Economic Analyses of Peanut Processing in Africa

Michiel Arnoldus
Kees-Jan van Til
Marius d’Hond
Barry Clausen

February 2016
Market overview
Common peanut products

In-shell peanuts

Shelled

Snacks

Peanut Butter

Crude oil

Refined oil

Shells
Animal food, soil mulch, biomass, absorbent

Press cake
Animal food

Bird seeds and peanut meal are two other end-products but the size of their respective markets is negligible.
Africa is a medium sized peanut producer

- Global in-shell peanut production in 2013 amounted to 45.8 million tons.
- African countries accounted for 26%.

- Global peanut oil production in 2013 amounted to 5.2 million tons.
- African countries accounted for 22%.

- The majority of peanut and peanut oil production is consumed domestically.
But Africa’s role in Peanut trade is negligible

2013 Metric Tons shelled peanuts | Data: FAOSTAT
Only Senegal exports peanut oil

2013 Metric Tons shelled peanuts | Data: FAOSTAT
Market overview: Snack Peanut Importers

Snack companies import peanuts to further process into a value-added product.

Where: Europe, USA, Russia, China, South Africa, South-East Asia

Product: Large kernels, minimum aflatoxin, blanched & unblanched, Virginia, Runners and Spanish cultivars. Round kernels for coated

Peanut - Exporters: Argentina, Brazil, USA, China, India

– Most peanuts consumed in Europe and Russia are imported from Latin America and the USA
– India supplies only to Eastern Europe because of their less strict aflatoxin controls & other quality issues.
– China and India are large suppliers to the South East Asian market
– Argentina is a small producer but the largest exporter

<table>
<thead>
<tr>
<th>Shelled peanuts (kernels)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Global production volume (Tons)</td>
<td>13,900,000</td>
</tr>
<tr>
<td>International trade volume (Tons)</td>
<td>1,400,000</td>
</tr>
<tr>
<td>Price range (US$/Ton CIF)</td>
<td>1,000–1,400</td>
</tr>
<tr>
<td>Current price (US$/Ton CIF)</td>
<td>1,800</td>
</tr>
</tbody>
</table>
Snack-peanuts price development

Peanuts for snacks prices, US$/Ton CIF Rotterdam

- 2011: Drought in the USA drove prices up
- 2009: Bumper crop reduced prices
- 2012: Subsequent oversupply brought them far down.
- 2013: A production shortfall in China and Argentina rose prices
- Current sales price: 1800 US$ / Ton

• 1800 US$ / Ton appears to be a reasonable minimum price to expect for snack-peanuts
Issues & Opportunities for Africa in Export Snack Peanuts

**Issues:**
- Africa is absent in the world market as an exporter due to aflatoxin. But, African countries do trade with each other.
- Difficulties in doing business (slow response time, not respecting contracts)
- Pesticide residues and aflatoxin contamination

**Opportunities:**
- If aflatoxin levels can be managed, nothing stands in the way of Africa becoming a big exporter of peanuts.
- Global consumption of snacks is increasing and so is health consciousness. Nuts are seen as a healthier snack choice, hence it is a growing market
- Attractive export prices
- Flavour of African peanuts is appreciated
- Europe seeks to diversify its supply base from Latin America and China to reduce climate risk (El Nino)
- China is the biggest consumer and producer, and is becoming a net-importer
- Russia and Eastern Europe are a large market with less strict enforcement of aflatoxin limits
- South Africa may become a structural net importer as domestic producers switch to soybean. It can also form a springboard to Europe
Market overview: peanut butter peanuts for export

Peanut butter companies use domestic supply or import peanuts to further process to peanut butter to sell at home and in neighboring countries.

Where: USA, Europe, South Africa, India
- Consumption in Europe is rising
- Produced by large brands close to end-markets
- Consumption as a spread is very low in the rest of Africa. Peanut paste for sauce is more common

What: Any uniformly sized batch of unblanched peanuts or splits, with minimum aflatoxin levels.
- Producers require uniformly sized batches for even roasting
- Producers require the peanut skins because they are in part added to the butter

Suppliers: Argentina, USA, Brazil, China supply peanuts.

<table>
<thead>
<tr>
<th></th>
<th>Peanut butter</th>
<th>Peanuts for Peanut Butter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global production volume (Tons)</td>
<td>90,500</td>
<td></td>
</tr>
<tr>
<td>International trade volume (Tons)</td>
<td>1,400,00</td>
<td></td>
</tr>
<tr>
<td>Price range (US$/Ton CIF)</td>
<td>2,700-3,400</td>
<td>Slightly below snack peanuts</td>
</tr>
<tr>
<td>Current price (US$/Ton CIF)</td>
<td>3,340</td>
<td>1,100</td>
</tr>
</tbody>
</table>
Issues & Opportunities for Africa

Issues:
• Peanut butter is a highly differentiated end-product and is produced close to the end-market to meet specific local demand → limited scope to produce in Africa for export
• Peanut butter producers avoid African peanuts because of aflatoxin.
• The opportunity to reduce aflatoxin during processing is limited
• Can you compete with informal peanut paste producers in Africa? (Are consumers willing to pay a price premium for quality?)

Opportunities:
• Worldwide consumption and thus demand for peanut butter is increasing
• Peanut butter provides a good market for splits and small peanuts not suitable for the snack market
• Peanut butter as a sauce ingredient is a large market in Africa
Export of peanuts for oil producers

Where: Europe, China, USA, South-East Asia

– Aromatic & refined oil is widely used in Asian cuisine because of flavour and suitability for cooking at high heat
– European market is in decline due to concerns about peanut allergy
– By far the biggest market is China and SE-Asia who use imports to augment domestic production

Product: Unblanched peanuts of any size and type, including splits, broken high aflatoxin. Aflatoxin can be greatly reduced during processing.

In most countries only poor quality nuts are used for oil. Only China & India used most peanuts for oil.

Factories buy large quantities when prices are low

Suppliers: All peanut exporting countries also export their rejects to the oil market. 100% of Senegal’s peanut exports are oil peanuts

<table>
<thead>
<tr>
<th></th>
<th>Peanuts for oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global production volume (Tons)</td>
<td>14,000,000</td>
</tr>
<tr>
<td>International trade volume (Tons)</td>
<td>350,000</td>
</tr>
<tr>
<td>Price range (US$/Ton CIF)</td>
<td>750-900</td>
</tr>
<tr>
<td>Current price (US$/Ton CIF)</td>
<td>850</td>
</tr>
</tbody>
</table>
Issues & Opportunities for Africa

Issues

• Price for oil peanuts is too low to run a profitable business producing solely for this market year-in-year-out
• Strong fluctuations in demand are determined by the harvest and demand in China, the largest consumer & importer
• Low domestic demand because peanut oil is 2,5 times more expensive than alternatives such as palm & cotton seed and 1,5 -2 times sunflower oil

Opportunities:

• Outlet for peanuts unsuitable in quality for the international snack and peanut butter markets or domestic consumption, particularly with high aflatoxin levels
• Peanuts can be sold to existing local cotton / sunflower / soy bean oil mills who tend to operate under capacity and can use existing equipment to produce peanut oil.
Crude oil export

Where: China, South-East Asia, USA, Europe
- Mostly used as cooking oil for high temperature frying
- Most crude oil is refined in the importing country according to specific client requirements for domestic market or neighbouring countries

Product: Crude oil is raw material for refined oil; low in free fatty acids and aflatoxin. Good odour and flavour
- Peanuts can also be cold-pressed to oil. This type is required for the pharmaceutical and cosmetics industry.
  - Cold-pressed oil may is often also organic
  - This is a very small niche market
  - Aflatoxin cannot be managed if peanuts are cold-pressed

Key Exporters: Argentina and Brazil; Senegal
- These countries supply in equal amount to China and Europe
- China uses imports to augment domestic crude oil production
Price of crude oil is often lower than that of snack grade peanuts, even though you need a minimum of 2,38 tons of peanut kernels to produce 1 ton of oil.

- Evidently only cheaper peanuts are used
- Crude oil production seems to be subsidised in one way or the other in China

Sale of press cake is an important revenue stream which is needed to make oil pressing a profitable business.

Crude oil price is also influenced by prices of competing oils such as soy, canola, sunflower (in addition to supply and demand for oil and for peanuts).

The market is obscure and secretive: finding oil producers and traders is very difficult, finding people willing to talk even more.

<table>
<thead>
<tr>
<th></th>
<th>Crude oil</th>
<th>Press cake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global production volume (Tons)</td>
<td>5,200,000</td>
<td>7,800,00</td>
</tr>
<tr>
<td>International trade volume (Tons)</td>
<td>200,000</td>
<td>126,500</td>
</tr>
<tr>
<td>Price range (US$/Ton CIF)</td>
<td>1,250 – 1,850</td>
<td>300–450</td>
</tr>
<tr>
<td>Current price (US$/Ton CIF)</td>
<td>1,250</td>
<td>440</td>
</tr>
</tbody>
</table>
Peanut oil is very expensive compared to other food oils

Prices of cooking oils move together as they are substitutes

1250 US$/Ton is a reasonable price to expect for crude oil; prices do not structurally stay below this mark
The Chinese peanut oil mystery

- A maximum oil yield is 42%, in other words, 1 ton of oil requires at least 2.38 tons of peanut kernels.
- Chinese importers pay 850 US$ / Ton CIF for oil grade peanuts. This means their production cost are 2.38x$850= $2023 for peanuts alone.
- Yet 1 ton crude oil sells for around $1250 since 2014...
  - Other processing cost (labour, energy, solvents, depreciation) still need to be added
  - The sales seedcake gives some revenue, but not sufficient to cover the gap...

How is this possible?

- Chinese traders import cheap, low-quality high-aflatoxin peanuts.
- Aflatoxin import limits are not enforced if peanuts are destined for oil.
  - Moreover, many importing businesses are partly state-owned.
- Once in China, peanuts are sorted and graded and about 50% is sold as snack peanuts, while the rest is used for oil.

Conclusion:

- It is more profitable to export ‘oil grade’ peanuts to China then crude oil.
- Unless you sort out the best peanuts before making oil and sell those on the snack market yourself, which is what Senegalese factories are now doing.
**Issues & Opportunities for Africa in Crude oil**

**Issues**
- Crude oil prices are very low. Crude oil production is a high volume low margin business (gross margin<10%). The margin is in refining, not crude oil.
- Difficult to differentiate from competitors.
- Peanut oil will always be more expensive than substitutes such as palm, cotton and sunflower oil. This makes it difficult to sell in low income countries where there is no tradition of using peanut oil.
- Solvent extraction and modern equipment are necessary to get a yield that make the product/business competitive.
- Cold-pressed oil is not an option because the market is small and it does not allow for aflatoxin reduction.
- You cannot compete with Chinese oil producers unless you can sell part of your peanuts on the snackmarket and only use the rejects for oil
- Prices for refined oil in African markets are much higher then for crude oil. It is therefore much more profitable to sell refined oil

**Opportunities:**
- China will increasingly become a net-importer, which may drive up prices in the future.
- Africa has many oil pressing factories with spare capacity who could easily produce peanut oil for a domestic niche market or export.
- If you can sell part of your raw material supply as snack peanuts, you can make a profit as an oil factory
Refined oil

Where: Europe, China, USA, South-East Asia.

