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## FINAL REPORT ON ECONOMIC AND FINANCIAL VIABILITY OF PROCESSING GROUNDNUTS IN GAMBIA

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# 1 Report

## 1.1 *Background*

ITC is the lead implementing agency for the “Gambia Youth Empowerment Project” (YEP) funded by the European Union (EU). The overall objective of this four-year project is to tackle the economic root causes of irregular migration through increased job opportunities and income prospects for youth. The project will improve skills, foster entrepreneurship and create employment for youth along selected value chains. During the inception phase, ITC has identified key Youth employment opportunities and income generating activities (that meet both market attractiveness criteria and relevance/suitability criteria for the Youth). These promising Youth employment opportunities include: (1) Processed Groundnut and Cashew nut; (2) Backyard Poultry Farming (egg and meat); (3) Local Building Materials (Compressed and Stabilized Earth Blocks/CSEB); and (4) ICTs.

**This report addresses the opportunities in Processed Groundnut and Groundnut.**

## 1.2 *Mission to Gambia*

The International ITC expert visited the Gambia in September 2017 and worked together with Mr. Abdoulie Khan and Mr. Modou Touray to visit value chain actors, markets and to interview potential entrepreneurial youngsters in the country.

## 1.3 *Cigar Box Method®*

The focus of this report is on economic and financial feasibility. The calculations were done with an internationally recognized tool, called the Cigar Box Method®. The Cigar Box Method is briefly explained in Annex B. The exchange rates used are 47 dalasi per USD and 55 per Euro.

## 1.4 *Assumptions*

The cash flow models built are all very transparent and can be adjusted as needed. All assumptions are in blue color which makes them easy to find and change. All assumptions have been critically verified. Two verifications methods were used:

1. Internal verification. This means making use of the knowledge of the Team’s experts, the background data provided by ITC and Trademap, and information collected during the interviews.
2. External verification. This means actual collection of information from markets, such as prices and the quality of the products for sale.

## 2 Groundnuts

### 2.1 Overview

The value chain is divided into Farming, Primary Processing and Secondary Processing. Table 1 gives an overview of the margins and profits that can be generated from 600 tons of UGN from a hypothetical area of 750 hectares, 187 farms with 4 hectares. The underlying assumptions for each link in the chain (in blue color) can be on the respective sheets in the Excel file attached.

**Table 1 – Margins and Profit in the Groundnut Value Chain from 600 tons of UGN**

Value chain	Margin in dalasi per	Margin %	Fixed costs all units	Production	FTE	Profit from 600 ton	Profit per ton UGN	Profit per FTE	Value added
0 Goundnut Farming #1 (187*4 ha = 750 ha)	8,171	50%	4,114,000	600 ton UGN	432	748,000	1,247	1,733	100%
1 UGN decortication #1 Tolling	1,171	38%	150,000	408 ton shelled	20	330,000	550	16,500	44%
2 UGN decortication #2 Trading	4,981	16%	450,000	408 ton shelled	20	1,580,000	2,633	79,000	211%
3 Secondary groundnut processing	22,287	31%	2,160,000	397 ton peanut		6,690,000	11,150		
3. Roasting HPS, 60%	24,074	24%	1,080,000	221 ton peanut	12	4,240,000	11,778	353,333	567%
4. Paste making from FAQ, 40%	20,044	40%	1,080,000	176 ton paste	14	2,450,000	10,208	175,000	328%

