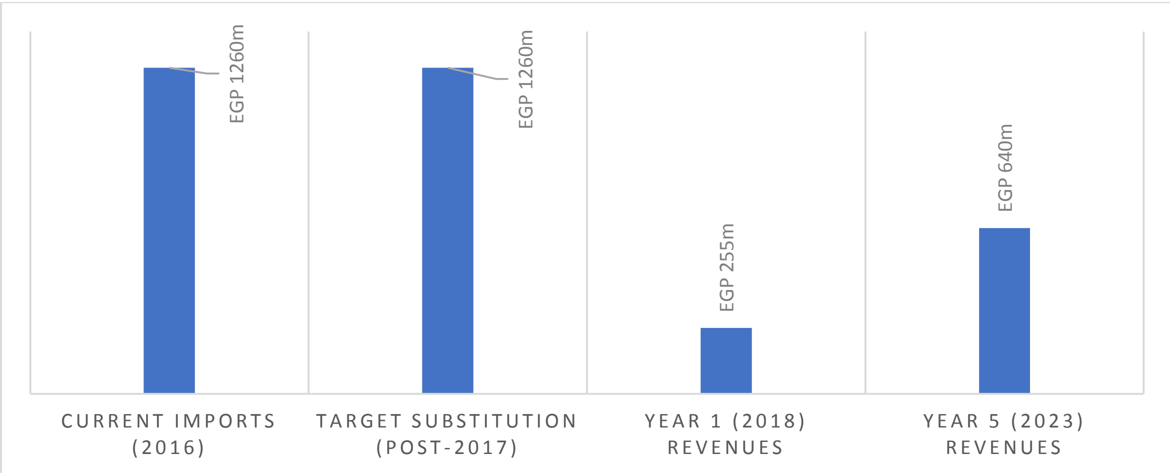


Figure 20 Comparison between Target Market Size and Year 1-5 Revenues for MDF Production Line

6.2.5 Estimated Marketing Costs

Marketing the product as an alternative to imported wood may require a considerable budget and it is assumed that the marketing budget will account for around 7.5% of sales targets stated above. These sales targets after all are highly contingent on aggressive marketing before operations. This brings the total marketing budget for Year 1 to EGP 19.13m.

6.3 Direct Inputs Required

This section describes the main raw materials required for the process, including other inputs such as additives, etc., as well as the expected costs, their availability (including seasonality when referring to crops) and any risks expected in securing each input and how to mitigate it. It also shows the utilities required, specific consumption benchmarks used, as well as direct labor requirements and any other direct inputs.

6.3.1 Material Required

This opportunity relies on sugarcane bagasse as a primary raw material. Other types of agricultural waste can be put in the mix, but this study assumes 100% reliance on bagasse, as the non-wood fiber required to manufacture MDF. The following table provides the figures for feddans cultivated and tons produced are according to figures provided by the CAPMAS Annual Bulletin for Statistical Crop Area and Plant Production for the years 2014-2015.

Table 60 Production Schedule according to Seasonality of Sugarcane in Luxor and Qena

Crop Name	Luxor		Qena		Seasonality / Production Schedule											
	feddans	tons	feddans	tons	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sugarcane	67,422	3,257,224	118,089	5,690,000	x	x	x	x	x							x

Based on Ministry of Agriculture 2014 data, there is enough local supply in Southern Upper Egypt (which includes Luxor, Qena, Sohag, Aswan and Assiut), it is estimated that sugarcane fields in the region (Luxor, Qena, Sohag, Aswan) generate over 1 million tons of waste per year. Furthermore, sugar factories in the region such as in Qus and Armant are significant sources of bagasse. Armant alone generates around 62,000 tons of unused bagasse annually.

Sugarcane bagasse will likely be sourced from nearby sugar factories. They are priced comparably to the price of fuels like mazut since the waste bagasse is normally re-used as an alternative fuel in the sugar refining process. It is assumed that 5 tons of bagasse are equivalent to 1 ton of mazut, which is currently priced at a maximum of EGP 3,500 per ton (this is the price cement factories pay for, other industries only pay EGP 2,500 per ton). This brings the price of 1 ton of sugarcane bagasse to EGP 700. However, it is expected a premium will be paid to secure supply, so 1 ton will cost no less than EGP 1,000.

6.3.2 Resin Required

Another major input is urea formaldehyde (UF) which is the main resin used in this production process. The following table shows the specifications normally used.

Table 61 Urea Formaldehyde Specifications Required in MDF Production Process

Item	Value
Solid Content	60 %
PH	6.8-7.1
Viscosity	30-45 sec
Density	1.28 g/cm3
Gel time	50- 65 sec
Free Formaldehyde	2 % max.

It is calculated that for every cubic meter of MDF produced, 90 kg of UF is required. UF is manufactured in Egypt at a handful of facilities and is sold for EGP 15 per kg.

6.3.3 Transportation

Transportation costs were also accounted for in this study. It is expected that the facility will bear the costs of transporting the product to the local markets, which are concentrated up north in the Delta region (Damietta furniture cluster, etc.). Transporting such a heavy product will incur costs deemed material to this study. It is assumed that each ton transported will cost around EGP 500, which translates to around EGP 515 per m^3 of MDF produced.

6.3.4 Utilities

Assuming today's tariffs for electricity, natural gas and water, the following specific consumption rates were calculated for the main product. The main utilities are thermal for pressing, and water/wastewater for cooking/de-fibering, with medium electricity requirements[7].

Table 62 Specific Consumption and Expected Cost per ton for Year 1

	Specific Consumption		***Expected Bill***	
Utilities				
Electricity	300	kWh/m3	230.10	EGP/m3
Gas	1,000	kWh/m3	310.00	EGP/m3
Water	2	m3/m3	6.20	EGP/m3
Wastewater	2	m3/m3	5.34	EGP/m3

The above tariffs are for the fiscal year 2017/2018 and are assumed to be tied to inflation projections over the consequent years.

6.3.5 Direct Labor

Seasonal labor will be required during the months of production and its estimated that a total of 30 workers will be required, working in groups of 15 for each of the two shifts per day. The following table shows how many workers will be required during the sugarcane harvest.

Table 63 Seasonal Labor Required for MDF Production

Production – Seasonal	***No. of Workers***	***EGP per ton handled***
Workers per Season	30	50

6.4 Project Engineering

This section describes the production process in detail, any specific technologies used, the estimated plant capacity, as well as the main components required along with an estimate for civil engineering works (factory infrastructure, etc.) and the total area required.

6.4.1 Description of Technology

The MDF production line uses industry standard technology that is available from a few countries. The production line cannot be sourced locally, it is usually imported from countries like Italy and Japan, who are known for their specialty in manufacturing these lines. There are providers from China as well that can manufacture similar lines, albeit at lower capacities.

This study assumes that a refurbished production line will be imported from Japan and re-assembled at the selected site (i.e. not newly manufactured, but previously used and decommissioned).

6.4.2 Estimated Plant Capacity

The plant capacity is estimated to produce a maximum of 340 m^3 of MDF per day (assuming 22 hours of operation, two shifts plus maintenance). As stated in the product description, it is important to note the

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[7] The specific consumption rates were obtained from the European Commission's (EC) Best Available Techniques Reference Documents (BREFs) as well as the SCOoPE project, also funded by the EC, as well as from industry experts and practitioners.

dimensions and density of the panels, as it affects the yield of the feedstock. It is assumed that around 30% of losses in mass occur during the drying stage, as moisture content (MC) is reduced.

The following table summarizes the conversion ratios used in the study.

Table 64 Conversion Ratio for MDF

Feedstock	Max. Output (m3/day)	Density of MDF (kg/m3)	Input (tons/day) – assuming no losses	Conversion Ratio	Factor in MC Losses	Final Input (tons/day)	Final Conversion Ratio
Bagasse	340	680	230	1.48	30%	330	1.03

6.4.3 Process Flow

The process is illustrated in the following figure.

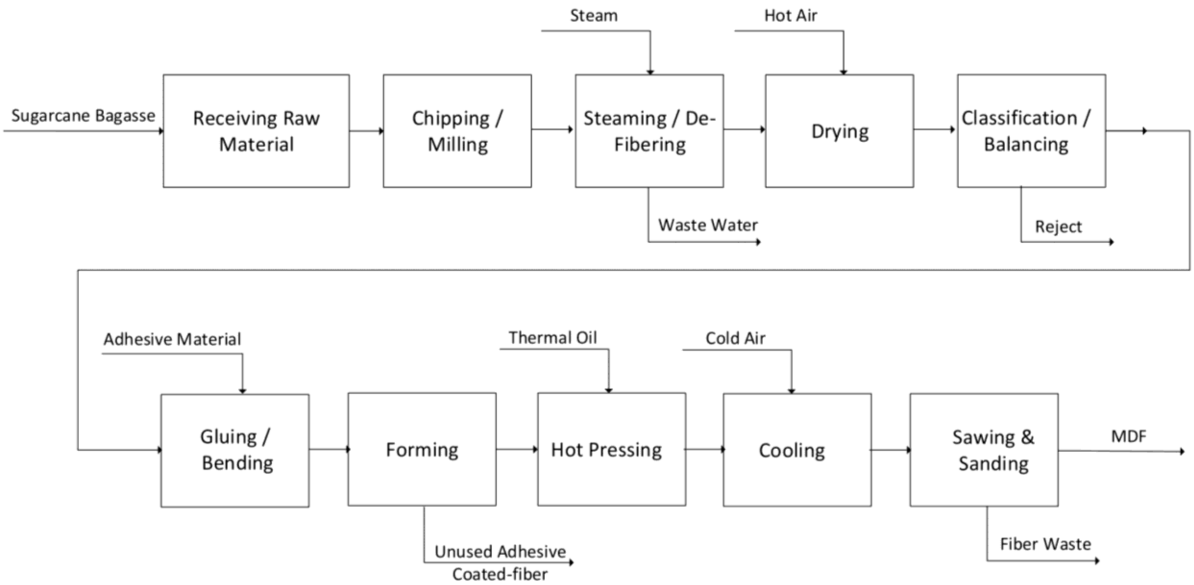


Figure 21 Process Flow Diagram of MDF Production

The process steps illustrated are described in detail in the following table.