Product: Odourless and colourless oil, used for cooking. It is a very differentiated product.

Suppliers: Refining happens close to the end-market, in accordance with specific requirements of customers.

There is no international trade in refined oil except for between neighbouring countries.

<table>
<thead>
<tr>
<th>Refined oil</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Global production volume (Tons)</strong></td>
</tr>
<tr>
<td><strong>Almost all crude oil is subsequently refined</strong></td>
</tr>
<tr>
<td><strong>International trade volume (Tons)</strong></td>
</tr>
<tr>
<td>50,000</td>
</tr>
<tr>
<td><strong>Price range (US$/Ton CIF)</strong></td>
</tr>
<tr>
<td>1,700 – 2,000</td>
</tr>
<tr>
<td><strong>Current price (US$/Ton CIF)</strong></td>
</tr>
<tr>
<td>1,750</td>
</tr>
</tbody>
</table>

Margins on refining are high (30%) because it is sold as a differentiated end-product.
Issues & Opportunities for Africa

**Issues**

- Most oil is refined close to the end-market hence there is no market for exporting refined oil.
- Because peanut oil is expensive compared to its substitutes it is not popular in the domestic African market

**Opportunities:**

- Refined oil in general has a retail price that is at least 50% higher than crude oil. Therefore it makes more sense to sell refined oil than crude oil on a domestic market.
- Selling refined oil made from rejects/cheap peanuts on the domestic market may be profitable.
Local African snack Market

• There is a large market for roasted snack peanuts. In many countries it is the most widely consumed snack due to its flavour & affordability
• Peanut paste is commonly used as a sauce
• But is there really a sizable market for aflatoxin free and/or high quality peanuts/ peanut paste?
  – Do consumers see anything wrong with the peanuts/ peanut butter they currently buy? Are consumers looking for something better and willing & able to pay?
  – Have they even heard about aflatoxin, let alone do they understand what it is, perceive it as a problem and are prepared to pay for aflatoxin free peanuts?
• Are local consumers prepared to pay the same price as the EU/ China market?
• Can modern processors aimed at the export market really compete with informal producers in this segment?

Only proper consumer research can tell us the answers...and thus whether there is a local market opportunity
Conclusion

• The international snack market is large, profitable, growing and looking to diversify supply. If Africa can manage aflatoxin it can earn good money.
• International peanut butter producers are an interesting market for splits and smaller peanuts, but aflatoxin management is more difficult
• Proper consumer research is needed to determine if there is local market opportunity for Peanut paste & snack peanuts
• Crude-oil production for the international market is a high volume low margin business, but reaching high volumes in Africa is difficult while the risky business environment requires higher margins to absorb shocks
• Domestic and international oil producers are an important market for snack market rejects (size, shape, aflatoxin) → cost recovery
• For domestic consumption refined oil is more profitable and can be made by many domestic oil producers, but demand may be limited due to high prices compared to alternatives

Strategic options for further research:
Peanuts for snacks and peanut butter, peanuts for oil / crude oil & refined oil for cost recovery
Peanut processing

From the farm to your table
Processing overview

Snacks
- Blanching
- Dry roasting or oil frying
- Seasoning
- Packaging

Peanut butter
- Roasting
- Blanching
- Coring
- Grinding & blending
- Packaging

Crude Oil
- Grinding
- Add water
- Heating
- Pressing
- Solvent extraction
- Filtration
- Bleaching
- Deodorisation
- Neutralisation
- Packaging

Press cake: animal feed for ruminants

Shells are used for animal feed, biomass fuel and soil improvement

Testing
May occur at various steps
Processing overview

- Shells are used for animal feed, biomass fuel and soil improvement

**Snacks**
- Blanching
- Dry roasting or oil frying
- Seasoning
- Packaging

**Peanut butter**
- Roasting
- Blanching
- Coring
- Grinding & blending
- Grinding & blending
- Cooling
- Packaging

**Crude Oil**
- Grinding
- Add water
- Heating
- Pressing
- Solvent extraction
- Filtration
- Bleaching
- Deodorisation
- Neutralisation
- Packaging

**Refined Oil**

**Press cake**
animal feed for ruminants

Testing
May occur at various steps
Harvesting & Post Harvest: 3 Steps

In-field sun drying
Or: Machine drying at the processing plant

Cleaning by hand on farm or by trader or by machine in processing plant

Peanuts may be hand or mechanically shelled, on farm/trader or shelled mechanically at processor
Cleaning and de-stoning

Peanut cleaning machine
Removes dust, stalks etc. with vibrating screens

De-stoning machine
Uses air, vibration and gravity to remove heavy particles like stones.
Shelling

Peanuts are:
Hand-shelled on farm
Or
Shelled mechanically outside the processing plant

Critical process: poor quality shellers damage peanuts

Mechanical shellers require substantial maintenance and repair

Peanut Shelling Machine
Sorting & Grading

1. In a grader, peanuts are sorted for size using vibrating screens of set sizes.

2. An optical sorter detects discoloured, broken and deformed peanuts and ejects them using jets of air.

3. Hand sorting on conveyor belts removes remaining foreign matter and bad peanuts. Where labour is cheap complete hand sorting on belts is common. UV lights are used to light up aflatoxin-contaminated peanuts...

But this is not as reliable as optical sorting!
After sorting, peanuts are graded according to the end product.

- Coated peanuts (round kernels)
- Dry/Oil roasted peanuts (large, oval, whole)
- Peanut Butter Any size & splits, but sorted by size for even roasting
- Peanut Oil (rejects: broken, splits, high in aflatoxine, damaged, small)
Processing overview

Snacks
- Blanching
- Dry roasting or oil frying
- seasoning
- Packaging

Peanut butter
- Roasting
  - Blanching
  - Coring
  - Grinding & blending
  - Packaging

Crude Oil
- Grinding
  - Add water
  - Heating
  - Pressing
  - Solvent extraction
  - Filtration
  - Bleaching
  - Deodorisation
  - Neutralisation
  - Packaging

Shells are used for animal feed, biomass fuel and soil improvement

Testing May occur at various steps

Press cake: animal feed for ruminants
Testing

Peanuts are tested for:

• Aflatoxin
• Salmonella
• Moisture Content
• Agro-chemicals
• Heavy Metals

Aflatoxin can be tested for at various stages:

• Presence in the soil
• Post-harvest
  o Some farmers leave their aflatoxin-contaminated peanuts on the land, but most African farmers are likely to consume their contaminated peanuts
• Pre-storage
• Pre-shipping
• Arrival at the port
• Arrival at the factory/ start of production process
• Exit of factory
Shells are used for animal feed, biomass fuel and soil improvement.

Processing overview:

**Snacks**
- Blanching
- Dry roasting or oil frying
- Seasoning
- Packaging

**Peanut butter**
- Roasting
- Blanching
- Coring
- Grinding & blending
- Cooling
- Packaging

**Crude Oil**
- Grinding
- Add water
- Heating
- Pressing
- Solvent extraction
- Filtration
- Bleaching
- Deodorisation
- Neutralisation
- Packaging

Testing: May occur at various steps.

Press cake: animal feed for ruminants.
Roasting & drying

For snacks and peanut butter

Peanuts are roasted in a conveyor oven
Or
Dried to loosen skins before blanching & reduce moisture content

Roaster/Drier

Then they are air cooled to avoid over-cooking

Air Cooler
Blanching: removing the skin from the kernel

For snacks blanching is ideally done before export to reduce risk of aflatoxine.

But peanut butter manufacturers roast first and blanch afterwards..and sometimes add part of the skins back in for colour & fiber.

Blanching Machine

Blanched Peanuts
Oil fried peanuts

1. Peanuts are blanched
2. Fried in oil
3. Cooled
4. Sprayed with oil to adhere flavouring
5. Coated with salt and spice
6. Packaged
Dry roasted peanuts

1. Blanched peanuts are placed in a seasoning drum with salt and spices

2. Roasted in an oven with conveyor belt in batches of even size

3. Cooled

4. Packaged
In-shell snack peanuts

1. In-shell snack peanuts are placed in a pressure salt bath to force salt into the kernels
2. Dried and roasted in shell
3. Cooled
4. Optically or hand sorted for broken / openend shells/ pieces of shells and loose kernels
5. Packaged
Peanut butter

1. Peanuts are roasted to enhance flavour in batches of similar size for even roasting (splits are used but roasted separately).
2. The skins are either blanched or retained to add fibre.
3. Peanuts are split and the small bitter heart is removed.
4. Peanuts are ground into paste.
5. Salt, sugar (optional), hydrogenated fats & preservatives maybe added.
6. The butter is cooled before packaging.
Processing overview

- Shells are used for animal feed, biomass fuel and soil improvement

Snacks
- Blanching
- Dry roasting or oil frying
- Seasoning
- Packaging

Peanut butter
- Roasting
- Blanching
- Coring
- Grinding & blending
- Grinding & blending
- Cooling
- Packaging

Crude Oil
- Grining
- Add water
- Heating
- Pressing
- Solvent extraction
- Filtration
- Bleaching
- Deodorisation
- Neutralisation
- Packaging

Testing
- May occur at various steps

Processing overview

- Shells are used for animal feed, biomass fuel and soil improvement

Snacks
- Blanching
- Dry roasting or oil frying
- Seasoning
- Packaging

Peanut butter
- Roasting
- Blanching
- Coring
- Grinding & blending
- Cooling
- Packaging

Crude Oil
- Grining
- Add water
- Heating
- Pressing
- Solvent extraction
- Filtration
- Bleaching
- Deodorisation
- Neutralisation
- Packaging

Press cake: animal feed for ruminants
Types of Peanut oils

There are several types or grades of peanut oil:

- Crude or unrefined
- Aromatic
- Refined
- (Organic) cold pressed
Crude peanut oil

1. Peanuts are cleaned of foreign matter.
2. Roasting is only required to enhance flavour for aromatic oil
3. Peanuts are ground and water is added
4. Peanut paste is heated
5. Oil is extracted in a mechanical screw-press
6. Filtered to remove particles & reduce aflatoxine
7. Packaged
Peanut oil is filtered before packaging and/or refining to remove peanut particles, metals and other foreign matter.
Solvent extraction
Of the press cake

• A Hexane solvent process can be added to extract the remaining oil from the press-cake
• Per ton, 0.5L hexane is required
• The solvent is then separated and re-used with a loss of less than 1%
• The oil is filtered and packed
• The waste matter or press cake is sold as animal feed
Peanut oil yield percentages

- 1 kg of in-shells gives 650 grams kernels (65%)
- 650 grams kernels gives a maximum 279.5 grams of oil (43%)
Refining peanut oil

Peanut oil is refined to remove odour, improve flavour and colour.

- Caustic soda removes free fatty acids
- A bleaching earth removes pigment
- Steam distillation filters and deodorises

Crude  →  Refined
Cold pressed peanut oil

Niche product for pharmaceutical and cosmetics industry and organic peanut oil

Advantages

• Preserves flavour aroma and nutritional value
• Preserves anti-oxidants which prevent oxidation

Disadvantages

• No heat & solvent extraction = lower yield (<30%?= higher cost
• No refining to remove Aflatoxin
• Not well suited for cooking

Cold pressed oil is often organic

Cold Press Oil Expeller
Cultivars & Sizes
Peanut Varieties

Runner peanuts are the most common variety in the US and Argentina because of their high yield. Their longer growing season makes them generally unsuitable for dry land farming in Africa as it exceeds the length of the rainy season.