### 2.2 Conclusions

- **Farming** needs to be professionalized drastically including better and more inputs, mechanization and irrigation, because traditional growing of groundnuts is not profitable for farmers, meaning that farmers cannot obtain an adequate remuneration for their labor input. The average yield is 800 kg per hectare and this is far too low.
- An average 2-hectare farm drains cash and requires a yield of at least 1.3 ton per hectare to breakeven. Farmers know this, and therefore keep their own seed for planting and sell only their surplus after home consumption. A farm of 2 hectares makes a loss, but at least has a positive cash flow, that covers 50% of the farmer's labor input.
- A 4-hectare farm gives a small profit of D4,140 (8%). With current agronomic practices, 1 hectare requires 210 man-days, or 0.57 FTE. The profit from a 4-hectare farm is therefore D1,733 (€32) per FTE.
- **Primary processing** (decortication) is profitable. A shelling machine for 1-ton input per hour and operating three months per year, can shell 1,080 tons of UGN, yielding 730 tons of peanut. The operations require 20 FTE for milling, winnowing, grading and packing.
  - Processing 600 tons on tolling will give 408 tons of shelled, ungraded nuts (32% loss). This gives D330,000 profit or D16,500 per FTE;
  - Processing & Trading, after grading with 3% overall grading loss, will give 237 tons of HPS (60%) and 158 tons of FAQ (40%). This yields D1,58 million profit, or D79,000 per FTE.
- **Secondary processing**, e.g. roasting and/or paste making is also profitable and adds good value to the crop, it is more labor intensive hence it creates more jobs. A processing unit with a capacity of 80 kg output per hour requires 12-14 FTE. A constraint can be the size of the local market.
  - Roasting 237 tons of HPS gives 221 tons of produce (7% loss) and D4.2 million profit. When 12 FTE are occupied this is D 353,000 per FTE.

- Grinding 158 tons of FAQ gives 176 tons of paste (7% roasting loss, and 15% water addition) and D2.4 million profit. For 14 FTE this means D175,000 per FTE.
- All figures improve if the processor combines primary and secondary processing or adds another crop like cashew.

## 2.3 Margin and Profit Comparison in the Groundnut Value Chain

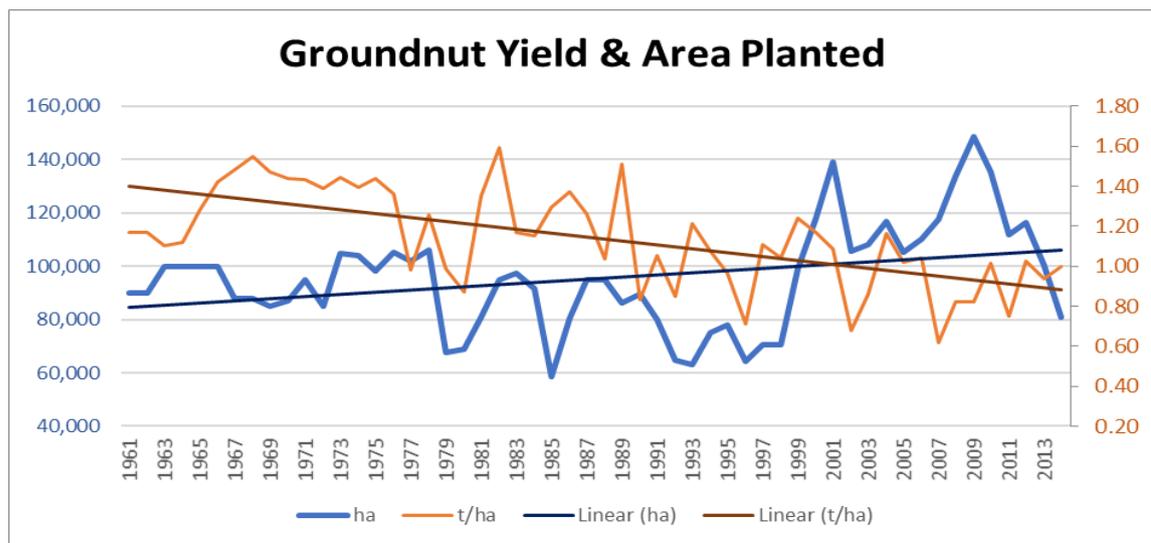
The value chain is divided into Farming, Primary Processing and Secondary Processing

### 2.3.1 Groundnut farming

Although an important crop for food and export, groundnut production has been declining gradually over the past 50 years. Although production increased in the past 15 years compared with the '80s-'90s, it is still below the average production in '60s-'70s.