Table 65 Step-by-Step Details of MDF Production Process

#	Name	Description
Step 1	Receiving Raw Material	Sugarcane bagasse is received in loading area and prepared for chipping step.
Step 2	Chipping / Milling	Bagasse is taken through knife system to be cut up and sliced into smaller pieces. A disc or drum chipper is used to produce chips of bagasse. Each particle reduction (milling) process will produce a range of particle sizes. Different chip size/type used for surface and core layers –fine chips or particles on the surface (good finish), coarser chips in the core. It is important to produce chip surfaces with as little damage as possible to improve particle-particle bonding; a mechanically weak surface layer will lead to possible break-down of the glue-line, resulting in degraded board properties.
Step 3	Steaming / De-Fibering	Batch steaming system is used for cooking the bagasse. A sufficient quantity of bagasse is transferred into the steaming vessel and saturated steam is then injected. After a short pre-steaming time to equalize the steam pressure and temperature inside the steaming vessel, the exhaust valve is closed, and steam pressure and temperature are raised up to the start point of steaming condition.

		The steaming time is started after reaching the target steaming temperature and continued for 5 minutes. A steaming temperature of 175 °C (p = 6 bar) is recommended.
Step 4	Drying	Chips will have high moisture content which can lead to delamination. Drying ensures that furnish has homogenous moisture content (core and surface layers can have different moisture contents). Some moisture content is necessary to assist in heat transfer during pressing process. Optimization of MC important: too much and this will cause problems with board blows, too little will lead to poor heat transfer in the press and incomplete resin cure, resulting in poor mechanical properties. Driers work on the principle of passing the particles through a stream of hot air (180-200 degrees Celsius).
Step 5	Classification / Balancing	This is to control particle size distribution –important so as to optimize the position and size of the particles relative to their position in the board –small particles on the surface, bigger particles in the core. This can be done by sieving, where particles pass through different sized sieves, and different particle sizes pass onto the next size down.
Step 6	Gluing / Bending	An adhesive or glue such as urea formaldehyde (UF) needs to be applied to the surface of the particles to bind the particles together. The resins are generally applied as liquids in the form of an atomized spray. Additional mechanical blending can enhance the coverage of the resin over the particles.
Step 7	Forming	Chip/resin blend is then formed into a mattress. In the mat forming process, the air/fiber stream is concentrated and metered through a series of jets and thickness control vanes onto a continuously moving belt. The mat as it exits the mat forming unit is of very low density and up to several inches thick (mat thickness correlates to ultimate panel thickness). There is some waste from the forming process, in the form of unused adhesive-coated fiber. In most MDF facilities this waste is reused and consumed as fuel.
Step 8	Hot Pressing	There is at this point little contact between adhesive-coated fibers, and few bonds have been formed. The mat is then fed into a heated continuous press line. The mat is gradually compressed between two endlessly revolving stainless-steel belts, heated by a thermal oil bath. Pressure on the mat increases, as the gap between the belts is decreased down the length of the forming line, (which can be 100 meters or more long). The ultimate pressure applied to the compressed MDF panel is determined by panel thickness and desired panel properties.
Step 9	Cooling	The final step in the pressing line is air cooling, to bring the fresh panel down to near ambient temperature, to be sawn and sanded.
Step 10	Sawing & Sanding	Usually the sawing line, that produces these finished panels, is a fully automated process which cuts the continuous panel into pre-programmed lengths and widths. There is little waste in this process, which is optimized to manufacture as much product as possible. The waste, that is might be generated, is typically consumed as fuel. Prior to sawing to size, the panel product is sanded to eliminate surface inconsistencies and minor variations in thickness.

6.4.4 Main Components and Equipment

The following is a list of the main components of the production line:

- Drum chipper
- Hot grinder machine
- Fiber dryer
- Paving and forming machine
- Hot pressing machine
- Board cooling system
- Cutting system

- Sanding system

The production line is imported all together. The price for the line is provided as a lump-sum below.

Table 66 Price Estimate for MDF Production Line

Maximum Capacity	**Total Lump-Sum Price in EGP**
Daily Output of 340 m3 of MDF panels	USD 3.3m (EGP 59.4m)

The estimated useful life of this production line, assuming proper maintenance and care, can go up to 15 years.

6.4.5 Civil Engineering Works

In addition to the production line, there are key components of the factory's infrastructure that need to be considered, such as:

- Boiler system for heating oil
- Electrical Generator
- Air compression system
- Cooling system
- Piping etc.

Total infrastructure costs are estimated to be around EGP 2.0 million for a facility of this size.

6.4.6 Area Required

The area required for this production line is estimated to be around 1,500 m^2. The land is assumed to cost around EGP 3,000 per m^2, which amounts to EGP 4.5m for land acquisition. Building structure and office space is estimated to cost an additional EGP 1.2m.

Important Note: Land is expected to be given for free in the Boghdadi industrial zone (IDA jurisdiction) by Luxor governorate. However, it is sold against a fee in New Tiba (NUCA jurisdiction). To be conservative, land was assumed to be bought against a fee.

6.5 Selling, General and Administrative Expenses (SG&A)

This section provides details on the selling, general and administrative expenses associated with the facility, otherwise known as overhead costs.

6.5.1 Salaries and Wages

This opportunity is expected to employ around 28 permanent staff plus an additional 30 seasonal workers (2x15 for the season). They are summarized below:

Table 67 List of Staff and Monthly Salaries for MDF Production Line

Position	*Staff*	*Monthly*
Management		
CEO	1	15.000
…		
Production - Permanent		
Plant Manager	1	10.000
Quality Control	2	6.000
Hall Supervisors	2	6.000
Engineering	2	5.000

Workers	4	3.000
…		
Sales, General and Administration		
Procurement	2	5.000
Sales Manager	1	8.000
Sales	2	5.000
Marketing	2	5.000
Finance & Accounting	2	5.000
HR Manager	1	10.000
Maintenance	4	3.000
Security	2	2.000
…		
Total	**28**	**staff**

Salaries for permanent staff amount to EGP 145,000 per month in Year 1, which is EGP 1.74m total for the year. That is only 1% of total revenue for Year 1.

Wages for seasonal workers amount to EGP 1.24m for each production season. This assumes 30 workers per season, getting paid between EGP 50 per ton of feedstock handled.

6.5.2 Factory

Factory overheads that fall outside human resource expenses and production costs are expected to be at a minimum. Maintenance and storage costs are estimated to be around EGP 10,000 and EGP 15,000 per month respectively.

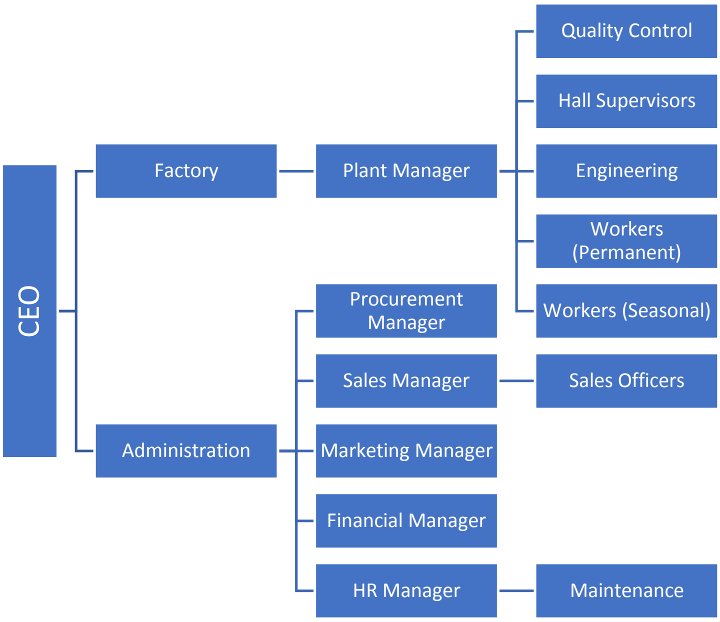
6.5.3 Other Selling, General and Administrative

The main line item in this category is the marketing budget, which is determined as 7.5% of expected sales. This amounts to EGP 19.13m for Year 1.

Utilities associated with administrative office space are expected to be around EGP 4,000 per month.

6.6 Organizational Structure

6.6.1 Organizational Chart



6.7 Financial Analysis and Investment

This section provides details of revenues, cost of goods sold (variable costs), margin analysis by product, selling, general and administrative (SG&A) expenses (aka overheads), fixed assets (initial capital expenditures) for the first year. The total initial investment is provided, and a 10-year projection of the income statements and statements of cash flow are calculated. Finally, the results of the feasibility and sensitivity analyses are provided as a summary of the key findings of the financial model.