Spanish varieties are known for their nuttier taste which makes them desirable for the snack peanut market and for peanut butter. Kernels tend to be smaller and more round. These are the main varieties produced in Africa.

Virginia varieties produce the largest kernels which are oblong in shape. They are mostly farmed in the US for the premium snack market but are also used for all-natural peanut butter or roasted in-shell. This variety is unsuitable for most African growing regions.
Peanut Cultivars

Within a variety, there may be several cultivars that are grown.
The market is not very specific about which cultivars it accepts and cultivars are
generally selected for their growing characteristics such as yield, drought and
disease tolerance.

Oil content of different cultivars does not vary much (between 45 and 55%)
The selection criteria for peanuts depends on the intended use:
• Spanish varieties may fetch a premium on the snack market for their nutty taste
• Roundness in shape makes them more suitable for coating
• Cultivars that produce uniform sized kernels roast more evenly and are therefore suitable for roasted snack nuts and peanut butter.
• Most farmers in Africa achieve inferior yields and quality because they simply keep back part of their crop for replanting the following year.
• Adopting new, improved cultivars could contribute to profitability at all levels of the industry.
Example of a cultivar suitable for Africa

• **The Spanish Tufa cultivar** is an example that possesses characteristics that could be suitable for the African peanut industry:
  – High yield (2.3-2.5 tons/Ha on dry land compared to African norms of <1 ton/Ha)
  – Drought resistance
  – Medium Oleic/Linoleic Oil ratios that lead to better shelf-life than low Oleic varieties, Akwa and Anelle which are the industry standard
  – Smaller (60-70/Oz) but uniform kernel size suitable for roasting
  – Round and split resistant kernels suitable for coating
  – Excellent taste
Value chains for the most common end-products
Peanut Value Chain in Latin America & USA

Dry – Cleaning service
- Optional: Wet in-shells

Farmer
- Production
  - Opt.: on field drying & on farm cleaning

Dried & cleaned In-shells

Animal food producer
- Animal food

Local Oil producer
- Pressing, solvent extraction
  - Opt.: Refining

Unblanched smaller kernels & splits, higher in aflatoxin
- Crude oil export

Crude oil export

Processor & exporter
- Cleaning, shelling, sorting & grading, blanching, roasting

Unblanched kernels & splits, smaller sizes

EU/ Asia oil mill & refinery (via trader)
- (Un) Blanched larger whole kernels

Unblanched seeds & kernels

Snack company (local & international)
- Snack peanuts

Refrined oil

Refined oil

Retailer
- Snack peanuts

Peanut butter manuf.
- Peanut butter

Peanut butter

Beef & lamb farmers
- Cold pressed oil

Drug & cosmetic industry
- Pharmaceutical & cosmetic industry

Animal food

Dry – Cleaning service
- Local Oil producer
- Farmer
- Beef & lamb farmers
- Animal food producer
- Pharmaceutical & cosmetic industry
- EU/ Asia oil mill & refinery (via trader)
- Snack company (local & international)
- Peanut butter manuf.
- Retailer
- Consumers
Peanut Value Chain in Africa

**Farmer**
- Production and on-field drying and on-farm cleaning. Usually shelling. Home consumption
- Dried & cleaned kernels and in-shells

**Local Oil producer**
- Pressing, solvent extraction
- Opt.: Refining
- Low quality unsorted kernels
- Crude oil export
- Refined oil

**EU/Asia/US oil mill & refinery (via trader)**
- Unblanched whole kernels for snacks
- Refined oil

**Trader exporter (via collector*)**
- Cleaning, shelling, sorting and grading, blanching, roasting, storage
- Unblanched whole kernels for snacks
- *multiple levels of trader-processors can be involved

**Retailer**
- Refined oil

**Consortium mill**
- Press cake

**Animal food producer**
- Press cake

**Beef & lamb farmers**
- Animal food

**Consumers**
- Animal food producer
- Beef & lamb farmers
- Local Oil producer
- EU/Asia/US oil mill & refinery (via trader)
- Neighbourhood mill
- Optional: Peanuts
- Peanut paste

-Village market

Local peanut snacks / butter producer
- Local peanut snacks / butter producer
- Neighbourhood mill
- Optional: Peanuts
- Peanut paste

---

*(multiple levels of trader-processors can be involved)*

---

*Consumers*
Causes, prevention, and reduction of aflatoxin
Causes and prevention of aflatoxin

Aflatoxin can develop and spread at various stages:

On-farm
- Land
- Seed
- Drought
- Harvest
- Drying on land

Processing
- Hand-shelling
- Sorting
- Blanching
- Poor Testing

Storage & transport
- Wet kernels
- Plastic bags
- Warehouses
- Shells and skins
- Cross-contamination

Aflatoxin contamination

The causes and prevention measures of aflatoxin will be elaborated upon in the following slides. A more detailed explanation can be found in the appendix.
Aflatoxin causes and prevention: On-farm

**Land**
- **Cause:** Contaminated soil: high aspergillus flavus
- **Prevention:**
  - Crop rotation
  - Test soil before sowing

**Drought**
- **Cause:** Stressed plants are easily infected
- **Prevention:**
  - Irrigation
  - Drought resistant cultivar

**Dirt**
- **Cause:** Contaminated soil stays on the peanut
- **Prevention:**
  - Clean properly to <1% dirt

**Seed**
- **Cause:**
  - Old degenerated seed
  - Wrong cultivar
- **Prevention:**
  - Certified healthy and drought resistant variety.
  - Limited oleic content

**Harvest**
- **Cause:** Early or late harvesting
- **Prevention:**
  - Test maturity regularly to determine harvest
  - Working capital to prevent early selling

**On-land drying**
- **Cause:**
  - Drying in heaps in field (moisture in heap, soil contact, rain)
- **Prevention:**
  - Dry on racks above the ground/ in special dryers
Aflatoxin causes and prevention: Processing

**Hand-shelling**
- **Cause:**
  - Wet hands & soaked shells increase moisture in peanuts
- **Prevention:**
  - Machine shelling as soon as peanuts are dry

**Testing**
- **Cause:**
  - Poor methods
  - Infrequent testing
- **Prevention:**
  - Certified techniques (Elisa)
  - Multiple samples at various stages: from farm to export

**Sorting**
- **Cause:**
  - Not sorting out all contaminated peanuts
- **Prevention:**
  - Optical sorter + hand sorting

**En-route**
- **Cause:**
  - Shipping containers with close-to-max aflatoxin levels
- **Prevention:**
  - Only send shipments with peanuts well below limits
  - Blanch before shipping
Aflatoxin causes and prevention: Storage

**Wet kernels**

**Cause:**
- Storing wet kernels

**Prevention:**
- Dry until at 6-8% moisture
- Test moist prior to storage

**Plastic bags**

**Cause:**
- Polypropylene bags do not breath sufficiently

**Prevention:**
- Use jute bags
- PP bags with ventilation

**Warehouse**

**Cause:**
- Hot and moist storage conditions in warehouses

**Prevention:**
- Ventilation and cooling
- Leave space around bags

**Shells/skins**

**Cause:**
- Aflatoxin present in shell/skin may contaminate kernel

**Prevention:**
- Shell and/or blanch prior to lengthy storage

**Cross-cont.**

**Cause:**
- Aflatoxin batch contaminates clean batches

**Prevention:**
- Do not mix batches
- Test batch before storing
Aflatoxin reduction in processing

Aflatoxin contamination can be reduced at various processing stages:

- Machine drying
- Machine shelling
- Selection
- Blanching

- Pressing
- Filtering
- Refining

Aflatoxin Reduction
Aflatoxin reduction: Peanut snacks & butter

**Snack peanuts & peanut butter**
- Machine drying
- Machine shelling
- Selection
- Blanching

**Manual sorting**: contaminated peanuts light up under special UV light and can be removed manually.

**Optical sorting**: machine uses photocell technology to identify darker nuts. With small air pulses the infected nuts are blown away. A combination works best

The skin contains most aflatoxin. Blanching the peanut can remove up to 80% of the aflatoxin and prevent further infection and spreading.

**Issues:**
- Many importers prefer to play it safe by buying from e.g. Argentina instead of Africa
- In-shell peanuts leave ample opportunity for aflatoxin to develop during transport, and is not recommended for Africa
- Peanut butter manufacturers import unblanched peanuts which eliminates an important aflatoxin reduction opportunity for African processors. In addition part of skins may be added to the butter.
Aflatoxin reduction: Peanut oil

**Peanut oil**

- **Pressing**
  - Most aflatoxin stays behind in the press-cake.

- **Filtering**
  - Most aflatoxin can be filtered out when filtering crude oil.

- **Refining**
  - More aflatoxin can be taken out at the refining stage through the techniques of bleaching, filtering, and deodorisation.

**Issues:**
- Press cake with high aflatoxin levels should not be used as animal feed, because of animal health, and reintroduction in human food chain (e.g. via milk). In China this is not seen as a problem, but in Europe the press cake needs to be destroyed.
- Though most aflatoxin can be filtered out, it reduces the speed of the process and thereby production capacity of the line. At high contamination levels filtering becomes too slow for it to be economical.
What to do as an exporter if a load is rejected in the EU?

3 Options:

1. Sell to Eastern Europe, where limits are not as strictly enforced
   - $750/ton
   - Only works if not too far over limit

2. Sell as birdfeed
   - 600$/ton
   - Demand is limited, may not always be possible

3. Sell for oil extraction
   - 400$/ton
   - Low price because filtering is needed & seedcake needs to be destroyed at your cost
## Maximum Aflatoxin Levels Per Country

<table>
<thead>
<tr>
<th>Country</th>
<th>Afla B1 ppb</th>
<th>Afla B1B2G1G2 ppb</th>
<th>For Animal Feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td></td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Brazil</td>
<td>30</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td></td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>China</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>European Union</td>
<td>2</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>20</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>30</td>
<td>120</td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td>10</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Malawi</td>
<td></td>
<td>5 (export)</td>
<td></td>
</tr>
<tr>
<td>Myanmar</td>
<td></td>
<td>No regulations</td>
<td></td>
</tr>
<tr>
<td>Nigeria</td>
<td></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Russia</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Senegal</td>
<td></td>
<td>50</td>
<td>300</td>
</tr>
<tr>
<td>South Africa</td>
<td></td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>United States</td>
<td></td>
<td>20</td>
<td>300</td>
</tr>
</tbody>
</table>

- The EU has stringent and strictly enforced regulations
- Regulations in Eastern Europe are not strictly enforced
- Chinese limits apparently do not apply/ are not enforced if peanuts are destined for oil crushing
Conclusion

- There are many causes of aflatoxin contamination, but most have adequate solutions.
- Prevention requires substantial investments in farmers, processors and traders, and only works if there is a financial incentive in the form of higher prices.
- Even then it will take several years for aflatoxin levels to come down.
- Countries like Argentina and South Africa with trained farmers still experience up to 15% infected peanuts, but sell these as oil grade peanuts (or in SA as snacks on informal market).
- It is more difficult to reduce aflatoxin in peanuts for peanut butter, because they are exported unblanched.
- This leaves blanched peanuts for snacks and peanut oil as aflatoxin-manageable products.