- '60s-'70s 125,000 ton per year
- '80s-'90s 92,000 ton per year
- This century 109,000 ton per year

This is caused by two opposing long-term trends: declining yields and increased area planted, but the increased area cannot compensate the reduction in yield.



The low yields in Gambia are primarily caused by lack of fertilizers and the use of low quality farmer-saved seed. The fluctuations in the yields are caused by the (lack of) rains because the crop is not irrigated.

Most farmers do not sell their entire crop, but keep groundnuts for food and seed. To plant one hectare equals 70 kg of shelled peanuts, or 125 kg of unshelled nuts (UGN). This is about 16% of the average UGN yield of 800 kg per hectare. About 44% of the groundnuts are kept for home consumption; the remaining 40% is sold. The saleable quantity increases with farm size.

Use GN from 1 hectare	Kg	%
Seed	125	16%
Eaten	355	44%
Sold	320	40%
Harvested total	800	100%

In Table 2, we calculated profitability of two ‘sales options’ from a 2-hectare groundnut farm.

- (1) All Produce is Sold and groundnuts for planting seed and for home consumption are purchased from the market, and
- (2) Food & feed groundnuts are saved after harvest and only about 40% is sold

Our calculations show that both ‘sales options’ (with the low yields and other assumptions made for traditional groundnut farming) are not profitable in the sense that a surplus is remaining after remunerating the farm family’s own labor. What is surprising, is that it is indeed better for farmers to choose option (2) and not sell all groundnuts, to avoid the extra costs for purchasing shelled planting seed that costs D35 per kg, and unshelled groundnut needed for home consumption.

Option (1) factually drains cash out of a 2-hectare farm. The minimum farm size to breakeven is 3.7 hectares above which it can start to make money. See Table 7 for details.

Option (2) offers a small positive cash flow, that allows to pay about 20% of the household labor input during the 120-day growing season, the breakeven point is a farm of 12.1 hectares. See Table 9.

**Table 2 - Groundnut Farming Profitability & Cash Flow for 2 hectares and 4 hectares**

Groundnut profitability	Farm #1		Farm #2	
	All UGN Sold	Food & Seed Kept	All UGN Sold	Food & Seed Kept
Size of farm in hectare	2.0	2.0	4.0	4.0
Yield per ha	0.800	0.320	0.800	0.320
Quantity sold in tons	1.60	0.64	3.20	1.28
Price per ton	16,500	16,500	16,500	16,500
Revenues	26,400	10,560	52,800	21,120
Variable costs	13,260	8,360	26,521	16,721
Planting seed at D 35/kg	4,900	0	9,800	0
Fertilizers	2,800	2,800	5,600	5,600
Hired labor	5,200	5,200	10,400	10,400
Other costs	360	360	721	721
Contribution	13,073	2,173	26,146	4,346
<i>Contribution %</i>	50%	21%	50%	21%
Fixed costs	23,365	10,177	24,470	10,873
Depreciation	4,200	4,200	4,200	4,200
Interest working capital	1,105	697	2,210	1,393
Family labor, other farm costs	5,280	5,280	5,280	5,280
GN purchased back at D18/kg	12,780	0	12,780	0
Profit / Loss	-10,292	-8,004	1,676	-6,527
<i>Profitability %</i>	-39%	-76%	3%	-31%
Cash flow	-1,292	996	10,676	2,473
Breakeven size in hectares	3.7	12.8	3.7	12.8

### 2.3.2 Groundnut processing

adds value, that is obvious. We calculated value addition of primary processing of two systems (1) UGN decortication Tolling; (2) UGN decortication Trading; and of secondary processing, also two systems (3) Roasting shelled HPS; (4) Paste making from shelled FAQ.

The Value Chain we used to make calculations is as follows:

- Farming: 750 hectares of groundnuts → 600 tons of UGN
- Decortication: 600 tons decortication → 408 tons of shelled nuts
- Grading: 408 tons of shelled nuts → 237 tons of HPS & 158 tons of FAQ
- Roasting: 237 tons of HPS → 221 tons of roasted HPS peanuts
- Pasting: 158 tons of FAQ → 176 tons of peanut paste

#### Primary Processing: UGN Decortication

The investment in a simple decortication unit with an input capacity of 1 ton of UGN per hour and 680 kg shelled peanuts, is D141,000 for the sheller and diesel generator – excluding the building. Winnowing and sieving are done manually and must be done during day time. This restricts capacity utilization to 12 hours per day. UGN can be stored well but is preferably shelled within one month. Therefore, the length of the processing season is only 90 days. Using these assumptions, one sheller can produce 734 tons of shelled peanuts.