6.7.1 Revenues

The estimated revenues for Year 1 are summarized below:

Product	**Months of Production**	**Total m3 Produced**	**Selling Price (EGP/m3)**	**Revenue (EGP 000s)**
MDF Panels	Dec – May	25,502 tons	10,000	255,024

6.7.2 Cost of Goods Sold

The estimated total COGS for Year 1 are summarized below:

Inputs	**Quantity**	**Units**
Sugarcane		
Tons bought	24,750	*tons*
Cost per ton	2,000	*EGP/ton*
Cost per year	**49,500**	*EGP 000s*
Additives – UF Resin		
Tons bought	2,295	*tons*
Cost per ton	20,000	*EGP/ton*

Cost per year	**45,904**	*EGP 000s*
Seasonal Labor		
Workers	**1,238**	*EGP*
Transportation		
Cost per ton	500	*EGP/ton*
Cost per m3	515	*EGP/ton*
Cost per year	**13,139**	*EGP 000s*
Utilities		
Electricity	5,868	*EGP 000s*
Gas	7,906	*EGP 000s*
Water	158	*EGP 000s*
Wastewater	136	*EGP 000s*
Total Utilities	**14,068**	*EGP 000s*
Total COGS	**87,623**	*EGP 000s*

6.7.3 Gross Margin Analysis by Product

Looking at each product's line items separately, gross margin can be calculated to show how profitable each product is and how much it contributes in covering overheads, ultimately increasing bottom line figures.

	MDF Panels
	EGP 000s
Revenues	**255,024**
Raw Material	49,500
Resin	45,904
Seasonal Labor	1,238
Transportation	13,139
Electricity	5,868
Gas	7,906
Water	158
Wastewater	136
Total COGS	**126,164**
Gross Margin	**50.5%**
(-) Overheads	8.3%
Operating Margin	**42.2%**

6.7.4 Selling, General and Administrative Expenses

SG&A for Year 1 is summarized below:

Human Resources	*EGP 000s*
Total Permanent Staff Salaries	1,740
Overheads	
Factory	
Maintenance	120
Storage	180

General & Administrative	-
Marketing (7.5% of Sales)	19,127
Utilities	48
Total Overheads	**19,475**
Total SG&A	**21,215**

6.7.5 Fixed Assets

The following table summarized the fixed assets (aka Property, Plant and Equipment) required for operation of the facility, along with the associated yearly depreciation expense.

Fixed Assets	**Cost**	**Dep. Life**	**Yearly Dep. Exp.**
	EGP 000s		*EGP 000s*
Production Line	59,400	10 years	5,940
Infrastructure	2,000	15 years	133
Building	1,000	30 years	33
Office	200	10 years	20
Land	4,500	0 years	N/A
Total CAPEX	**67,100**		**6,127**

6.7.6 Minimum Investment Required

The minimum investment required will be the total fixed asset purchases required for operation plus 3-months' worth of working capital.

	EGP 000s
Initial Capital Expenditures on Fixed Assets	67,100
Working Capital for 3 months	36,266
Total Investment Required	**103,366**

Important Note: A general assumption was made in all studies that at least 3 months of working capital be covered in the initial investment. This clearly pushes up the initial ask in this particular case and can be reviewed at the feasibility study stage.

6.7.7 Projected Income Statements

The following is the projected income statements for the first 10 years of operation:

Table 68 Projected Income Statements for MDF Production Line (EGP thousands)

Income Statement	1	2	3	4	5	6	7	8	9	10
Sales	255,024	357,034	464,144	556,972	640,518	685,355	733,329	784,662	839,589	898,360
COGS	(123,849)	(173,388)	(225,405)	(270,486)	(311,059)	(332,833)	(356,131)	(381,061)	(407,735)	(436,276)
Gross Profit	**131,175**	**183,645**	**238,739**	**286,486**	**329,459**	**352,522**	**377,198**	**403,602**	**431,854**	**462,084**
SG&A	(21,215)	(29,701)	(38,611)	(46,333)	(53,283)	(57,013)	(61,004)	(65,274)	(69,843)	(74,732)
EBITDA	**109,960**	**153,944**	**200,128**	**240,153**	**276,176**	**295,509**	**316,194**	**338,328**	**362,011**	**387,352**
Depreciation	(6,127)	(6,127)	(6,127)	(6,127)	(6,127)	(6,127)	(6,127)	(6,127)	(6,127)	(6,127)
EBIT	**103,834**	**147,818**	**194,001**	**234,027**	**270,050**	**289,382**	**310,068**	**332,201**	**355,884**	**381,225**
Interest Expense	(12,267)	(11,090)	(9,685)	(8,011)	(6,013)	(3,632)	(792)	-	-	-
Earnings before Tax	**91,566**	**136,728**	**184,316**	**226,016**	**264,036**	**285,750**	**309,276**	**332,201**	**355,884**	**381,225**
Loss Carry Forward	*91,566*	*228,294*	*412,610*	*638,626*	*902,662*	*1,096,846*	*1,269,394*	*1,417,279*	*1,547,147*	*1,664,336*
Taxes	(20,602)	(30,764)	(41,471)	(50,854)	(59,408)	(64,294)	(69,587)	(74,745)	(80,074)	(85,776)
Net Income	**70,964**	**105,964**	**142,845**	**175,162**	**204,628**	**221,456**	**239,689**	**257,456**	**275,810**	**295,449**
%Growth		*49%*	*35%*	*23%*	*17%*	*8%*	*8%*	*7%*	*7%*	*7%*
%NetMargin	*28%*	*30%*	*31%*	*31%*	*32%*	*32%*	*33%*	*33%*	*33%*	*33%*

6.7.8 Projected Cash Flow Statements

The following is the projected cash flow statements for the first 10 years of operation:

Table 69 Projected Cash Flow Statement for MDF Production Line (EGP thousands)

Cash Flow Statement	1	2	3	4	5	6	7	8	9	10
Net Income	70,964	105,964	142,845	175,162	204,628	221,456	239,689	257,456	275,810	295,449
(+) Depreciation	6,127	6,127	6,127	6,127	6,127	6,127	6,127	6,127	6,127	6,127
(+) Changes in Working Capital	(54,816)	(21,926)	(23,023)	(19,953)	(17,958)	(9,637)	(10,312)	(11,034)	(11,806)	(12,632)
Operating Cash Flow	**22,275**	**90,165**	**125,949**	**161,336**	**192,797**	**217,946**	**235,504**	**252,549**	**270,131**	**288,943**
(-) Capital Expenditures	(67,100)	-	-	-	-	-	-	-	-	-
Investing Cash Flow	**(67,100)**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
(+) Direct Equity	31,010									
(+) Debt Financing	72,356									
(-) Dividends	(21,289)	(31,789)	(42,853)	(52,549)	(61,388)	(66,437)	(71,907)	(77,237)	(82,743)	(88,635)
(-) Loan Principal	(6,117)	(7,295)	(8,699)	(10,374)	(12,371)	(14,753)	(17,593)	-	-	-
Financing Cash Flow	**75,960**	**(39,084)**	**(51,553)**	**(62,923)**	**(73,759)**	**(81,190)**	**(89,499)**	**(77,237)**	**(82,743)**	**(88,635)**
Cash Balance										
Begin of Period	-	31,135	82,215	156,611	255,025	374,063	510,819	656,823	832,135	1,019,523
Net Change	31,135	51,081	74,396	98,414	119,038	136,756	146,004	175,312	187,388	200,309
End of Period	**31,135**	**82,215**	**156,611**	**255,025**	**374,063**	**510,819**	**656,823**	**832,135**	**1,019,523**	**1,219,832**

6.7.9 Feasibility Analysis

The following table summarizes the key findings from the feasibility analysis:

Key Metric (based on 10-yr projections)	Result (EGP 000s)
Capital Expenditures Required	EGP 67,100
Working Capital Required for first 3 months	EGP 36,266
Minimum Investment Required	EGP 103,366
Direct Investment (Equity)	EGP 31,010
Debt Financing	EGP 72,356
Enterprise Value	EGP 917,367
Internal Rate of Return	73%
Simple Payback	2.8 years
Discounted Payback	2.3 years
Profitability Index	8.87

6.7.10 Sensitivity Analysis

The feasibility of this opportunity will be most sensitive to fluctuations in bagasse prices. Holding all other relevant factors constant, such as MDF target density, resin prices, moisture content loss during production, etc. a calculation was made to see how far up prices can go before operating margins reach 0%, while holding selling prices at EGP 10,000. The results were as follows:

- Bagasse can go up as high as EGP 6,900 per ton. This study assumes an average price of EGP 2,000 per kg only, which is already quite conservative, as market prices are currently at EGP 700-1,000 per ton.

Since resin is an important factor, and contributes to around 39.3% of COGS, the sensitivity of its price was also calculated, holding the other variables constant:

- UF resin can go as high as EGP 77.66 per kg. This study assumes prices of EGP 20.00 per kg, which are higher than current market prices of EGP 15.00 per kg.

It is clear from the above that this opportunity creates value, as it takes very cheap raw materials such as sugarcane bagasse that is normally regarded as waste, and creates a product that is in huge demand locally and is currently being heavily imported each year to meet growing demand.

6.8 Impact

Economic - Value added to local agricultural waste is quite significant. Based on this study's assumptions, before deducting other COGS and overheads, 680 kg of bagasse, costing EGP 680, produces 1 m^3 of MDF panels, selling at EGP 6,000 per m^3 – that is 89% value added to the waste.