Strategic options:
Blanched peanuts for snacks & peanut oil
Strategic options
Exporting blanched peanuts for snacks is a profitable opportunity and allows for aflatoxin management.

More research needed. How many consumers are willing to pay extra for high quality and aflatoxin-free products? Can you compete with informal producers?
Which product – market combinations offer a cost recovery opportunity?

<table>
<thead>
<tr>
<th></th>
<th>Peanuts for peanut butter</th>
<th>International snack peanuts</th>
<th>Crude peanut oil</th>
<th>Refined peanut oil</th>
<th>Cold pressed oil</th>
<th>Peanuts for oil</th>
<th>Local snack peanuts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demand</strong></td>
<td>+</td>
<td>++</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><strong>Price</strong></td>
<td>+</td>
<td>++</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td><strong>Aflatoxin tolerance/ management potential</strong></td>
<td>-</td>
<td>+</td>
<td>++</td>
<td>++</td>
<td>-</td>
<td>++</td>
<td>-</td>
</tr>
</tbody>
</table>

Crude oil, refined oil, and peanuts for oil are a cost recovery opportunity for peanuts that are too contaminated for the snack market.
Business cases
Business models analysed

1. Processor-exporter of snack peanuts to EU & rejects for oil production
2. Crude oil factory for export to China
3. Refined oil factory for local market
1. Processor-exporter of snack-nuts to EU (Senegal, Ghana, Tanzania)

- **Activities:**
  - Purchase of dried in-shells from farmers (via collectors)
  - Cleaning, shelling, sorting, grading, blanching, export
  - Alternatively, the facility could provide processing services for exporters/traders at a fixed fee per ton. The infrastructure is then shared between multiple traders/processors

- **Market:**
  - 20% oil-grade for export to China
  - 80% export to EU, of which 20% is rejected due to aflatoxin and sold in Eastern Europe (Snacks), as birdfeed or oil peanuts

- **Volume per annum:**
  - 15,385 ton in-shells, 10,000 ton kernels
  - 6,320 ton sold as snack peanuts, 1580 ton rejects, 2000 ton oil-grade

- **Investment:** $1,44 million for 5ton/hour capacity
- **Profitability:** 36.4% Senegal, 25% Tanzania*, 35% Ghana*
- **Senegal offers the most reliable data for factory gate in-shell peanut prices and is the main example**

*Main cost driver is peanut price. Reliable farm-gate prices for unshelled peanuts were difficult to obtain. Estimates from local consultants & context report vary greatly
### Variable production cost for 1 ton exported peanuts (mix of snack & oil-grade)

#### Ghana

<table>
<thead>
<tr>
<th>Cost (unit)</th>
<th>Quantity</th>
<th>Price/ unit in GHC</th>
<th>Cost/ton in GHC</th>
<th>Cost/ton in Euro</th>
<th>Cost/ton in USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inshell peanuts (65% yield)</td>
<td>1,54</td>
<td>1205</td>
<td>1923077</td>
<td>787,18 €</td>
<td>$865,90</td>
</tr>
<tr>
<td>Labour (hours)</td>
<td>5</td>
<td>1,0</td>
<td>5,00</td>
<td>1 €</td>
<td>$1,24</td>
</tr>
<tr>
<td>Packaging (50kg bags)</td>
<td>20</td>
<td>558</td>
<td>11164,51</td>
<td>4,57 €</td>
<td>$5,03</td>
</tr>
<tr>
<td>Fumigation/pest control</td>
<td>1,0000</td>
<td>3762</td>
<td>3762,22</td>
<td>1,54 €</td>
<td>$1,69</td>
</tr>
<tr>
<td>Electricity (kwh)</td>
<td>60</td>
<td>205,00</td>
<td>12300,00</td>
<td>5,03 €</td>
<td>$5,54</td>
</tr>
<tr>
<td><strong>Variable production cost/kg</strong></td>
<td></td>
<td></td>
<td>1954767</td>
<td>€ 800,15</td>
<td>$880,17</td>
</tr>
</tbody>
</table>

#### Tanzania

<table>
<thead>
<tr>
<th>Cost (unit)</th>
<th>Quantity</th>
<th>Price/ unit in TZS</th>
<th>Cost/ton in TZS</th>
<th>Cost/ton in Euro</th>
<th>Cost/ton in USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inshell peanuts (65% yield)</td>
<td>1,5385</td>
<td>1250000</td>
<td>1923077</td>
<td>787,18 €</td>
<td>$865,90</td>
</tr>
<tr>
<td>Labour (hours)</td>
<td>5</td>
<td>893</td>
<td>4463,75</td>
<td>1,83 €</td>
<td>$2,01</td>
</tr>
<tr>
<td>Packaging (50kg bags)</td>
<td>20</td>
<td>558</td>
<td>11164,51</td>
<td>4,57 €</td>
<td>$5,03</td>
</tr>
<tr>
<td>Fumigation/pest control</td>
<td>1,0000</td>
<td>3762</td>
<td>3762,22</td>
<td>1,54 €</td>
<td>$1,69</td>
</tr>
<tr>
<td>Electricity (kwh)</td>
<td>60</td>
<td>205,00</td>
<td>12300,00</td>
<td>5,03 €</td>
<td>$5,54</td>
</tr>
<tr>
<td><strong>Variable production cost/kg</strong></td>
<td></td>
<td></td>
<td>1954767</td>
<td>€ 800,15</td>
<td>$880,17</td>
</tr>
</tbody>
</table>

#### Senegal

<table>
<thead>
<tr>
<th>Cost (unit)</th>
<th>Quantity</th>
<th>Price/ unit in FCFA</th>
<th>Cost/ton in FCFA</th>
<th>Cost/ton in Euro</th>
<th>Cost/ton in USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inshell peanuts (65% yield)</td>
<td>1,54</td>
<td>250000</td>
<td>384615</td>
<td>586,30 €</td>
<td>$664,93</td>
</tr>
<tr>
<td>Labour (hours)</td>
<td>5</td>
<td>270</td>
<td>1350</td>
<td>2,06 €</td>
<td>$2,26</td>
</tr>
<tr>
<td>Packaging (50kg bags)</td>
<td>20</td>
<td>150</td>
<td>3000</td>
<td>4,57 €</td>
<td>$5,03</td>
</tr>
<tr>
<td>Fumigation/pest control</td>
<td>1</td>
<td>1009</td>
<td>1009</td>
<td>1,54 €</td>
<td>$1,69</td>
</tr>
<tr>
<td>Electricity (kwh)</td>
<td>60</td>
<td>106</td>
<td>6360</td>
<td>9,70 €</td>
<td>$10,66</td>
</tr>
<tr>
<td><strong>Variable production cost/kg</strong></td>
<td></td>
<td></td>
<td>396334</td>
<td>€ 604,17</td>
<td>$664,59</td>
</tr>
</tbody>
</table>
Peanuts are the main cost-driver, responsible for 75% of cost.

<table>
<thead>
<tr>
<th>Production costs per ton in Senegal</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Peanuts</td>
<td>$ 664.93</td>
</tr>
<tr>
<td>Other variable cost</td>
<td>$ 18.65</td>
</tr>
<tr>
<td>Export cost</td>
<td>$ 161.82</td>
</tr>
<tr>
<td>Fixed cost</td>
<td>$ 863.94</td>
</tr>
<tr>
<td>TOTAL</td>
<td>$ 1,554.72</td>
</tr>
</tbody>
</table>

**Production cost of 1 ton Snack & Oil peanuts in Senegal**

- Peanuts: 75%
- Other variable cost: 19%
- Export cost: 4%
- Fixed cost: 4%

**Production cost breakdown:**

- Peanuts: $ 664.93
- Other variable cost: $ 18.65
- Export cost: $ 161.82
- Fixed cost: $ 863.94
- Total cost: $ 1,554.72
Revenues are driven by % of accepted snack-grade peanuts & price paid

<table>
<thead>
<tr>
<th>Product Description</th>
<th>Sales price/ ton USD</th>
<th>Sales price/ ton EUR</th>
<th>Sales price/ ton TZS</th>
<th>Sales volume/ year (tons)</th>
<th>Total revenue/ year in USD</th>
<th>Total revenue/ year in EURO</th>
<th>% Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peanut Kernels HPS (CIF China)</td>
<td>$ 1,800</td>
<td>1636</td>
<td>3997636</td>
<td>6320</td>
<td>$11,376,000</td>
<td>€10,341,818</td>
<td>77%</td>
</tr>
<tr>
<td>Peanut Kernels oil-grade (CIF China)</td>
<td>$ 850</td>
<td>773</td>
<td>1887773</td>
<td>2000</td>
<td>$1,700,000</td>
<td>€1,545,455</td>
<td>12%</td>
</tr>
<tr>
<td>Shells (local market)</td>
<td>$ 122.89</td>
<td>112</td>
<td>73290</td>
<td>5385</td>
<td>$661,741</td>
<td>€601,583</td>
<td>4%</td>
</tr>
<tr>
<td>Higher Afla Peanut Eastern Europe</td>
<td>$ 750</td>
<td>682</td>
<td>1665682</td>
<td>790</td>
<td>$592,500</td>
<td>€538,636</td>
<td>4%</td>
</tr>
<tr>
<td>Birdseed Peanuts Afla too high for Eastern Europe</td>
<td>$ 600</td>
<td>545</td>
<td>1332545</td>
<td>395</td>
<td>$237,000</td>
<td>€215,455</td>
<td>2%</td>
</tr>
<tr>
<td>Oil seed in EU with high afla (press cake destroyed)</td>
<td>$ 400</td>
<td>364</td>
<td>888364</td>
<td>395</td>
<td>$158,000</td>
<td>€143,636</td>
<td>1%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>15285</td>
<td>14,725,241</td>
<td>€13,386,583</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Even if only 10% are sold as Snack-grade it is still profitable
- The average sales price needed for all peanut products to break-even is 900$/ton CIF Rotterdam
Investment costs depend on equipment quality but are modest

<table>
<thead>
<tr>
<th>Equipment List</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Shellers</td>
<td>4</td>
</tr>
<tr>
<td>Cleaners</td>
<td>2</td>
</tr>
<tr>
<td>grader</td>
<td>1</td>
</tr>
<tr>
<td>Destoner</td>
<td>1</td>
</tr>
<tr>
<td>elevators</td>
<td>2</td>
</tr>
<tr>
<td>conveyor</td>
<td>2</td>
</tr>
<tr>
<td>optical sorter</td>
<td>1</td>
</tr>
<tr>
<td>blancher</td>
<td>1</td>
</tr>
<tr>
<td>Generator</td>
<td>1</td>
</tr>
<tr>
<td>voltage stabilisor</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Investments</th>
<th>USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment</td>
<td>650000</td>
</tr>
<tr>
<td>Building 2000m² @300USD</td>
<td>600000</td>
</tr>
<tr>
<td>Land 4000m² @40USD</td>
<td>160000</td>
</tr>
<tr>
<td>Cars pickup trucks</td>
<td>30000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1440000</strong></td>
</tr>
</tbody>
</table>