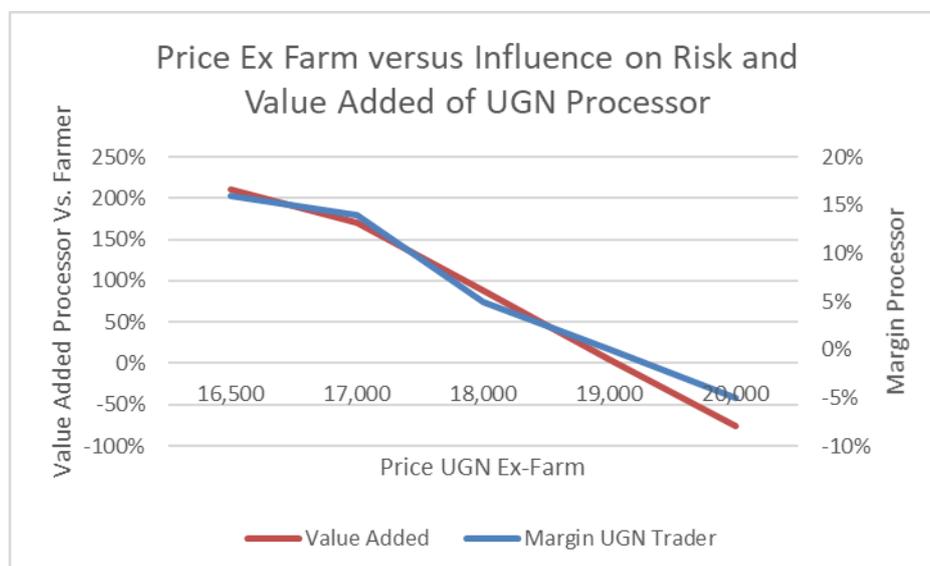
Output capacity per hour (ton)	0.68
Hours per day	12
Length of processing season in days	90
Maximum capacity per year	734

After winnowing, the shelled peanuts are sorted into two broad grades: HPS handpicked selected and FAQ Fair Average Quality. The processing parameters and prices in the overview below are used for the Cigar Box calculations.

Shelling UGN		unit	Dalasi/kg	Value	FG value %
Input of dried UGN		600 ton	16.5	9,900	78%
Output after decortication	-32%	408 ton			
Processing ratio		1.47			
- HPS (handpicked selected)	60%	245 ton	35.0	8,568	68%
- FAQ broken and split (grade II)	40%	163 ton	25.0	4,080	32%
<b>Value Finished goods FG</b>	<b>100%</b>		<b>31.0</b>	<b>12,648</b>	

- (1) **UGN Decortication & Tolling** is decortication for the owner against a service fee. There is no need for working capital and gives a margin of D1,100 per ton (35%), hence the risks are quite low. The raw material breakeven point for tolling is 119 tons, equivalent to 220 hectares under Farming System #1, or 546 hectares under Farming System #2. Tolling 600 tons of UGN gives 408 tons of peanuts with D328,000 profit (26%) and adds 44% on top of the UGN value. (Table 12).
- (2) **UGN Decortication & Trading** means that the processor buys the nuts, processes, grades and sells. The profitability and risks of the processor/trader depend on the prices, especially the farm gate price in Gambia. At the current level of D16,500 per ton and a weighted sales price of the processed nuts of D31,000 per ton, the processor can realize a margin of D4,981 per ton (16%). He has moderate Fixed Costs of D446,000 per year and this results in a breakeven point of 890 tons, or 12% capacity utilization. Processing 600

tons of UGN (56% capacity utilization) gives 408 tons of peanuts with D1.58 million profit (13%) and adds 2.1 times value of the UGN. (Table 13). This depends on pricing as the graph below shows. A small increase in farm gate price leads to quick loss of value added. The breakeven price is D19,000 per ton (*ceteris paribus*).