Social - Direct jobs created by this facility will include 28 permanent plant staff plus another 30 seasonal workers. Indirect jobs created will be mainly in logistics, marketing and distribution.

Environmental – This opportunity helps mitigate open burning of agricultural waste and therefore reducing carbon emissions.

7 IO6 Biomass Fuel Pellets Production Facility

7.1 Overview

This opportunity takes advantage of local waste streams, mainly sugarcane residue, corn stalk, as well as wood cuttings and sawdust, palm tree fronds and banana tree leaves. The final product is high-calorific value biomass pellets that can be burned on-site at energy intensive factories such as cement kilns. With growing energy demand from local industries and increasing political will to enable the use of such technologies and valorize abundant supplies of agricultural waste, this opportunity fills a clear market gap that has already seen players enter in the last few years, especially with the backdrop of conventional energy subsidy removal.

The potential mainly lies in serving local energy-intensive industries, which have already started preparing their factories to receive alternative fuels, such as the cement plants in Qena and Assiut. However, for this opportunity to remain financially sustainable, more than half the production must be aimed towards export to take advantage of higher selling prices abroad.

7.2 Market Demand

This section provides a description of the products and targeted markets, including a brief analysis on the current market structure, the potential for import substitution and export where applicable.

7.2.1 Product Description

This opportunity looks at producing one product only:

Product A: biomass pellets made from agriwaste, mainly sugarcane residue and corn stalk, with calorific value of at least 5,000 kcal/kg.

For illustrative purposes only.

7.2.2 Current Market Structure

One way to assess local demand for fuel pellets is to look at the thermal needs of local cement production. Local cement producers are the primary target market segment, as their demand for thermal energy is growing. This sector suffered from shortages in natural gas in recent years, which saw it switch to other sources such as coal. This switch was controversial, as not only it is polluting, but it had to be imported as Egypt does not produce any coal. Biomass fuel pellets provide a cleaner, local abundant alternative that is already in high demand by local cement plants all over the country.

The IFC conducted a valuable study, published in 2016, that provides data on clinker production in Egypt and the associated thermal needs, with projections to the future. They are summarized in the following table.

Table 70 Local Clinker Production (IFC, 2016)

	Unit	**2015**	**2020**	**2025**
Clinker Production	*million tons*	48.70	62.10	72.00
Thermal Consumption	*million gcal*	46.00	58.70	68.00
Thermal Consumption	*gcal/ton*	0.94	0.95	0.94

The associated thermal consumption can be used to estimate the amount of pellets required. Assuming that a ton of pellets provides 5 gcal (i.e. 5 kcal per kg) and is sold at EGP 600 per ton, the above thermal consumption forecasts can be translated to tonnage and market value. The following table summarizes the calculations.

Table 71 Thermal Consumption Needs in Pellet Equivalent (IFC, 2016)

	Unit	2015	2020	2025
Equivalent in Pellets	*million tons*	9.20	11.74	13.60
Equivalent in Pellets	*millions EGP*	5,520.00	7,044.00	8,160.00
Equivalent in Pellets	*millions USD*	306.67	391.33	453.33

The numbers above provide a measure of thermal demands of the cement industry on a national scale. Estimating thermal demands on a more local scale, the two major cement plants in Qena governorate were selected; Misr Qena and El Nahda plants. Redoing the same calculations above, and assuming no future increase in current capacities, the thermal needs of these two local plants are summarized below.

Table 72 Thermal Consumption Needs in Pellet Equivalent for Local Plants

	Unit	Current
Misr Qena	*million tons*	1.40
El Nahda	*million tons*	1.71
Total Production Capacity	*million tons*	3.11
Thermal Consumption	*million gcal*	2.94
Equivalent in Pellets	*million tons*	0.59
Equivalent in Pellets	*millions EGP*	352.51
Equivalent in Pellets	*millions USD*	19.58

From an export perspective, Egypt currently does poorly. In 2016, Egypt exported 611 tons of “wood pellets” according to Trade Map, which are worth USD 92,000 only, to two countries; Italy and Cyprus. Looking at the top importing countries in Europe alone, the market potential is huge. The following table shows the top European countries that import “wood pellets”, the category which includes wood pellets burnt for fuel. The data available does not distinguish fuel pellets separately.

Table 73 Top Importing European Markets of Wood Pellets

		Value imported in 2016 (USD thousand)	Quantity imported in 2016	Quantity Unit	Unit value (USD/unit)
1	United Kingdom	1,237,511	7,086,469	*tons*	175
2	Italy	317,709	1,663,820	*tons*	191
3	Denmark	298,185	2,053,682	*tons*	145
4	Belgium	155,205	906,477	*tons*	171
5	Germany	70,563	422,808	*tons*	167
	Total Imported		**12.13**	***million tons***	**170 (avg./ton)**
	Thermal Equivalent		**60.67**	***million gcal***	
	Total Value		**1,819.99**	***million USD***	

This opportunity requires a portion of the production to be directed towards export due to better selling prices and therefore make the investment attractive. Thermal energy demand by European industry as shown above is high and is expected to keep growing. Furthermore, European industry is already sold on the idea of biomass pellets as an alternative fuel and is equipped to take advantage of it technologically.

7.2.3 Target Market Size

Assuming 20% of the European wood pellet market is used as alternative fuel, and assuming that only the local cement industry accounts for total potential local demand for biomass fuel pellets, the overall market size can be determined. The target market share is only 5% of the export potential and 10% of local consumption, as constrained by the capacities of this plant. The attractiveness of this opportunity is there is ample demand both locally and abroad, and this can be captured with subsequent investments in capacity.

Table 74 Target Market Size for Pellets

	5-yr trailing average 2012-2016 (USD thousands)		
	Pellets	Target %	Target Value
Export to European Industry	363,998	5%	18,200
Local Cement Industry	306,667	10%	30,667
	USD 670,664		USD 48,867

Expected Selling Prices: As stated before, the selling prices will differ from local and export, and because of this discrepancy it is vital to export a portion to make the opportunity feasible. Local selling prices are expected to be around EGP 600 per ton, while export prices can go higher than USD 170 per ton. This study assumed the local to export ration at 1:1 (50% each), selling locally at EGP 600 per ton at current market rates, and exporting at USD 150 (EGP 2,700). This brings the average price sold to EGP 1,650 per ton.

7.2.4 Estimated Annual Sales and Forecasts

The plant, described in more detail under Project Engineering, is assumed to start operating at 50% capacity in Year 1 and reach around 91% by Year 10 as part of the conservative assumptions typical resorted to in the present document. Revenue growth forecasts to account for in price inflation and better capacity utilization in subsequent years are assumed, with an aggressive marketing push in the first 5 years, as shown in Annex I.

This translates to estimated production and annual sales for Year 1 as follows:

- 33,750 tons of biomass fuel pellets, bringing in EGP 55.7m in revenue.

The following graph shows a comparison of the target market and expected revenues in the first five years.

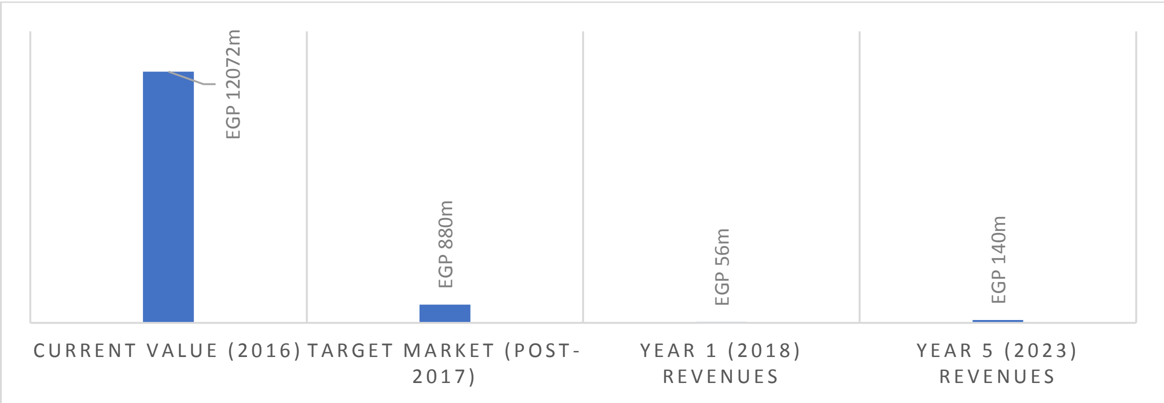


Figure 22 Comparison between Target Market Size and Year 1-5 Revenues for Biomass Fuel Pellets Production Line

7.2.5 Estimated Marketing Costs

Marketing the product on the global stage will require a considerable budget and it is assumed that the marketing budget will account for around 7.5% of sales targets stated above. These sales targets after all are highly contingent on aggressive marketing before operations. This brings the total marketing budget for Year 1 to EGP 4.18m.

7.3 Direct Inputs Required

This section describes the main raw materials required for the process, including other inputs such as additives, etc., as well as the expected costs, their availability (including seasonality when referring to crops) and any risks expected in securing each input and how to mitigate it. It also shows the utilities required, specific consumption benchmarks used, as well as direct labor requirements and any other direct inputs.

7.3.1 Material Required

This opportunity relies on sugarcane residue and corn stalk as a primary raw material. Other types of agricultural waste can be put in the mix, and the production schedule is not expected to be affected by seasonality of the two crops. It is assumed that production will be consistent throughout the year by making up for seasonal gaps through storage and sourcing other kinds of agricultural waste such as wood cuttings and sawdust, palm tree fronds and banana tree leaves

The following table provides the figures for feddans cultivated and tons produced are according to figures provided by the CAPMAS Annual Bulletin for Statistical Crop Area and Plant Production for the years 2014-2015.