- Equipment cost are $450,000 for all Chinese equipment, $900,000 for US/EU equipment
- Chinese equipment works, but requires more maintenance, has more downtime and has shorter lifespan
- In this case we have taken a mix (i.e. Optical sorter, shellers, grader and generator from GB/US, rest from China)
- Because depreciation and interest on equipment is such a small part of the cost price and the loss on rejected containers is high, it makes sense to invest in good quality sorting equipment to reduce rejections
Fixed cost are driven by salaries, depreciation & interest…but total only 4% of cost price

<table>
<thead>
<tr>
<th>Fixed cost per year</th>
<th>In FCFA</th>
<th>in Euro</th>
<th>in USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Licenses</td>
<td>1.100.000</td>
<td>1.677 €</td>
<td>$1.844,51</td>
</tr>
<tr>
<td>Security</td>
<td>1.200.000</td>
<td>1.829 €</td>
<td>$2.012,20</td>
</tr>
<tr>
<td>Electricity connection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depreciation equipment</td>
<td>28.426.667</td>
<td>43.333 €</td>
<td>$47.666,67</td>
</tr>
<tr>
<td>Depreciation vehicles</td>
<td>4.920.000</td>
<td>7.500 €</td>
<td>$8.250,00</td>
</tr>
<tr>
<td>Working Capital Loan interest 8% of 1,7mln USD 5mths</td>
<td>33.793.939</td>
<td>51.515 €</td>
<td>$56.666,67</td>
</tr>
<tr>
<td>Maintenance equipment</td>
<td>15.000.000</td>
<td>22.866 €</td>
<td>$25.152,44</td>
</tr>
<tr>
<td>Investment loan interest 12% on 70% of investment</td>
<td>19.680.000</td>
<td>109.964 €</td>
<td>$120.960,00</td>
</tr>
<tr>
<td>Driver salaries</td>
<td>2.361.600</td>
<td>3.600 €</td>
<td>$3.960,00</td>
</tr>
<tr>
<td>Mgt salaries (sourcing, factory, sales, GM)</td>
<td>55.104.000</td>
<td>84.000 €</td>
<td>$92.400,00</td>
</tr>
<tr>
<td>Mkt+sales+travel cost</td>
<td>9.840.000</td>
<td>15.000 €</td>
<td>$16.500,00</td>
</tr>
<tr>
<td>Total Fixed cost</td>
<td>171.426.206</td>
<td>341.284 €</td>
<td>$375.412,48</td>
</tr>
<tr>
<td>Fixed cost/ton</td>
<td>17.142,621</td>
<td>€ 34,13</td>
<td>$37,54</td>
</tr>
</tbody>
</table>

Assumptions:
- Some highly qualified (expat) managers and well paid middle management are necessary
- 70% of investment cost is financed through a loan
- A working capital loan is necessary to buy in bulk at harvest
## Profitability

<table>
<thead>
<tr>
<th></th>
<th>Per Ton in USD</th>
<th>Per Ton in EUR</th>
<th>In USD</th>
<th>In EUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable production cost</td>
<td>665</td>
<td>604</td>
<td>6.645.851</td>
<td>6.041.683</td>
</tr>
<tr>
<td>Export cost</td>
<td>162</td>
<td>147</td>
<td>1.618.158</td>
<td>1.471.053</td>
</tr>
<tr>
<td>Fixed cost</td>
<td>38</td>
<td>34</td>
<td>375.412</td>
<td>341.284</td>
</tr>
<tr>
<td><strong>Total cost</strong></td>
<td><strong>864</strong></td>
<td><strong>785</strong></td>
<td><strong>8.639.421</strong></td>
<td><strong>7.854.019</strong></td>
</tr>
<tr>
<td>Sales Revenues</td>
<td>1.424</td>
<td>1.295</td>
<td>14.244.082</td>
<td>12.949.165</td>
</tr>
<tr>
<td>Gross margin</td>
<td>760</td>
<td>691</td>
<td>7.598.231</td>
<td>6.907.482</td>
</tr>
<tr>
<td></td>
<td>53%</td>
<td>53%</td>
<td>53%</td>
<td>53%</td>
</tr>
<tr>
<td><strong>Net Profit (before tax)</strong></td>
<td><strong>560</strong></td>
<td><strong>510</strong></td>
<td><strong>5.604.660</strong></td>
<td><strong>5.095.146</strong></td>
</tr>
<tr>
<td></td>
<td>39,3%</td>
<td>39,3%</td>
<td>39,3%</td>
<td>39,3%</td>
</tr>
</tbody>
</table>

- Profitability for Senegal is 39,3%, however:
  - If you want less aflatoxin, you will probably need to pay a price premium which increases sourcing cost
  - Fixed cost may increase due to investments in aflatoxin prevention methods at farmer level
  - Nevertheless, at 39,3% net profit there should be sufficient margin to do so.
Production volume & profitability

- 10,000 tons of kernels was chosen as it is generally regarded by experts as a minimum size to be economic, but still affordable: the investment capital is limited & manageable.
- However, even at 50% production capacity the factory is still profitable: 36.7% net profit (versus 39.3% at 100%). The fixed cost are only small part of cost price.
- Main reason to have a 10,000 ton factory is marketing: clients prefer to invest time in larger suppliers, and management of larger factories is not more complex or labour intensive.
2. Crude oil factory in Senegal for export to China

• Activities:
  – Purchase of dried in-shells from farmers (via collectors)
  – Purchase of broken peanuts & splits from traders & exporters
  – Cleaning, shelling, oil extraction, solvent extraction, filtering, export
  – Optional: sales of best kernels on the international snack market

• Market:
  – 100% of crude oil for export to China
  – 100% of seedcake for local market

• Volume per annum:
  – 100,000 ton in-shells
  – 27,300 ton oil 37,700 tons seed

• Investment: $ 12,6 million

• Profitability: -10% (loss!)
## Investment Costs for crude oil pressing plant in Senegal

<table>
<thead>
<tr>
<th>Description</th>
<th>QTY</th>
<th>Unit cost in USD</th>
<th>Cost in USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading cyclones</td>
<td>2</td>
<td>$ 63 500</td>
<td>$ 127 000</td>
</tr>
<tr>
<td>Unloading conveyor belts</td>
<td>3</td>
<td>$ 28 600</td>
<td>$ 85 800</td>
</tr>
<tr>
<td>Storage silo 200MT</td>
<td>1</td>
<td>$ 112 000</td>
<td>$ 112 000</td>
</tr>
<tr>
<td>Badge silo 25MT</td>
<td>3</td>
<td>$ 17 000</td>
<td>$ 51 000</td>
</tr>
<tr>
<td>Sheller and destoner</td>
<td>4</td>
<td>$ 202 350</td>
<td>$ 809 399</td>
</tr>
<tr>
<td>Seed cleaning unit</td>
<td>1</td>
<td>$ 212 000</td>
<td>$ 212 000</td>
</tr>
<tr>
<td>Dust Blower</td>
<td>4</td>
<td>$ 19 225</td>
<td>$ 76 900</td>
</tr>
<tr>
<td>Transporting Cyclones</td>
<td>4</td>
<td>$ 21 500</td>
<td>$ 86 000</td>
</tr>
<tr>
<td>Hammer mill</td>
<td>2</td>
<td>$ 53 134</td>
<td>$ 106 268</td>
</tr>
<tr>
<td>Screw conveyor</td>
<td>5</td>
<td>$ 66 418</td>
<td>$ 332 089</td>
</tr>
<tr>
<td>Bucket elevator</td>
<td>5</td>
<td>$ 66 797</td>
<td>$ 333 986</td>
</tr>
<tr>
<td>Roller crusher</td>
<td>2</td>
<td>$ 227 718</td>
<td>$ 455 436</td>
</tr>
<tr>
<td>Screw press</td>
<td>2</td>
<td>$ 759 060</td>
<td>$ 1 518 120</td>
</tr>
<tr>
<td>Filter press</td>
<td>2</td>
<td>$ 163 198</td>
<td>$ 326 396</td>
</tr>
<tr>
<td>Holding tank</td>
<td>2</td>
<td>$ 132 836</td>
<td>$ 265 671</td>
</tr>
<tr>
<td>Oil pump</td>
<td>2</td>
<td>$ 113 859</td>
<td>$ 227 718</td>
</tr>
<tr>
<td>Water treatment set</td>
<td>4</td>
<td>$ 18 977</td>
<td>$ 75 906</td>
</tr>
<tr>
<td>Boiler set</td>
<td>2</td>
<td>$ 569 295</td>
<td>$ 1 138 590</td>
</tr>
<tr>
<td>Weight bridge 80mt</td>
<td>1</td>
<td>$ 112 000</td>
<td>$ 112 000</td>
</tr>
<tr>
<td>Electricity generator 1.7MW</td>
<td>1</td>
<td>$ 600 000</td>
<td>$ 600 000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Investment</th>
<th>USD</th>
<th>EUR</th>
<th>Depreciation period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment</td>
<td>7 052 280</td>
<td>6411164</td>
<td>15</td>
</tr>
<tr>
<td>Building</td>
<td>4 500 000</td>
<td>4090909</td>
<td>30</td>
</tr>
<tr>
<td>Electricity supply</td>
<td>1 105 000</td>
<td>1004545</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>12657280</td>
<td>11506618</td>
<td></td>
</tr>
</tbody>
</table>

### Machinery Costs 100.000 MT factory

<table>
<thead>
<tr>
<th>Description</th>
<th>QTY</th>
<th>Unit cost in USD</th>
<th>Cost in USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading cyclones</td>
<td>2</td>
<td>$ 63 500</td>
<td>$ 127 000</td>
</tr>
<tr>
<td>Unloading conveyor belts</td>
<td>3</td>
<td>$ 28 600</td>
<td>$ 85 800</td>
</tr>
<tr>
<td>Storage silo 200MT</td>
<td>1</td>
<td>$ 112 000</td>
<td>$ 112 000</td>
</tr>
<tr>
<td>Badge silo 25MT</td>
<td>3</td>
<td>$ 17 000</td>
<td>$ 51 000</td>
</tr>
<tr>
<td>Sheller and destoner</td>
<td>4</td>
<td>$ 202 350</td>
<td>$ 809 399</td>
</tr>
<tr>
<td>Seed cleaning unit</td>
<td>1</td>
<td>$ 212 000</td>
<td>$ 212 000</td>
</tr>
<tr>
<td>Dust Blower</td>
<td>4</td>
<td>$ 19 225</td>
<td>$ 76 900</td>
</tr>
<tr>
<td>Transporting Cyclones</td>
<td>4</td>
<td>$ 21 500</td>
<td>$ 86 000</td>
</tr>
<tr>
<td>Hammer mill</td>
<td>2</td>
<td>$ 53 134</td>
<td>$ 106 268</td>
</tr>
<tr>
<td>Screw conveyor</td>
<td>5</td>
<td>$ 66 418</td>
<td>$ 332 089</td>
</tr>
<tr>
<td>Bucket elevator</td>
<td>5</td>
<td>$ 66 797</td>
<td>$ 333 986</td>
</tr>
<tr>
<td>Roller crusher</td>
<td>2</td>
<td>$ 227 718</td>
<td>$ 455 436</td>
</tr>
<tr>
<td>Screw press</td>
<td>2</td>
<td>$ 759 060</td>
<td>$ 1 518 120</td>
</tr>
<tr>
<td>Filter press</td>
<td>2</td>
<td>$ 163 198</td>
<td>$ 326 396</td>
</tr>
<tr>
<td>Holding tank</td>
<td>2</td>
<td>$ 132 836</td>
<td>$ 265 671</td>
</tr>
<tr>
<td>Oil pump</td>
<td>2</td>
<td>$ 113 859</td>
<td>$ 227 718</td>
</tr>
<tr>
<td>Water treatment set</td>
<td>4</td>
<td>$ 18 977</td>
<td>$ 75 906</td>
</tr>
<tr>
<td>Boiler set</td>
<td>2</td>
<td>$ 569 295</td>
<td>$ 1 138 590</td>
</tr>
<tr>
<td>Weight bridge 80mt</td>
<td>1</td>
<td>$ 112 000</td>
<td>$ 112 000</td>
</tr>
<tr>
<td>Electricity generator 1.7MW</td>
<td>1</td>
<td>$ 600 000</td>
<td>$ 600 000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Investment</th>
<th>USD</th>
<th>EUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment</td>
<td>7 052 280</td>
<td>6411164</td>
</tr>
</tbody>
</table>
## Fixed yearly costs for crude peanut oil plant