### **Secondary Processing: Roasting, Paste making**

The investment in a simple roaster is \$3,300 and for a more complete roasting & paste making unit with 80 kg output per hour is about \$8,800, or D420,000 – excluding the building. In principle, the equipment can work day and night but for all practical purposes (the women have their household to attend to) we restricted capacity utilization to 12 hours per day. Shelled peanuts can be stored well. Therefore, the length of the processing season is 360 days. Using these assumptions, one unit can produce 346 tons of processed peanuts.

Output capacity per hour (kg)	80
Hours per day	12
Length of processing season in days	360
Maximum capacity per year	345,600

Gading shelled UGN		unit	Dalasi/ton	Value	Value %
Input of shelled UGN		408 ton	16,500	6,732,000	55%
Output after grading	-3%	396 ton			
Processing ratio		1.03			
- HPS (handpicked selected)	60%	237 ton	35,000	8,310,960	68%
- FAQ broken and split (grade II)	40%	158 ton	25,000	3,957,600	32%
<b>Value Finished goods FG</b>	<b>100%</b>		<b>31,000</b>	<b>12,268,560</b>	

- (3) **Roasting HPS.** The Cigar Box for this activity assumes that HPS is procured at a market price of D35 per kg from the decorticator. Roasting is done with firewood and the losses are not more than 7-8%. If sold at D5 per 50g pouch, the margin is D24,000 per ton (24%). Breakeven can be achieved at 13% capacity utilization. Selling 221 tons of roasted FPS gives D4.2 million profit which is 5.6 times more than the profit from farming.
- (4) **Paste from FAQ.** The Cigar Box for this activity assumes that FAQ is procured at market price of D25 per kg from the decorticator. After roasting, the peanuts are grinded into

paste. The processing ratio is about 0.90 because water is added, meaning that 100 kg of FAQ yields 110 kg of paste. The paste is packed in (recycled) plastic buckets of 5 kg and sold on the market in consumer portions of 100 to 500 g, wrapped in plastic. If sold at D50 per kg, the margin is D14.3 (29%). Breakeven can be achieved at 22% capacity utilization. Selling 176 tons of FAQ paste gives D2.4 million profit which is 3.3 times more than the profit from farming.

## 2.4 Investment & Finance of a complete Groundnut Processing Unit

We calculated the return on investment of a complete unit with primary and secondary processing of groundnuts. Table 3 shows the investment required in fixed assets and for working capital. About D2.76 million (€53,000) is needed for groundnut processing building and equipment with a capacity to process 734 tons of nuts per year. The working capital depends on the quantity actually processed and the length of the procurement-production-sales cycle. In this table we assumed a first-year capacity utilization of 20% (215 tons of raw groundnut) and a cycle of 6 weeks.

**Table 3 - Investment & Finance Required for Groundnut Processing**

CB4 Table 1. Investment & Finance			v2 Groundnut Processor, Gambia 1000 Dalasi		
Investment			Finance		
<b>A</b>	Existing land plot (rented, leased)	0 0%	<b>E</b>	Equity	
	Civil works and storage	760 28%		Owner's Family	100% 318 12%
	Primary processing equipment	144 5%		Other Partners	0% 0 0%
	Secondary processing equipment	414 15%		Company owners	100% 318 12%
	Packaging system	0 0%		Grants	76% 1,000 36%
	Equipment, crates, other	0 0%		Total equity	1,318 48%
<b>B</b>	Working capital	1,443 52%	<b>D</b>	Debt	
	Technical assistance (grant) 2 yr	0 0%		Development loan	0 0%
				Working capital loan	1,443 52%
<b>C</b>	Services, initial labor, unforeseen	0 0%			1,443 52%
<b>Total Cost</b>		<b>2,761 100%</b>	<b>Total Finance</b>		<b>2,761 64%</b>

We assumed that about 80% of the production assets are paid for by a grant, leaving D320,000 to be paid by the rural entrepreneurs. We also assumed that all working capital can be borrowed at 24% per annum. To ensure working capital loan repayment, the minimum capacity utilization must be 17%, this means 2 months of operations.