Table 75 Seasonality of Sugarcane and Corn in Luxor and Qena

Crop Name	**Luxor**		**Qena**		**Seasonality**											
	feddans	tons	feddans	tons	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Sugarcane	67,422	3,257,224	118,089	5,690,000	x	x	x	x	x							x
Corn	24,999	46,890	80,283	130,591									x	x		

Based on Ministry of Agriculture 2014 data, there is enough local supply in Southern Upper Egypt (which includes Luxor, Qena, Sohag, Aswan and Assiut), it is estimated that sugarcane fields in the region (Luxor, Qena, Sohag, Aswan) generate over 1 million tons of waste per year. Corn fields in the same area are estimated to generate a further 186 thousand tons of waste. Other sources include tree trimmings and wood cuttings/sawdust. This more than covers the material needs of the facility.

It is expected that a ton of mixed agricultural waste will cost an average of EGP 500 per ton.

7.3.2 Utilities

Assuming today's tariffs for electricity, natural gas and water, the following specific consumption rates were calculated for the main product. The main utilities are thermal for pressing, and water/wastewater for cooking/de-fibering, with medium electricity requirements[8].

Table 76 Specific Consumption and Expected Cost per ton for Year 1

	Specific Consumption		***Expected Bill***	
Utilities				
Electricity	30.00	kWh/ton	23.01	EGP/ton
Diesel	3.40	liter/ton	12.41	EGP/ton
Water	0	m3/ton	0.00	EGP/ton
Wastewater	0	m3/ton	0.00	EGP/ton

[8] The specific consumption rates were obtained from the European Commission's (EC) Best Available Techniques Reference Documents (BREFs) as well as the SCOoPE project, also funded by the EC, as well as from industry experts and practitioners.

The above tariffs are for the fiscal year 2017/2018 and are assumed to be tied to inflation projections over the consequent years.

7.3.3 Direct Labor

Manual labor will be required during the months of production and its estimated that a total of 30 workers will be required, working in groups of 15 for each of the two shifts per day. The following table shows how many workers will be required for production.

Table 77 Seasonal Labor Required for Biomass Fuel Pellets Production

Production – Seasonal	***No. of Workers***	***EGP per ton handled***
Workers per Season	10	10

7.3.4 Packaging

The final product is usually packaged in jumbo bags that carry around 500kg worth of pellets. They are widely available from local suppliers, and one bag is expected to cost around EGP 75. They must be ordered in bulk. Year 1 will require around 67,500 bags.

7.4 Project Engineering

This section describes the production process in detail, any specific technologies used, the estimated plant capacity, as well as the main components required along with an estimate for civil engineering works (factory infrastructure, etc.) and the total area required.

7.4.1 Description of Technology

The biomass fuel pellet production line consists of several key components which are usually are sourced separately. The highest qualities and capacities are found mainly in Europe and the US, but components can also be sourced from China at lower costs, albeit at lower capacities. The production line does not use any special patented technologies, it is rather a combination of industry standard mechanical processes such as shredding, drying and pelletizing. The quality of the final product is affected by removing impurities such as ash content, and the calorific value of the input itself.

7.4.2 Estimated Plant Capacity

The plant capacity is estimated to receive a maximum of 300 tons of agriwaste per day, which is expected to yield around 225 tons of biomass fuel pellets. The losses mainly are due to loss of moisture content at the drying stage.

The following table summarizes the conversion ratios used in the study.

Table 78 Conversion Ratio for Biomass Fuel Pellets

Feedstock	**Max. Output (tons/day)**	**Losses Expected**	**Input (tons/day)**	**Conversion Ratio**	**Final Input (tons/day)**	**Yield**
Mixed Agriwaste	225	25%	225	4:3	300	75%

7.4.3 Process Flow

The process is illustrated in the following figure.

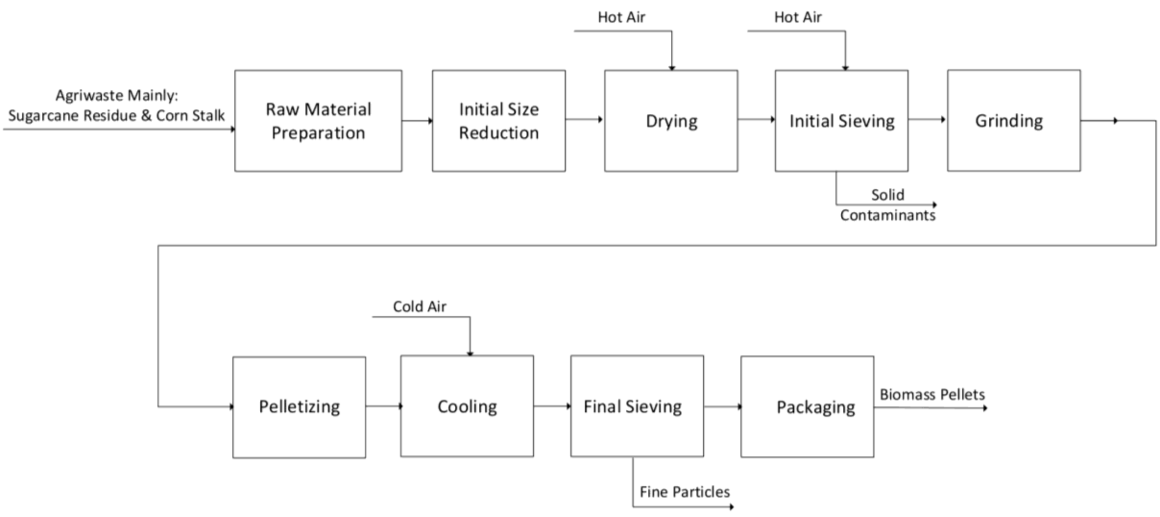


Figure 23 Process Flow Diagram of Biomass Fuel Pellets Production

The process steps illustrated are described in detail in the following table.

Table 79 Step-by-Step Details of Biomass Fuel Pellets Production Process

#	Name	Description
Step 1	Raw Material Preparation	Sugarcane bagasse and mixed agriwaste such as corn stalk, sawdust, etc. is received and prepared to undergo initial size reduction.
Step 2	Initial Size Reduction	The raw materials must undergo initial size reduction. This is normally done in a crusher or shredder which cuts up the material into pieces with a diameter that does not exceed 40mm.
Step 3	Drying	After initial size reduction, the chips are fed into a rotary drum dryer, which is the most cost-effective method of drying this kind of material. Drying is necessary to produce high quality pellets. Moisture content of the mixed material should range between 8-12%.
Step 4	Initial sieving	After the drying process, the raw material will be sieved to separate the contaminants such as stone and metal particles away from the wood raw materials. These contaminants may cause the mechanical failure of the pellet mills, so if the raw materials of the pellet plant have the potential to be contaminated by these solid particles, it is necessary for to sieve the raw materials before feeding them into the pellet mill. The machines for the initial sieving process is normally a de-stoner or magnetic separator
Step 5	Grinding	Grinding is also a size reduction step to make wood pellet. During the grinding process, the raw materials are fed into a hammer mill which will grind the raw materials into smaller pieces with a diameter under 5mm. Note: the hammer mill can only process raw materials with a diameter no more than 50mm, therefore, necessitating the initial size reduction step in the crusher/shredder.
Step 6	Pelletizing	After the grinding process, the material now should have the size and moisture requirements for pellet manufacture. The material is fed into a pellet mill. Generally, there are two kinds of pellet mills, ring die pellet mill for large capacities and flat die pellet mill for lower capacities.
Step 7	Cooling	After the pelletizing process, the pellet is vulnerable to deformation, as it remains warm from the constant pressing inside the pellet mill. To make the pellet regain its proper rigidity and temperature, it must be fed into a pellet cooler right after the pelletizing process. The types of pellet cooler can be divided into three types, the horizontal cooler, the vertical cooler and the counter flow cooler, the latter of which is recommended.

Step 8	Final sieving	Final sieving is different from initial sieving and is designed to remove fine particles from the final product. This is normally done using a vibrating screen or a trommel screen.
Step 9	Packaging	The pellets are finally packaged into jumbo bags, each carrying around 500kg of pellets, ready for shipping to the client.

7.4.4 Main Components and Equipment

The following is a list of the main components of the production line:

- Crusher/Shredder
- Hammer Mill
- Pelletizer
- Rotary or Drum Dryer
- Silos
- Truck Scale
- Counter flow cooler
- Trommel screen

Components are sourced separately, some local, some imported from different countries. The table below shows the expected prices of the main components.

Table 80 Price Estimate for Biomass Fuel Pellet Production Line

Component	**Price**
Crusher/Shredder (German/Italian/Belgian)	USD 300,000 (EGP 5.4m)
Raw Mill (American)	USD 390,000 (EGP 7m)
Pelletizer (Chinese)	USD 400,000 (EGP 7.2m)
Drum Dryers (European, refurbished)	EUR 500,000 (EGP 10m)
3xSilos (Local)	EGP 500,000
Truck Scale (Local)	EGP 250,000
Trommel Screen (Local)	EGP 1.5m
Total	**EGP 31,870,000**

The estimated useful life of this production line, assuming proper maintenance and care, can go up to 15 years.