<table>
<thead>
<tr>
<th></th>
<th>In FCFA</th>
<th>in Euro</th>
<th>in US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Licenses</td>
<td>1 100 000</td>
<td>1 677 €</td>
<td>$ 1 845</td>
</tr>
<tr>
<td>Security</td>
<td>1 200 000</td>
<td>1 829 €</td>
<td>$ 2 012</td>
</tr>
<tr>
<td>Electricity connection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depreciation equipment+ building</td>
<td>413 768 223</td>
<td>630 744 €</td>
<td>$ 693 819</td>
</tr>
<tr>
<td>Working Capital Loan interest 8% of 11 mln USD 6mths</td>
<td>262 400 000</td>
<td>400 000 €</td>
<td>$ 440 000</td>
</tr>
<tr>
<td>Maintenance equipment</td>
<td>15 000 000</td>
<td>22 866 €</td>
<td>$ 25 152</td>
</tr>
<tr>
<td>Investment loan interest 12% on 70% of investment</td>
<td>634 060 688</td>
<td>966 556 €</td>
<td>$ 1 063 212</td>
</tr>
<tr>
<td>Driver salaries</td>
<td>2 361 600</td>
<td>3 600 €</td>
<td>$ 3 960</td>
</tr>
<tr>
<td>Mgt salaries (sourcing, factory, sales, GM)</td>
<td>71 563 636</td>
<td>109 091 €</td>
<td>$ 120 000</td>
</tr>
<tr>
<td>Mkt+sales+travel cost</td>
<td>16 400 000</td>
<td>25 000 €</td>
<td>$ 27 500</td>
</tr>
<tr>
<td><strong>Total Fixed cost</strong></td>
<td><strong>1 417 854 148</strong></td>
<td><strong>2 161 363 €</strong></td>
<td><strong>$ 2 377 499</strong></td>
</tr>
<tr>
<td><strong>Fixed cost/ton</strong></td>
<td><strong>21 813.141</strong></td>
<td><strong>€ 69.27</strong></td>
<td><strong>$ 76</strong></td>
</tr>
</tbody>
</table>
Variable costs for 1 ton exported crude peanut oil (Senegal)

<table>
<thead>
<tr>
<th>Cost (unit)</th>
<th>Quantity</th>
<th>Price/ unit in FCFA</th>
<th>Cost/ton in FCFA</th>
<th>Cost/ton in Euro</th>
<th>Cost/ton in USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-shell peanuts</td>
<td>2.40</td>
<td>250000</td>
<td>600962</td>
<td>916.10 €</td>
<td>$1,007.71</td>
</tr>
<tr>
<td>Split / broken peanuts</td>
<td>0.52</td>
<td>310000</td>
<td>161458</td>
<td>246.13 €</td>
<td>$270.74</td>
</tr>
<tr>
<td>Labour (hours)</td>
<td>5.0</td>
<td>270.00</td>
<td>1350</td>
<td>2.06 €</td>
<td>$2.26</td>
</tr>
<tr>
<td>Packaging (20 ltr plastic barrels)</td>
<td>50</td>
<td>1000.00</td>
<td>50000</td>
<td>76.22 €</td>
<td>$83.84</td>
</tr>
<tr>
<td>Fumigation/pest control</td>
<td>1.0000</td>
<td>1009.00</td>
<td>1009</td>
<td>1.54 €</td>
<td>$1.69</td>
</tr>
<tr>
<td>Electricity (kwh)</td>
<td>150</td>
<td>106.00</td>
<td>15900</td>
<td>24.24 €</td>
<td>$26.66</td>
</tr>
<tr>
<td><strong>Variable production cost/kg</strong></td>
<td></td>
<td></td>
<td>830679</td>
<td>€1,266.28</td>
<td>$1,392.91</td>
</tr>
</tbody>
</table>

Export costs

<table>
<thead>
<tr>
<th></th>
<th>in FCFA</th>
<th>in EURO</th>
<th>in USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product per 20&quot; container (kg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost CIF China/EU container</td>
<td>1377600</td>
<td>2100.00 €</td>
<td>2310</td>
</tr>
<tr>
<td>Stuffing container</td>
<td>19024</td>
<td>29.00 €</td>
<td>31.9</td>
</tr>
<tr>
<td>Insurance</td>
<td>19680</td>
<td>30.00 €</td>
<td>33</td>
</tr>
<tr>
<td>Lab test/ samples</td>
<td>229600</td>
<td>350.00 €</td>
<td>385</td>
</tr>
<tr>
<td>Fumigation</td>
<td>170560</td>
<td>260.00 €</td>
<td>286</td>
</tr>
<tr>
<td>Export documentation</td>
<td>17056</td>
<td>26.00 €</td>
<td>28.6</td>
</tr>
<tr>
<td>TOTAL cost/ container</td>
<td>1833520</td>
<td>2795.00 €</td>
<td>3074.5</td>
</tr>
<tr>
<td><strong>Export cost/ton</strong></td>
<td>96501.1</td>
<td>147.11 €</td>
<td>161.82 €</td>
</tr>
</tbody>
</table>
Peanuts are the main cost-driver, responsible for 81% of cost

<table>
<thead>
<tr>
<th>Cost price Crude Oil (USD/Ton)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Peanuts</td>
<td>$1,278.45</td>
</tr>
<tr>
<td>Other variable cost</td>
<td>$114.46</td>
</tr>
<tr>
<td>Export cost</td>
<td>$161.82</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$1,554.72</strong></td>
</tr>
</tbody>
</table>
## Main and by-product volumes

<table>
<thead>
<tr>
<th></th>
<th>In-shells</th>
<th>Splits / broken</th>
<th>Kernels (shelled + splits/broken)</th>
<th>Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total production/ day</td>
<td>313</td>
<td>68</td>
<td>271</td>
<td>130</td>
</tr>
<tr>
<td>Total production/ year</td>
<td>75000</td>
<td>16250</td>
<td>65000</td>
<td>31200</td>
</tr>
<tr>
<td>Production days/ year</td>
<td>240</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Breakdown of Products

- **In-shells**
  - 82% 75,000 tons
  - Split/broken 18% 16,250 tons

- **Kernels**
  - 75% 48,750 tons
  - Split/broken 25% 16,250 tons

- **Shells**
  - 26,250 tons
  - 35% of in-shell volume

- **Crude oil**
  - 42% 27,300 tons

- **Press cake**
  - 58% 37,700 tons
Revenues are driven by the combined sales price of crude oil, press-cake and shells

- Crude oil itself comprises 77% of the revenue
- But at 21% the press cake is an important secondary source of revenue
- Shells make up a very small cost recovery

<table>
<thead>
<tr>
<th></th>
<th>Sales price/ton US$</th>
<th>Sales price/ton EUR</th>
<th>Sales price/ton FCFA</th>
<th>Sales volume/year (tons)</th>
<th>Total revenue/year in US$</th>
<th>Total revenue/year in EURO</th>
<th>% Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude oil (CIF China)</td>
<td>1,250</td>
<td>1,136</td>
<td>745,455</td>
<td>31,200</td>
<td>39,000,000</td>
<td>35,454,545</td>
<td>77%</td>
</tr>
<tr>
<td>Presscake (local market)</td>
<td>310</td>
<td>282</td>
<td>185,000</td>
<td>33,800</td>
<td>10,485,213</td>
<td>9,532,012</td>
<td>21%</td>
</tr>
<tr>
<td>Shells (local market)</td>
<td>34</td>
<td>30</td>
<td>20,000</td>
<td>26,250</td>
<td>880,335</td>
<td>800,305</td>
<td>2%</td>
</tr>
<tr>
<td>TOTAL</td>
<td>91,250</td>
<td>50,365,549</td>
<td>45,786,863</td>
<td>100%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Profitability of a crude peanut oil plant in Senegal

<table>
<thead>
<tr>
<th>Profitability</th>
<th>Per Ton in US$</th>
<th>Per Ton in EUR</th>
<th>In US$</th>
<th>In EUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable production cost</td>
<td>1392.91 €</td>
<td>1,266.28 $</td>
<td>43,458,687.32 €</td>
<td>39,507,897.56 €</td>
</tr>
<tr>
<td>Export cost</td>
<td>161.82 €</td>
<td>147.11 $</td>
<td>5,048,652.63 €</td>
<td>4,589,684.21 €</td>
</tr>
<tr>
<td>Fixed cost</td>
<td>76.20 €</td>
<td>69.27 $</td>
<td>2,377,499.33 €</td>
<td>2,161,363.03 €</td>
</tr>
<tr>
<td><strong>Total cost</strong></td>
<td><strong>1630.92 €</strong></td>
<td><strong>1,482.66 $</strong></td>
<td><strong>50,884,839.28 €</strong></td>
<td><strong>46,258,944.80 €</strong></td>
</tr>
<tr>
<td>Sales Revenues</td>
<td>1614.28</td>
<td>1467.53 $</td>
<td>50,365,548.78 €</td>
<td>45,786,862.53 €</td>
</tr>
<tr>
<td><strong>Gross margin</strong></td>
<td>221.37 €</td>
<td>201.25 $</td>
<td>6,906,861.46 €</td>
<td>6,278,964.97 €</td>
</tr>
<tr>
<td><strong>Net Profit (before tax)</strong></td>
<td>-16.64 €</td>
<td>15.13 $</td>
<td>-519,290.50 €</td>
<td>472,082.27 €</td>
</tr>
<tr>
<td></td>
<td>-1.0%</td>
<td>-1.0%</td>
<td>-1.0%</td>
<td>-1.0%</td>
</tr>
</tbody>
</table>

- Based on current world prices for crude peanut oil the plant would make an annual loss of 1%
- Currently you cannot afford to buy peanuts from farmers just to convert into oil. You need to sort and sell the best as snack grade
Production volume & profitability

- 100,000 tons in-shells was chosen to see if a large factory with economies of scale could be profitable.
- This compares to the capacity of the main existing producers in Senegal:
  - Suneor: 300,000 tons
  - WAO: 100,000 tons
  - NOVASEN: 100,000 tons
  - CAIT: 30,000 tons
- However, sourcing for a factory this size from small farmers requires a serious effort
- A 20,000 ton in-shell factory is more realistic but even less profitable: -10.7% (compared to -1%)
- The larger production volume of 100,000 brings fixed cost down from 177$ per ton to 76$, but this is not enough to become profitable
- Crude oil production in Senegal becomes profitable from prices of $1310 CIF/ton for a 100,000 ton factory, and $1410 for a 20,000 ton factory
- Since jan 2014, we have not seen prices above $1400
Does this mean Senegal’s oil plants run at a loss?