## 2.5 Return on Investment of Groundnut Processing

The ROI depends primarily on the capacity utilization, margins and FC3 Overhead costs. To attract youth to work for the processing unit (15-20 permanent workers are required) we assumed a monthly salary of D4,000 this 50% more than the average in the rural areas).

To calculate the ROI and Payback period, we assumed a first-year capacity utilization of 20% (46 tons of raw groundnut) increasing gradually to 80% in year 7. See the P&L in Table 4.

Because the harvest season is only 4 months, raw groundnut will need to be stored for capacity utilization above 30%. From Yr-3 onwards, the processor has sufficient cash flow to

rent storage space and pay the interest on the cash required. This will bring down the margin by about 2-3% and does not affect the profitability and business decision.

**Table 4 - Profit & Loss Projection Groundnut Processing**

<b>CB4 Table 2. P&amp;L</b>		<b>v2 Groundnut Processor, Gamk 1000 Dalasi</b>				
		<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2027</b>
<b>PRODUCTION</b>						
<i>Margin Primary processing</i>		16%	16%	14%	13%	23%
VC Primary Processing		3,822	5,732	7,825	9,896	14,024
<i>Margin Secondary processing</i>		30%	30%	28%	27%	22%
VC Secondary processing		7,688	11,533	15,819	20,050	34,505
<b>Variable costs</b>		<b>11,510</b>	<b>17,265</b>	<b>23,645</b>	<b>29,946</b>	<b>48,529</b>
Overhead (FC3)	2.7%	998	998	998	998	998
<b>Total Cost</b>		<b>12,508</b>	<b>18,263</b>	<b>24,643</b>	<b>30,944</b>	<b>49,527</b>
<b>SALES EXW</b> <i>price/kg (ex VAT)</i>						
Max. Sales Primary Processing (ton)	31	734	734	734	734	734
Max. Sales Secondary Processing (ton)	80	691	691	691	691	691
Capacity utilization % of maximum		20%	30%	40%	50%	80%
<b>Total Revenues</b>		<b>15,612</b>	<b>23,419</b>	<b>31,225</b>	<b>39,031</b>	<b>62,450</b>
<b>EBITDA</b>						
EBITDA %		20%	22%	21%	21%	21%
Depreciation		89	70	70	70	70
<b>EBIT</b>		<b>3,015</b>	<b>5,085</b>	<b>6,512</b>	<b>8,017</b>	<b>12,853</b>
Interest payments		346	0	0	0	0
<b>Profit before Tax</b>		<b>2,668</b>	<b>5,085</b>	<b>6,512</b>	<b>8,017</b>	<b>12,853</b>
Income tax paid	20%	-534	-1,017	-1,302	-1,603	-2,571
<b>Profit after Tax</b>		<b>2,135</b>	<b>4,068</b>	<b>5,210</b>	<b>6,414</b>	<b>10,282</b>

**Table 5 - Profitability ratios in Groundnut Processing**

<b>CB4 Table 6. Profitability Ratios</b>		<b>v2 Groundnut Processor, Gamk 1000 Dalasi</b>				
	<b>period</b>	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2027</b>
Cumulative Profit after tax /	3,368	2,135	6,203	11,413	17,826	75,344
Cumulative Equity paid in	318	318	318	318	318	318
<i>Return on equity (ROE)</i>	1059.1%	671%	975%	1196%	1401%	2369%
Cumulative Profit after tax /	3,368	2,135	6,203	11,413	17,826	75,344
Total Investment	-1,318	-1,318	-1,318	-1,318	-1,318	-1,318
<i>Return on investment (ROI)</i>	-255.5%	-162%	-235%	-289%	-338%	-572%
Annual Profit after tax /	94,179	2,668	5,085	6,512	8,017	12,853
Net Sales	460,568	15,612	23,419	31,225	39,031	62,450
<i>Return on Sales = Profitability</i>	20%	17%	22%	21%	21%	21%
Contribution /	105,228	4,102	6,154	7,580	9,085	13,921
Net Sales	460,568	15,612	23,419	31,225	39,031	62,450
<i>Contribution margin</i>	23%	26%	26%	24%	23%	22%