7.4.5 Civil Engineering Works

In addition to the production line, there are key components of the factory's infrastructure that need to be considered, such as:

- Boiler system for heating oil
- Electrical Generator
- Air compression system
- Cooling system
- Piping etc.

Total infrastructure costs are estimated to be around EGP 2m for a facility of this size.

7.4.6 Area Required

The area required for this production line is estimated to be around 1,000 m^2. The land is assumed to cost around EGP 3,000 per m^2, which amounts to EGP 3m for land acquisition.

Building structure and office space is estimated to cost an additional EGP 1.2m.

Important Note: Land is expected to be given for free in the Boghdadi industrial zone (IDA jurisdiction) by Luxor governorate. However, it is sold against a fee in New Tiba (NUCA jurisdiction). To be conservative, land was assumed to be bought against a fee.

7.5 Selling, General and Administrative Expenses (SG&A)

This section provides details on the selling, general and administrative expenses associated with the facility, otherwise known as overhead costs.

7.5.1 Salaries and Wages

This opportunity is expected to employ around 28 permanent staff plus an additional 10 seasonal workers. They are summarized below:

Table 81 List of Staff and Monthly Salaries for Biomass Fuel Pellets Production Line

Position	*Staff*	*Monthly*
Management		
CEO	1	15.000
…		
Production - Permanent		
Plant Manager	1	10.000
Quality Control	2	6.000
Hall Supervisors	2	6.000
Engineering	2	5.000
Workers	4	3.000
…		
Sales, General and Administration		
Procurement	2	5.000
Sales Manager	1	8.000
Sales	2	5.000
Marketing	2	5.000
Finance & Accounting	2	5.000
HR Manager	1	10.000
Maintenance	4	3.000
Security	2	2.000
…		
Total	**28**	**staff**

Salaries for permanent staff amount to EGP 145,000 per month in Year 1, which is EGP 1.74m total for the year. That is only 1% of total revenue for Year 1.

Wages for seasonal workers amount to EGP 450,000 for each production season. This assumes 10 workers per season, getting paid between EGP 50 per ton of feedstock handled.

7.5.2 Factory

Factory overheads that fall outside human resource expenses and production costs are expected to be at a minimum. Maintenance and storage costs are estimated to be around EGP 10,000 and EGP 15,000 per month respectively.

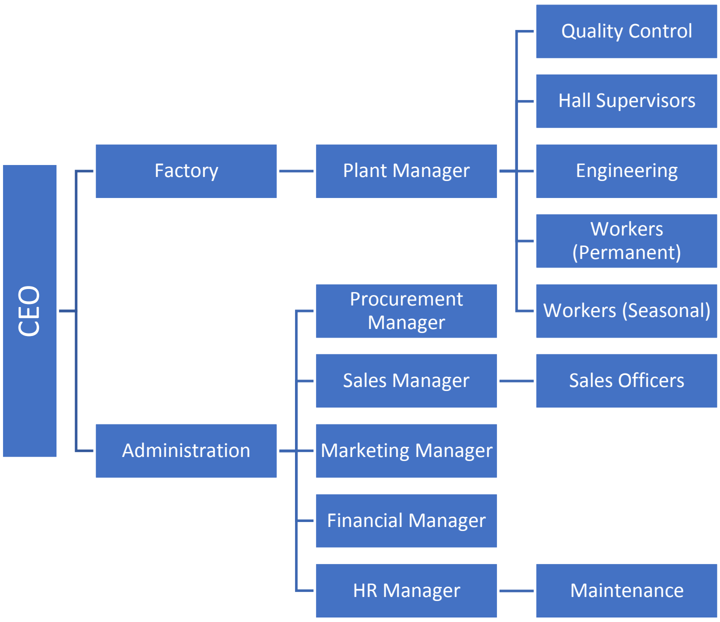
7.5.3 Other Selling, General and Administrative

The main line item in this category is the marketing budget, which is determined as 7.5% of expected sales. This amounts to EGP 4.18m for Year 1.

Utilities associated with administrative office space are expected to be around EGP 4,000 per month.

7.6 Organizational Structure

7.6.1 Organizational Chart



7.7 Financial Analysis and Investment

This section provides details of revenues, cost of goods sold (variable costs), margin analysis by product, selling, general and administrative (SG&A) expenses (aka overheads), fixed assets (initial capital expenditures) for the first year. The total initial investment is provided, and a 10-year projection of the income statements and statements of cash flow are calculated. Finally, the results of the feasibility and sensitivity analyses are provided as a summary of the key findings of the financial model.

7.7.1 Revenues

The estimated revenues for Year 1 are summarized below:

Product	Months of Production	Tons Produced	Selling Price	Revenue (000s)
Pellets (Local)	All Year	16,875 tons	EGP 600 per ton	EGP 10,125
Pellets (Export)		16,875 tons	USD 150 per ton	USD 2,531
Total		**33,750 tons**	**EGP 1,650[9] (avg.)**	**EGP 55,688**

[9] The average selling price was calculated based on the assumption that 50% of production would be directed to local energy-intensive industries, while the other 50% for export. USDEGP rate used is 18.

7.7.2 Cost of Goods Sold

The estimated total COGS for Year 1 are summarized below:

Inputs	**Quantity**	**Units**
Mixed Agriwaste		
Tons bought	45,000	*tons*
Cost per ton	0.500	*EGP 000s/ton*
Cost per year	**22,500**	*EGP 000s*
Seasonal Labor		
Workers	**450**	*EGP*
Packaging – Jumbo Bags		
Cost per bag of 500kg	0.750	*EGP 000s/ton*
Number of bags needed	**67,500**	*bags*
Cost per year	**5,063**	*EGP 000s*
Utilities		
Electricity	777	*EGP 000s*
Gas	419	*EGP 000s*
Water	-	*EGP 000s*
Wastewater	-	*EGP 000s*
Total Utilities	**1,195**	*EGP 000s*
Total COGS	**29,208**	*EGP 000s*

7.7.3 Gross Margin Analysis by Product

Looking at each product's line items separately, gross margin can be calculated to show how profitable each product is and how much it contributes in covering overheads, ultimately increasing bottom line figures.

	Biomass Fuel Pellets
	EGP 000s
Revenues	**55,688**
Raw Material	22,500
Seasonal Labor	450
Packaging	5,063
Electricity	777
Gas	419
Water	-
Wastewater	-
Total COGS	**29,208**
Gross Margin	**47.6%**
(-) Overheads	11.2%
Operating Margin	**36.3%**

7.7.4 Selling, General and Administrative Expenses

SG&A for Year 1 is summarized below:

Human Resources	*EGP 000s*
Total Permanent Staff Salaries	1,740
Overheads	
Factory	
Maintenance	120
Storage	180
General & Administrative	-
Marketing (7.5% of Sales)	4,177
Utilities	48
Total Overheads	**4,525**
Total SG&A	**6,265**

7.7.5 Fixed Assets

The following table summarized the fixed assets (aka Property, Plant and Equipment) required for operation of the facility, along with the associated yearly depreciation expense.

Fixed Assets	**Cost**	**Dep. Life**	**Yearly Dep. Exp.**
	EGP 000s		*EGP 000s*
Production Line	31,870	10 years	3,187
Infrastructure	2,000	15 years	133
Building	1,000	30 years	33
Office	200	10 years	20
Land	3,000	0 years	N/A
Total CAPEX	**38,070**		**3,374**

7.7.6 Minimum Investment Required

The minimum investment required will be the total fixed asset purchases required for operation plus 3-months' worth of working capital.

	EGP 000s
Initial Capital Expenditures on Fixed Assets	38,070
Working Capital for 3 months	8,868
Total Investment Required	**46,938**

7.7.7 Projected Income Statements

The following is the projected income statements for the first 10 years of operation:

Table 82 Projected Income Statements for Biomass Fuel Pellets Production Line

Income Statement	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Sales	55,688	77,963	101,351	121,622	139,865	149,655	160,131	171,340	183,334	196,168
COGS	(29,208)	(40,891)	(53,158)	(63,790)	(73,359)	(78,494)	(83,988)	(89,867)	(96,158)	(102,889)
Gross Profit	**26,480**	**37,071**	**48,193**	**57,831**	**66,506**	**71,162**	**76,143**	**81,473**	**87,176**	**93,278**
SG&A	(6,265)	(8,770)	(11,402)	(13,682)	(15,734)	(16,835)	(18,014)	(19,275)	(20,624)	(22,068)
EBITDA	**20,215**	**28,301**	**36,791**	**44,150**	**50,772**	**54,326**	**58,129**	**62,198**	**66,552**	**71,210**
Depreciation	(3,374)	(3,374)	(3,374)	(3,374)	(3,374)	(3,374)	(3,374)	(3,374)	(3,374)	(3,374)
EBIT	**16,841**	**24,927**	**33,418**	**40,776**	**47,398**	**50,952**	**54,755**	**58,824**	**63,178**	**67,837**
Interest Expense	(5,571)	(5,036)	(4,398)	(3,638)	(2,731)	(1,649)	(359)	-	-	-
Earnings before Tax	**11,271**	**19,892**	**29,020**	**37,138**	**44,668**	**49,303**	**54,396**	**58,824**	**63,178**	**67,837**
Loss Carry Forward	*11,271*	*31,162*	*60,182*	*97,320*	*141,988*	*180,020*	*214,524*	*244,329*	*270,369*	*293,538*
Taxes	(2,536)	(4,476)	(6,529)	(8,356)	(10,050)	(11,093)	(12,239)	(13,235)	(14,215)	(15,263)
Net Income	**8,735**	**15,416**	**22,490**	**28,782**	**34,617**	**38,210**	**42,157**	**45,589**	**48,963**	**52,573**
%Growth		*76%*	*46%*	*28%*	*20%*	*10%*	*10%*	*8%*	*7%*	*7%*
%NetMargin	*16%*	*20%*	*22%*	*24%*	*25%*	*26%*	*26%*	*27%*	*27%*	*27%*