No, because they have moved to a hybrid market model too!

- After shelling the whole kernels of good size that are low in aflatoxin are separated for export to China as snackgrade peanuts
- About 50% of kernels qualify for this market
- This means that oil factories run at 25% - 50% of production capacity these days. It is mostly used as a cost-recovery tool
- When Oil price is high, factories do not bother to sort but process everything into oil
3. Refined oil producer for Tanzanian market

- Activities:
  - Purchase of dried in-shells from farmers (via collectors) or oil grade peanuts from exporters
  - Cleaning, shelling, pressing, solvent extraction, refining

- Market:
  - 100% refined oil sold in local market to retailers:
    - Crude oil is not profitable, the margins are in refined oil
    - There is no export market for refined oil; oil is refined close to the end-user
    - Refined oil fetches 50% to 100% higher prices than crude in local market

- Volume per annum:
  - 20,000 tons inshells giving 5200 tons of refined oil (5652 litres)

- Investment: $ 3.94 million for a modern factory capable of extracting 42% oil from kernels that have 50% oil

- Profitability: 12% gross margin, 6.4% net margin*

*Main cost driver is peanut price, and reliable farm gate prices for unshelled peanuts were difficult to obtain. Estimates from local consultants & context report vary greatly. Peanut price used seems on the high side.
Production cost for 1 ton refined peanut oil:
Peanuts are 84%

<table>
<thead>
<tr>
<th>Cost (unit)</th>
<th>Quantity</th>
<th>Price/ unit in TZS</th>
<th>Cost/ton in TZS</th>
<th>Cost/ton in Euro</th>
<th>Cost/ton in US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inshell peanuts</td>
<td>3.85</td>
<td>1250000</td>
<td>4807692</td>
<td>1.967,95 €</td>
<td>$2.164,74</td>
</tr>
<tr>
<td>Labour (hours)</td>
<td>5.0</td>
<td>893</td>
<td>4464</td>
<td>1.83 €</td>
<td>$2,01</td>
</tr>
<tr>
<td>Packaging (1 ltr PET bottle)</td>
<td>1087</td>
<td>489</td>
<td>531087</td>
<td>217,39 €</td>
<td>$239,13</td>
</tr>
<tr>
<td>Fumigation/pest control</td>
<td>1,0000</td>
<td>3762</td>
<td>3762</td>
<td>1,54 €</td>
<td>$1,69</td>
</tr>
<tr>
<td>Electricity (kwh)</td>
<td>300</td>
<td>205,00</td>
<td>61500</td>
<td>25,17 €</td>
<td>$27,69</td>
</tr>
</tbody>
</table>

Steam

**Variable production cost/kg**

<table>
<thead>
<tr>
<th>Cost (unit)</th>
<th>Price/ unit in TZS</th>
<th>Cost/ton in TZS</th>
<th>Cost/ton in Euro</th>
<th>Cost/ton in US$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam</td>
<td>5408505</td>
<td>2.213,88 €</td>
<td>$2.435,27</td>
<td></td>
</tr>
</tbody>
</table>

• Peanuts are by far the largest cost: 84%
• Consumer packaging comes second 9%*

*costs estimated on experience in other product categories
Sales revenues

- Seed cake is an important secondary revenue source
- Currently limited amounts of peanut oil are sold at 6000TZS/litre, assuming a 30% retail margin this means 4615 TZS/litre wholesale, or 5017 TZS once converted to tons
- Question: can we sell 5200 tons at this price? Are enough consumers willing to pay a premium for peanut oil?

### Wholesale price estimate for peanut oil

<table>
<thead>
<tr>
<th></th>
<th>Retail price (TZS/l)</th>
<th>Retail margin</th>
<th>Wholesale price per litre (TZS/l)</th>
<th>Wholesale price per ton (TZS/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retail price (TZS/l)</td>
<td>6000</td>
<td>30% -1800</td>
<td>4615</td>
<td>5017</td>
</tr>
</tbody>
</table>

### Retail prices for refined oils in TZS/Litre

<table>
<thead>
<tr>
<th></th>
<th>Cotton oil</th>
<th>Palm oil</th>
<th>Sunflower oil</th>
<th>Peanut oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retail price (TZS/l)</td>
<td>2000 – 2300</td>
<td>2000 – 2500</td>
<td>3000 – 3500</td>
<td>5500 – 6000</td>
</tr>
<tr>
<td>Retail margin</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Investment cost are considerable

<table>
<thead>
<tr>
<th>Equipment list</th>
<th>Investments</th>
<th>USD</th>
<th>EUR</th>
<th>Depreciation period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unloading cyclones</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unloading conveyor belts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage silo</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Badge silo</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sheller and destoner</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seed cleaning unit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dust Blower</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transporting Cyclones</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hammer mill</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screw conveyor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bucket elevator</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roller crusher</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screw press</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filter press</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Holding tank</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oil pump</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neutrilizer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bleacher</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vacuum pump</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condenser</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deodorizer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water treatment set</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boiler set</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight bridge 80mt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity generator</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Investment in a pressing, solvent extraction and refining unit are nearly 4 million US$
- Solvent extraction is essential to be competitive. You cannot afford to leave oil in the press cake
- Peanut oil can be processed in most oil extraction and refining plants
- In Africa there are many plants running under capacity, so investment may not be necessary..
- However, many of these have outdated equipment not capable of high extraction rates needed to be competitive
Fixed cost are driven by depreciation, interest & managers salary, but are only 6% of cost price

<table>
<thead>
<tr>
<th>Fixed cost per year</th>
<th>In FCFA</th>
<th>in Euro</th>
<th>in USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Licenses</td>
<td>1,100,000</td>
<td>€ 1,677</td>
<td>$ 1,845</td>
</tr>
<tr>
<td>Security</td>
<td>1,200,000</td>
<td>€ 1,829</td>
<td>$ 2,012</td>
</tr>
<tr>
<td>Electricity connection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depreciation equipment+ building</td>
<td>129,188,267</td>
<td>€ 196,933</td>
<td>$ 216,627</td>
</tr>
<tr>
<td>Working Capital Loan interest 8% of 2,2 mln USD 6mths</td>
<td>52,480,000</td>
<td>€ 80,000</td>
<td>$ 88,000</td>
</tr>
<tr>
<td>Maintenance equipment</td>
<td>15,000,000</td>
<td>€ 22,866</td>
<td>$ 25,152</td>
</tr>
<tr>
<td>Investment loan interest 12% on 70% of investment</td>
<td>197,843,398</td>
<td>€ 301,591</td>
<td>$ 331,750</td>
</tr>
<tr>
<td>Driver salaries</td>
<td>2,361,600</td>
<td>€ 3,600</td>
<td>$ 3,960</td>
</tr>
<tr>
<td>Mgt salaries (sourcing, factory, sales, GM)</td>
<td>71,563,636</td>
<td>€ 109,091</td>
<td>$ 120,000</td>
</tr>
<tr>
<td>Mkt+sales+travel cost</td>
<td>16,400,000</td>
<td>€ 25,000</td>
<td>$ 27,500</td>
</tr>
<tr>
<td><strong>Total Fixed cost</strong></td>
<td><strong>487136900.8</strong></td>
<td><strong>742586.739</strong></td>
<td><strong>816845.413</strong></td>
</tr>
<tr>
<td><strong>Fixed cost/ton</strong></td>
<td><strong>37,472.069</strong></td>
<td>€ <strong>119.00</strong></td>
<td>$ <strong>130.90</strong></td>
</tr>
</tbody>
</table>

Assumptions:
- Some highly qualified (expat) managers and well paid middle management is necessary
- 70% of investment cost is financed through a loan
- A working capital loan is necessary to buy in bulk at harvest time
Main and by-product volumes

<table>
<thead>
<tr>
<th></th>
<th>Inshells</th>
<th>Kernels</th>
<th>Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total production/day</td>
<td>83</td>
<td>54</td>
<td>26.0</td>
</tr>
<tr>
<td>Total production/year</td>
<td>20,000</td>
<td>13,000</td>
<td>6240</td>
</tr>
<tr>
<td>Production days/year</td>
<td>240</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

In-shells: 20,000 tons

Shells: 35% 7,000 tons

Kernels: 65% 13,000 tons

Crude oil: 42% 27,300 tons

Press cake: 58% 37,700 tons
Business shows a modest profitability of 16,2%  

<table>
<thead>
<tr>
<th></th>
<th>Per Ton in US$</th>
<th>Per Ton in EUR</th>
<th>In US$</th>
<th>In EUR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable production cost</td>
<td>2435,27</td>
<td>2.213,88</td>
<td>$12.663.384,64</td>
<td>€ 11.512.167,86</td>
</tr>
<tr>
<td>Export cost</td>
<td>0,00</td>
<td>€ -</td>
<td>$-</td>
<td>€ -</td>
</tr>
<tr>
<td>Fixed cost</td>
<td>157,09</td>
<td>€ 142,81</td>
<td>$816.845,41</td>
<td>€ 742.586,74</td>
</tr>
<tr>
<td><strong>Total cost</strong></td>
<td><strong>2592,35</strong></td>
<td><strong>2.356,68</strong></td>
<td><strong>$13.480.230,06</strong></td>
<td><strong>€ 12.254.754,60</strong></td>
</tr>
</tbody>
</table>

Sales Revenues  

| Sales Revenues | 2769,33        | 2517,57       | $14.400.492,03 | € 13.091.356,39 |

Gross margin  

| Gross margin | 334,06         | 303,69        | $1.737.107,38  | € 1.579.188,53  |
|             | 12%            | 12%           | 12%           | 12%           |

Net Profit (before tax)  

| Net Profit (before tax) | 176,97         | 160,88        | $920.261,97    | € 836.601,79    |
|                        | 6,4%           | 6,4%          | 6,4%          | 6,4%          |

Points of discussion:

- Purchase price of peanuts seems high compared to other countries → more research needed
- Consumer research is needed to determine whether entire production can be sold at 6000TZS/ litre retail
- Research is needed to determine realistic wholesale price & distribution cost, as well as packaging cost
- If the best peanuts can be exported as Snack grade like in Senegal, profitability could be much higher
Production volume & profitability

• 20,000 tonnes of in-shell peanuts was chosen because of the limited size of the local market for an expensive oil like peanut oil
• At 100,000 tonnes of in-shells net profitability would be around 21%...
• But at 100,000 ton capacity factory would probably produce to much to sell in local market
Recommendations
Conclusions & recommendations