**Table 6 - IRR and Payback Period Groundnut Processing**

<b>CB4 Table 7. IRR and NPV</b>		<b>v2 Groundnut Processor, Ga11,000 Dalasi</b>				
		<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2027</b>
Investment in assets		1,318	0	0	0	0
Net cash flow		3,542	4,138	5,280	6,483	10,352
Discounted net cash flow	24.0%	3,542	3,337	3,434	3,400	1,494
Accumulated discounted net cash flow		3,542	6,879	10,313	13,713	28,461
		<b>NPV</b>	<b>IRR</b>	<b>PBP</b>		
Net Present Value / IRR (10 yrs)		28,461	#NUM!			
Net Present Value / IRR (15 yrs)		32,561	#NUM!	2 years		

The ROI = 255% and the investment of D2.76 million is repaid in Year 2. See Excel sheet CB4\_Groundnut\_Processor for all other CB4 tables.

## 2.6 Employment from Groundnut

The processing unit above directly employs at least 15 permanent works. And, at 85% capacity utilization, needs 860 tons of groundnut from 1,000 hectares. This requires about 21,000 man-days, or 583 FTE for farming.

Table 7 - CB1 Groundnut Farm #1 – 2 hectares

CB1 GROUNDNUT FARM #1   2 HA   ALL PRODUCE SOLD						GAMBIA		2017	
Unshelled groundnuts (UGN), 6% moisture, 50-52% oil, in 60kg PP bag									
Hectares planted	2.0 ha		Yield per hectare	0.800 ton/ha		Harvests per year		1	
Quality grade finished product	UGN		Eaten	Seed	GMD per ton		GMD per season		
Percentage grade	100%						Total Revenue	26,400	
Price (delivered)	16,500				16,500		Total Cost	36,692	
VC4 Transport (farm to CPMS)					42		<b>Profit Before Tax</b>	<b>-10,292</b>	
VC4 Other costs					0		Profit %	<b>-39%</b>	
<b>P (Ex Farm)</b>					<b>16,458</b>		Cash flow	<b>-1,292</b>	
	qty	price	total farm	cost/ha	cost/ton		Asset value	58,000	
Seed, 90% germination	140	35	4,900	2,450	3,063	37%	Depreciation %	7.2%	
Fertilizers (kg)	200	14	2,800	1,400	1,750	21%	<b>FC1</b>	<b>4,200</b> 18%	
Pesticides, herbicides (per ha)	2	0	0	0	0	0%	Debt for working capital	13,260	
<b>VC1</b>			<b>7,700</b>	<b>3,850</b>	<b>4,813</b>	<b>58%</b>	Interest rate, 4 months	8.3%	
Hired labor for weeding, man days	4	400	1,600	800	1,000	12%	<b>FC2</b>	<b>1,105</b> 5%	
Hired labor harvesting, man days	6	600	3,600	1,800	2,250	27%	FTE family labor, 2FTE 120 days	4,800 21%	
Horse for seeding use (kms)	13	27	360	180	225	3%	Purchase of GN for food at D18/kg	12,780 55%	
Irrigation water, kWh	0	0	0	0	0	0%	Other overhead (10% of family labor cost)	480 2%	
<b>VC2</b>			<b>5,560</b>	<b>2,780</b>	<b>3,475</b>	<b>42%</b>	<b>FC3</b>	<b>18,060</b> 77%	
Packaging of groundnuts (60kg)	27	0	0.0	0	0	0%	<b>FC</b>	<b>23,365</b> 100%	
Packaging of by-products	0	0	0.0	0	0	0%	FC % attributed to product	100%	
<b>VC3</b>			<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0%</b>	<b>FC (attributed to product)</b>	<b>23,365</b> 100%	
<b>VC</b>			<b>13,260</b>	<b>6,630</b>	<b>8,288</b>	<b>100%</b>	<b>Margin</b>	<b>6,536</b> <b>8,171</b>	
<b>Margin</b>							Margin %	50%	
<b>Contribution</b>							Quantity sold q (= ha * yield)	1.6	
VC			6,630	8,288	36%		Break even volume (ton)	2.9	
FC / q			11,683	14,603	64%		Break even yield (ton/ha)	1.4	
TC / q			18,313	22,891	100%				
<b>Profit / q</b>			<b>-5,146</b>	<b>-6,433</b>	<b>-39%</b>				