7.7.8 Projected Cash Flow Statements

The following is the projected cash flow statements for the first 10 years of operation:

Table 83 Projected Cash Flow Statement for Biomass Fuel Pellets Production Line

Cash Flow Statement	1	2	3	4	5	6	7	8	9	10
Net Income	8,735	15,416	22,490	28,782	34,617	38,210	42,157	45,589	48,963	52,573
(+) Depreciation	3,374	3,374	3,374	3,374	3,374	3,374	3,374	3,374	3,374	3,374
(+) Changes in Working Capital	(10,995)	(4,398)	(4,618)	(4,002)	(3,602)	(1,933)	(2,068)	(2,213)	(2,368)	(2,534)
Operating Cash Flow	**1,114**	**14,392**	**21,246**	**28,154**	**34,389**	**39,651**	**43,462**	**46,749**	**49,969**	**53,413**
(-) Capital Expenditures	(38,070)	-	-	-	-	-	-	-	-	-
Investing Cash Flow	**(38,070)**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
(+) Direct Equity	14,081									
(+) Debt Financing	32,857									
(-) Dividends	(2,620)	(4,625)	(6,747)	(8,635)	(10,385)	(11,463)	(12,647)	(13,677)	(14,689)	(15,772)
(-) Loan Principal	(2,778)	(3,313)	(3,950)	(4,711)	(5,618)	(6,699)	(7,989)	-	-	-
Financing Cash Flow	**41,540**	**(7,937)**	**(10,697)**	**(13,345)**	**(16,003)**	**(18,162)**	**(20,636)**	**(13,677)**	**(14,689)**	**(15,772)**
Cash Balance										
Begin of Period	-	4,584	11,038	21,587	36,396	54,782	76,270	99,097	132,169	167,449
Net Change	4,584	6,454	10,549	14,808	18,386	21,489	22,826	33,073	35,280	37,641
End of Period	**4,584**	**11,038**	**21,587**	**36,396**	**54,782**	**76,270**	**99,097**	**132,169**	**167,449**	**205,091**

7.7.9 Feasibility Analysis

The following table summarizes the key findings from the feasibility analysis:

Key Metric (based on 10-yr projections)	**Result (EGP 000s)**
Capital Expenditures Required	EGP 38,070
Working Capital Required for first 3 months	EGP 8,868
Minimum Investment Required	EGP 46,938
Direct Investment (Equity)	EGP 14,081
Debt Financing	EGP 32,857
Enterprise Value	EGP 157,075
Internal Rate of Return	39%
Simple Payback	3.1 years
Discounted Payback	5.4 years
Profitability Index	3.35

7.7.10 Sensitivity Analysis

The feasibility of this opportunity will be most sensitive to fluctuations in agriwaste prices. Holding all other relevant factors constant, a calculation was made to see how far up prices can go before operating margins reach 0%. The results were as follows:

Agriwaste can go up as high as EGP 949 per ton. This study assumes an average price of EGP 500 per ton as per current market prices, while holding selling prices at an average of EGP 1,650 (50% local, 50% export).

Also, since exporting part of production is vital to keeping this business sustainable with the way local prices are, another calculation was made is the least percentage of production that can be direct towards export before operating margins reach 0%. The results were as follows:

Export component can go down to 19% before wiping operating margins, assuming selling prices are held constant at EGP 600 per ton locally and USD 150 per ton globally. The 50-50% distribution is assumed to make the investment attractive (to keep IRR above 30%).

7.8 Impact

Economic - Value added to local agricultural waste is quite significant. Based on this study's assumptions, before deducting other COGS and overheads:

> 1 ton of agriwaste, costing EGP 500, produces around 0.75 tons of biomass pellets, selling at an average price of EGP 1,600– that is 60% value added to the waste.

Social - Direct jobs created by this facility will include 28 permanent plant staff plus another 5-10 seasonal workers. Indirect jobs created will be mainly in logistics, marketing and distribution.

Environmental – This opportunity helps mitigate the open burning of agricultural waste and therefore reducing carbon emissions.

8 Key Considerations

8.1 Overview

This section highlights the main challenges that need to be taken into consideration when assessing these investment opportunities. Most of the risks and mitigation measures are cross-cutting as the main input are agricultural produce or their wastes, while in many occasions the final product is food.

Macroeconomic factors such as currency effects also affect all the investment opportunities, whether due to the importation of technology, or export of product. The macro-economic and financial assumptions used in this study are explained in more detail in Annex I.

There are regulatory factors as well, which are detailed in Annex II.

8.2 EGP Devaluation Effects

These opportunities take advantage of the abundant supplies of local crops such as tomatoes, mangoes, grapes, bananas, sugarcane and dates to produce in-demand value-added products that are mainly geared towards export (with the exception of IO5). It is clear from the analysis that due to the effects of the EGP devaluation, exporting provides a more attractive business model due to the higher top-line numbers (revenues).

However, this fact is somewhat negated in the case the technology is imported, as this has also increased in cost due to devaluation. This is especially clear in IO5 and IO6, which import already-expensive technology from the US and Europe, and presents a clear barrier to investment. While the minimum investment required is pushed high by this effect, it does not take away from the attractiveness of the investment.

For opportunities where the production line will be mostly manufactured locally, EGP devaluation has had a minimal effect on initial capital expenditure requirements. This combination of a sharp increase in export prices because of the EGP devaluation, as well as uptick in demand due to price competitiveness, with the relatively lower increase in local costs both in capital expenditure requirements and inputs (raw materials, labor, etc.) make these opportunities especially attractive.

8.3 Supply Chain Risks and Mitigation

A major challenge is the level of losses caused by inefficiencies in the production, process and transportation of fruits and vegetables in general in Egypt, and more so in the production of tomatoes. On average, approximately 25-30% of all crops are lost because of poor post-harvest handling, which can exceed 60% in the case of tomatoes. This poses a supply chain risk for IO1, IO3 and IO4.

Furthermore, only 3% of that supply is currently directed to food processors. Farming tomatoes for industrial purposes remains very limited. To compound the problem further, tomato farmers in Upper Egypt are largely smallholders (5 feddans or less) which makes contract farming for industrial scale operations more complicated.

There is a genuine risk that farmers do not honor contracts post-harvest, especially due to infamous price fluctuations throughout the year. This issue is less risky for in other crops, but still needs mitigation through proper mapping of the suppliers in the feasibility study stage to identify those that can provide secure, consistent supplies and are willing to engage in contract farming.

8.4 Conversion Factors and Yields

Supply chain risks are amplified due to high conversion factors, or low yields of fresh produce relative to final product i.e. to produce just 1 kg of final product, a multiple of that weight is required as input. This makes these opportunities highly sensitive to supply chain shocks, whether in the form of price fluctuations or inconsistency in quantity and quality. In other words, the lower the yield (the higher the amount of kg input required for 1kg output) the more sensitive the business is to this risk.

As shown in the sensitivity analysis of each opportunity, the feasibility of the model is highly sensitive to the prices of the main inputs; agricultural produce or waste. This problem becomes obvious in crops like tomatoes. Due to their high-water content (92%), they have a low yield when it comes to producing paste (7:1), which poses a threat given the price volatility of tomatoes over the course of the year.

These risks can be mitigated by buying in bulk when prices are low and boost production in shorter periods to take advantage of the long shelf-lives these products have (apart from IO4, which packs fresh produce for export).

In addition, a leverage point for factories is that wholesale traders who compete for the same supply normally reject around 20% of what is harvested to avoid the risk of losses when selling to the consumer market. This places industrial facilities well as a market for fresh produce, as it may have a lower rejection rate on bulk orders. This is mainly because the quality standard required for industrial processing is expected to be lower than consumer markets for fresh produce, which means farmers will be more encouraged to sell to them alongside existing markets.

Moreover, it is expected that food processing facilities that are visible, due to proximity, to the local farmers can create a shift in agricultural practices that have previously led to oversupply, and inconsistent quality and prices, especially in the case of tomatoes. Having a clear, large, accessible source of demand for their produce alleviates the risks and uncertainties they normally deal with.

8.5 Marketing and Distribution

All the opportunities without exception require an aggressive marketing campaign to boost. This is the reason that a marketing budget of 7.5% of Year 1 revenues was set across the board. One of the issues that persistently came up during data collection and field visits is that marketing is key.

Effective marketing enables the potential of the investment opportunity to be fully captured, and there is a local culture does not place enough emphasis on its importance for business, especially in sectors like agribusiness. For opportunities like those selected in this study, entering competitive spaces both locally and internationally, marketing is essential in creating the necessary demand for these products.

9 Annex I – Financial Model and Key Assumptions

This section provides details as to how the financial models were built for each of the investment opportunities in this study, and the key assumptions used.

9.1 Methodology for Financial Model

This section provides an explanation of the methodology used.