- The international snack market offers great opportunities for Africa, if aflatoxin can be controlled
- The business model of a processor exporter of snack peanuts & oil grade peanuts seems profitable
- Off-grade peanuts are best sold to China for oil production, or turned into refined oil for the local market in existing oil plants
- Any business active in peanuts needs to operate a hybrid model, where the best product is used for snacks, while off-grades are sold or used for oil
- Organise research in Ghana and Tanzania to:
  - Improve the profitability estimates of a snacks exporting company:
    - To estimate the cost of aflatoxin control measures
    - To estimate a realistic factory gate price of low aflatoxin peanuts (taking into account possible premium)
  - Research the market for (refined) peanut oil and interest and ability of specific local processors
Recommendations for further research in Ghana and Tanzania
The need for local research in Ghana & Tanzania

1. Identification of a business opportunity in supplying aflatoxin free products in local markets:
   - In principle peanuts are an excellent source of nutrition in Africa where malnutrition continues to be an issue...
   - However aflatoxin is a serious food safety issue in Africa
   - GiZ would like to know whether there is a business opportunity in supplying aflatoxin free peanuts/ peanut products in domestic markets
   - There may be a market in baby cereal & emergency supplies distributed by NGOs, but it is risky to base a business on this fickle market
   - Local consumer research is needed to establish whether the opportunity is there

2. Refining existing business opportunities in oil and snack peanut export
   - Realistic factory gate prices for quality inshell peanuts with low aflatoxin levels are needed to refine calculations
   - We need to determine at which level peanuts need to be sourced (farmer, collector, regional wholesaler-trader) and at which price
   - We need to estimate the operational and investment cost needed to reduce aflatoxin

3. Establishing the business opportunity of processing reject peanuts in refined oil for the local market
   - Realistic factory gate price is needed for in-shell peanuts
   - Estimate of potential yield in interested factories (assessment of what is possible with their current equipment)
   - Market research to determine demand, expected sales price, distribution cost etc.
Identification of local business opportunities: Additional research questions

• Key research question: *Is there sufficient demand and willingness to pay amongst African consumers for high quality aflatoxin free peanuts* to make production for local market an attractive alternative for export?
  – To which extend are consumers aware of aflatoxin and perceive this as a problem/risk?
  – What does the current market for peanut snacks & paste look like?
    • What products are currently on offer, and where and how are they sold, at which prices?
    • Who are the current producers, how do they produce and what are their challenges?
    • What are consumer’s buying criteria?
    • To which extend are these satisfied by the current products on offer?
    • What are the estimated sales volumes & consumption per capita
    • Are there specific market segments in terms of consumption behaviour etc.
  – *Is there sufficient demand for a ‘better’ product, and what kind of product at which price?*
    • What products should be produced for which target market?
    • Which scale/production volume can realistically be marketed?
    • At which price can this product be sold (taking into account retail and trade margins)

*Though there may not be a demand for aflatoxin free peanuts, it is possible that other quality criteria exist that offer an opportunity for product diversification and a price premium that can fund aflatoxin control measures*
Identification of local business opportunities: Additional research questions: cont.

- Is the production of these products an attractive alternative to export, that allows for investments in aflatoxin prevention?
  - What type of peanut is needed from farmers?
  - How can these peanuts be sourced? (middle man / trader)
  - What type of processing equipment is necessary, at what price?
  - What would be the production cost & profitability?
  - How does this compare to the alternative (Export)

- What is exactly the size of the NGO/ Food aid opportunity?
  - Potential sales volume & price
  - Stability of demand/ risk
  - Cost of production given product specifications & other procurement requirement (e.g. HACCP certification)
## Proposed research tools

<table>
<thead>
<tr>
<th>Method</th>
<th>Topic of interest / analysis</th>
</tr>
</thead>
</table>
| **Profitability analyses**                  | • Analyse existing products offering & competitive environment  
• Establish retail pricing & margins & structure of supply chain  
• Establish interest in distributing new/other products  
• Estimate sales volumes & market shares                                                                                                                                           |
| **Consumer focus groups & consumer on-street interviews** | • Understand consumer preferences regarding product, pack, price etc. & consumption patterns & buying behaviour  
• Assess public awareness & knowledge & attitude regarding aflatoxin contamination  
• Consumer segmentation                                                                                                                                                    |
| **Interviews with wholesalers, distributors & intermediaries** | • Understand distribution channels & margins  
• Assess realistic ex-factory sales prices                                                                                                                                                                           |
| **Interviews with existing peanut processors** | • Identify food safety issues  
• Assess challenges & profitability  
• Gather peanut sourcing experiences in order to establish realistic sourcing strategy & price  
• Assess causes of quality issues identified by consumers                                                                                                                     |
| **Interviews with NGO**                      | • Assess potential demand, purchase criteria, competitiveness vis-à-vis imports and profitability of the food-aid market                                                                                           |
### Proposed research tools: cont.

<table>
<thead>
<tr>
<th>Method</th>
<th>Topic of interest / analysis</th>
</tr>
</thead>
</table>
| Peanut supply chain analyses: interview with farmers, collectors & traders | • Identify realistic sourcing strategy for processors & sourcing prices  
• Understand barriers & cost to implementation of aflatoxin prevention methods  
• Define price premium necessary to stimulate farmers & traders to invest in quality and aflatoxin prevention |
| Quality analyses of a number of samples in cooperation with buyers | • Establish % of snack and oil grade peanuts & aflatoxine contamination level currently in market |
| Profitability analyses | • Update existing calculations using updated information (e.g. factory gate prices for peanuts & percentage of snack grade peanuts)  
• Produce calculations for new business models identified during research  
• Analyses of the cost of aflatoxin prevention methods |
| visit of existing oil factories | • Assess current utilisation rate & times of free capacity  
• Assess interest in peanut oil processing  
• Assess ability to refine & market oil  
• Assess potential extraction rate based on current equipment, and future investments |
Appendix
<table>
<thead>
<tr>
<th>Factor</th>
<th>Cause</th>
<th>Prevention</th>
<th>Equipment</th>
</tr>
</thead>
</table>
| Land     | Contaminated soil: Aflatoxin is always in the soil in the form of Aspargillus flavus. Reusing the same patch of land for peanuts increases inoculation. | - Rotate crops every 2 years so that the inoculation of Aspargillus decreases.  
- Test the soil for aflatoxin presence prior to sowing using ELISA testing kits | -Sufficient land to rotate crops  
- ELISA testing kits |
| Drought  | Stressed plants are easily infected: Plants growing under drought do not build up a healthy aflatoxin resistance. | - Irrigate land to aid the plants in growing  
- Use a drought-resistant cultivar | - Irrigation system |
| Cultivar | Old degenerated seed: A healthy plant is immune to aflatoxin contamination. Reusing seed reduces plant health and yield.  
Wrong cultivar: A cultivar that is not apt for the local African environment will deliver an unhealthy plant, which results in high aflatoxin susceptibility | - Select a variety that fares well in the particular farming environment (drought, soil content).  
- Renew seed every three years  
- Aflatoxin feeds on oleic. Select a cultivar that has a limited oleic content. | - Certified seeds |
| Harvest  | Early or late harvesting: If peanuts are harvested too late, aflatoxin will have more chance to manifest itself. Prematurely harvested peanuts have more sugar content and this aids post-harvest development of aflatoxin | - Harvest at the right time by testing the peanuts regularly whether they are mature enough to harvest.  
- Have sufficient working capital to prevent being forced by insolvency to sell too early |
<table>
<thead>
<tr>
<th>Factor</th>
<th>Cause</th>
<th>Prevention</th>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dirt</td>
<td>Contaminated soil stays on the peanut: Aflatoxin is present in the soil. If dirt and foreign matter remains on the peanut, it offers more chance for aflatoxin to manifest itself.</td>
<td>- Clean properly and as soon as possible after harvesting, to dirt levels below 1%</td>
<td>- Destoning machine - Cleaning machine</td>
</tr>
<tr>
<td>In-field drying</td>
<td>Drying in heaps on land: High temperature and moisture inside the heap will cause aflatoxin development. Longer drying periods and rain also increase risk.</td>
<td>- After harvesting, dry the in-shells right away by spreading them on drying racks above ground, or in large dryers. Reduce moisture quickly to 6%-8% before storage</td>
<td>- Simple peanut dryers or drying racks</td>
</tr>
<tr>
<td>Hand-shelling</td>
<td>Wet hands and soaked shells increase moisture in peanuts: Shellers tend to wet their hands or the shells to make shelling easier. This increased moisture is breeding ground for aflatoxin.</td>
<td>- Shell the peanuts using machines, as soon as peanuts are dry enough</td>
<td>- Shelling machines</td>
</tr>
<tr>
<td>Sorting</td>
<td>Not sorting out the contaminated peanuts: Infected kernels are often deformed and have a different colour. If not sorted out of the batch, they increase the aflatoxin levels</td>
<td>- Remove discoloured and deformed kernels by hand or a combination of optical sorting machines and hand sorting. Special UV light can be used to detect infected kernels</td>
<td>- Conveyer belt - Optical sorting machine - Special UV light</td>
</tr>
<tr>
<td>Testing</td>
<td>Poor methods: Aflatoxin might not be detected using the wrong techniques or sampling method. One sample cannot be representative for the entire load</td>
<td>- Test properly using recommended sampling techniques. Take multiple samples per container load, tested in accredited laboratory</td>
<td>- Certified testing equipment</td>
</tr>
<tr>
<td>Factor</td>
<td>Cause</td>
<td>Prevention</td>
<td>Equipment</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>En-route</td>
<td>Shipping containers with close-to-max aflatoxin levels: Aflatoxin levels might increase during transport driving the levels of these batches above the limits.</td>
<td>Only ship batches with low aflatoxin levels well below the limit of the country of destination.</td>
<td></td>
</tr>
<tr>
<td>Plastic bags</td>
<td>Polypropylene (PP) bags do not breath sufficiently: Moisture is trapped inside the bags.</td>
<td>Use jute bags instead (only for in-shell groundnuts)</td>
<td>- Jute bags (Opt.: 2nd hand) - PP bags with ventilation</td>
</tr>
<tr>
<td>Warehouse</td>
<td>Hot and moist storage conditions in warehouses: These are the conditions that stimulate aflatoxin development</td>
<td>Use well-ventilated and cooled warehouses</td>
<td>- Quality warehouses with storing racks</td>
</tr>
<tr>
<td>Shells/skins</td>
<td>Aflatoxin present in shell/skin may contaminate kernel: most aflatoxin is present in and on the shell</td>
<td>Remove the shell and optionally blanching the peanuts prevents aflatoxin from multiplying</td>
<td>- Shelling and blanching machine</td>
</tr>
<tr>
<td>Cross-contamination</td>
<td>Aflatoxin can easily spread to healthy peanuts, particularly under warm, moist and unventilated conditions</td>
<td>Test extensively on field as well as before purchase and entering storage.</td>
<td></td>
</tr>
</tbody>
</table>

- Jute bags (Opt.: 2nd hand)
- PP bags with ventilation
- Quality warehouses with storing racks