9.1.1 Income Statement for Year 1

Year 1 estimations are first provided for the following:

- Revenues
  - Number of revenue streams
  - Production schedule
  - Quantities produced and sold
  - Expected selling prices
- Cost of Goods Sold (COGS)
  - Main inputs required and their amounts to produce 1 unit of output, taking into account yields
  - Cost structure of final product, including other inputs
  - Specific consumption to calculate utilities
- Selling, General and Administrative Expenses (SG&A)
  - Staff and expected salaries
  - Maintenance, storage and utilities
  - Marketing expenses

This is to determine the income statement for Year 1 from which to project onwards till Year 10 in the financial model, using the percentage of sales method. Assumptions were used to determine future growth and inflation rates, which were used to project future sales and operating capacity. These assumptions were as follows:

Table 84 Growth and Inflation Rate Assumptions

	Year 1	*Year 2*	*Year 3*	*Year 4*	*Year 5*	*Year 6-10*	*Onwards*
Growth Rate	-	40.0%	30.0%	20.0%	15.0%	7.0%	3%
Expected Inflation	-	14.0%	10.0%	8.0%	7.5%	7.0%	3%

9.1.2 Plant Utilization

Another important assumption made is plant utilization i.e. what is actual operating capacity in Year 1 and how that scales going forward. This affects production and resulting revenues. For simplicity a general assumption was made for all opportunities; that the plant will begin to operate at 50% of that capacity initially for two main reasons:

- To reduce working capital requirements, specifically how much raw material is required, and in turn reduced total initial investment. Due to yield factors stated in 8.4, the raw material requirements account for a huge portion of operating expenses.
- To give room for growth in sales in consequent years without the requirement for additional capital expenditures in the first 10 years projected.

The expected operating capacity across the 10-year projection period, as previously mentioned, is shown again below, taking into account the growth in revenue, with more effort to boost capacity utilization focused in the first 5 years of operation:

Table 85 Plant Utilization Assumptions

	Year 1	***Year 2***	***Year 3***	***Year 4***	***Year 5 & Onwards***
Expected Utilization	50.0%	63.0%	75.6%	84.7%	91.0%

Based on Year 1 income statement, gross margin, SG&A margin and a tax rate of 22.5% was used to project until Year 10. It was assumed that these margins hold all the way through. This is a more conservative approach as margins should increase going forward.

9.1.3 Working Capital Roll-Forward

Working capital roll-forward is conducted to determine changes in accounts receivable, inventory and accounts payable. These are balance sheet items, but it was decided that projected balance sheets were not needed for the purposes of this study. However, these items influence free cash flow as they determine the cash conversion cycle and therefore need to be calculated. The following shows the assumptions used to project accounts receivable, inventory, and accounts payable going forward, using the average number of days method. These assumptions were made based on data collected from industry experts and practitioners.

Table 86 Working Capital Roll-Forward Assumptions

Working Capital Roll-Forward	IO1	IO2	IO3	IO4	IO4	IO5	IO6
Days of Sale Outstanding (DSO)	60 days	60 days	60 days	60 days	60 days	60 days	60 days
Inventory Turnover	30 days	30 days	30 days	30 days	3 days	45 days	30 days
Days Payable Outstanding (DPO)	15 days	15 days	15 days	15 days	7 days	7 days	7 days

9.1.4 Fixed Assets and Investment in Capacity

Fixed Assets (initial capital expenditures) purchased are determined along with their respective depreciation schedules. Simple straight-line depreciation was used. It was assumed that there are no other investments in capacity made during the 10-year projection period.

9.1.5 Initial Working Capital Requirements

Working capital requirements are determined as well to calculate the total initial investment required. It was assumed that a minimum of three months working capital be covered in the initial investment across the board for simplicity reasons.

9.1.6 Capital Structure and Financing

Suggested capital structure (Debt to Equity ratio) and means of financing are summarized and reflected in the cash flow statement. The initial investment will be financed through debt and equity. The debt portion is expected to account for 70%. The loan is assumed to be 7 years long, with quarterly payments, at an annual interest rate of 18%. The following table shows the debt schedule for each year. The other 30% will be financed through equity, with the promise of a 30% payout ratio.

Financing	
Debt-to-Equity Ratio	70%
Dividend Payout Ratio	30%
Loan Duration	7 years

Payment Frequency	Quarterly
Annual Interest Rate	18%

9.1.7 Cash Flow Statements

After calculating working capital requirements, investing cash flow to purchase fixed assets, and financing cash flows (which include debt service payments, dividend payments in addition to the cash received through debt and equity), the cash flow statements can be calculated.

9.1.8 Free Cash Flow and Feasibility Metrics Used

Free cash flow to firm is calculated (FCFF) based on the 10-year income and cash flow statement projections. The following feasibility metrics are calculated:

- Enterprise Value
- Internal Rate of Return – using the perpetuity method.
- Simple Payback Period
- Discounted Payback Period
- Profitability Index

To calculate the above metrics, the following discount rates and terminal growth (g) rate were used:

Valuation	
Cost of Equity	23%
Weighted Average Cost of Capital	20%
Terminal Growth Rate into Perpetuity	3.0%

9.1.9 Foreign Exchange Rates

In most of the opportunities, there are items quoted in USD or EUR terms, whether related to selling prices of products on export markets or for technology imported from abroad. The rates assumed were deliberately higher than current levels to provide a more conservative analysis, given the volatile nature of the EGP following its flotation, which coincided with the preparation of this report.

The rates used were as follows:

- USDEGP at 18.
- EUREGP at 20.

10 Annex II – Regulatory Requirements

10.1 For Food Processing Industries

Food processing industry (FPI) falls within the intersecting sectors of industry and agriculture. The regulatory requirements for the overlapping sectors of the business corresponds to permits from various stakeholders. The regulations explained here affect Investment Opportunities 1-4.

In brief, the various sets of regulatory requirements include that of registering the company, securing a plot at the Industrial Zone to establish the production facility, negotiating a deal and obtaining permits from the governorate directorate for waste collection, issuing the operational license of the facility, and complying with the EOS – Egyptian Organization for Standardization and Quality Control – standards after production on a regular basis.

Moreover, the FPI sector is more challenging – especially for exports – for the certificates required to obtain and the necessity to comply with international standards. The two main lines of standards enforced by the World Trade Organization concerning FPI industries are the SPS and TBT measures (Ali Abdallah et. al, 2015). The SPS stands for the sanitary and phytosanitary measures while the TBT measures refer to the technical regulations and procedures for assessment of conformity with technical regulations and standards – excluding those covered by the SPS agreement.

Imbedded within these two global agreements are the Codex Alimentarius Commission (CAC) guidelines which include the specific guidelines for the FPI standards for export and trade. The Egyptian Organization for Standardization and Quality Control (EOS) adopts the Codex guidelines to monitor the compliance of FPIs with food safety regulations and standards. It is under the Ministry of Industry and Foreign Trade. Other than safety regulations, there are specific standards for packaging and labelling in which the FPIs should follow.

In Egypt, the Egyptian Accreditation Council under the Ministry of Trade and Industry is responsible for accrediting the inspection bodies and testing laboratories that facilitate the process of accreditation for FPI industries (IMC, 2005). Most of the 115 labs are public.

The National Food Safety Authority (NFSA) was created in January 2017 as a single regulator, which replaces around 17 agencies units. Its main power and functions include handling everything related to food safety, inspections of imports and exports, licensing, certifications, regulations of genetically modified foods, and setting/enforcing penalties for violations.

Major Laws or Decrees Impacting Food Exports and Imports (GAIN Report, 2015):

- Ministerial Decree 770/2005 Concerning the Executive Regulation to Implement Import and Export Law no.118/1975 as well as Inspection and Control Procedures of Imported and Exported Goods
- Prime Ministerial Decree 1186/2003 Inspection and Control Measures of Exports and Imports
- Law 82/2002 The Protection of Intellectual Property Rights
- Law 121/1982 The Registration of Importers
- Presidential Decree 106/2000 Facilitating Inspection and Control Procedures of Exported and Imported Goods
- Law 118/1975 Import and Export

FPI industries are also required to register with the Export Council for Food Processing Industries, and obtain the following ISO certifications specifically for export:

- ISO 22000
- ISO 9002

Complying with requirements of food safety is a challenge within a largely informal food-processing-industry in Egypt. However, a regular operating license is sufficient to sell products on the local market.

10.2 For Waste Management

Investment Opportunities 5 and 6 involve the management of agricultural waste and the manufacturing of useful products from material otherwise deemed as waste.

The regulatory requirements for the overlapping sectors of the business corresponds to permits from various stakeholders. In a nutshell, the various sets of regulatory requirements include that of registering the company, securing a plot at the Industrial Zone to establish the production facility, negotiating a deal and obtaining permits from the Governorate Directorate for waste collection, issuing the operational license of the facility, and complying with the EOS – Egyptian Organization for Standardization and Quality Control – standards after production on a regular basis.

The following presents some of the Waste and Alternative Fuel Related Laws and Regulations in Egypt (IFC, 2016). The most important of which is Law number 4/1994 and its amendments by law number 9/2009 and its executive regulations: This law is concerned with regulating all issues related to the protection of the environment. It also encourages the recycling and reuse of waste along the different value chains. Article 37 of law 4/1994 and article 38 of its executive regulations considers the use of waste as an Alternative Fuel a part of the legally approved recycling processes.

- Approval of the location for waste storage or treatment facilities by EEAA.
- Requirement that all facilities involved in waste recycling and treatment conduct an Environmental Impact study
- Requirements for the operation of waste management facilities
- Operational permit from the governorate
- Waste transportation contractors
- Environmental register
- Approval system for waste collection
- Environmental register for handling any hazardous waste

11 References

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