Note: figures in blue are assumptions; figures in pink are calculated in another sheet; figures in black are formulas

Table 8 - CB1 Groundnut Farm #1 – 4 hectares

CB1 GROUNDNUT FARM #1   4 HA   ALL PRODUCE SOLD						GAMBIA		2017	
Unshelled groundnuts (UGN), 6% moisture, 50-52% oil, in 60kg PP bag									
Hectares planted	4.0 ha		Yield per hectare	0.800 ton/ha		Harvests per year		1	
Quality grade finished product					<b>GMD per ton</b>		<b>GMD per season</b>		
Percentage grade	UGN		Eaten		Seed		Total Revenue	52,800	
Price (delivered)	100%						Total Cost	51,124	
VC4 Transport (farm to CPMS)	16,500						<b>Profit Before Tax</b>	<b>1,676</b>	
VC4 Other costs					42		Profit %	3%	
<b>P (Ex Farm)</b>					<b>0</b>		Cash flow	10,676	
					<b>16,458</b>				
	qty	price	total farm	cost/ha	cost/ton		Asset value	58,000	
Seed, 90% germination	280	35	9,800	2,450	3,063	37%	Depreciation %	7.2%	
Fertilizers (kg)	400	14	5,600	1,400	1,750	21%	<b>FC1</b>	<b>4,200</b> 17%	
Pesticides, herbicides (per ha)	4	0	0	0	0	0%	Debt for working capital	26,521	
<b>VC1</b>			<b>15,400</b>	<b>3,850</b>	<b>4,813</b>	<b>58%</b>	Interest rate, 4 months	8.3%	
Hired labor for weeding, man days	8	400	3,200	800	1,000	12%	<b>FC2</b>	<b>2,210</b> 9%	
Hired labor harvesting, man days	12	600	7,200	1,800	2,250	27%	FTE family labor, 2FTE 120 days	4,800 20%	
Horse for seeding use (kms)	26	27	721	180	225	3%	Purchase of GN for food at D18/kg	12,780 52%	
Irrigation water, kWh	0	0	0	0	0	0%	Other overhead (10% of family labor cost)	480 2%	
<b>VC2</b>			<b>11,121</b>	<b>2,780</b>	<b>3,475</b>	<b>42%</b>	<b>FC3</b>	<b>18,060</b> 74%	
Packaging of groundnuts (60kg)	53	0	0.0	0	0	0%	<b>FC</b>	<b>24,470</b> 100%	
Packaging of by-products	0	0	0.0	0	0	0%	FC % attributed to product	100%	
<b>VC3</b>			<b>0.0</b>	<b>0</b>	<b>0</b>	<b>0%</b>	<b>FC (attributed to product)</b>	<b>24,470</b> 100%	
<b>VC</b>			<b>26,521</b>	<b>6,630</b>	<b>8,288</b>	<b>100%</b>			
<b>Margin</b>			<b>6,536</b>			<b>8,171</b>	<b>Contribution</b>	<b>26,146</b>	
Margin %						50%	Quantity sold q (= ha * yield)	3.2	
VC			6,630	8,288	52%		Break even volume (ton)	3.0	
FC / q			6,118	7,647	48%		Break even yield (ton/ha)	0.7	
TC / q			12,748	15,935	100%				
<b>Profit / q</b>			<b>419</b>	<b>524</b>	<b>3%</b>				

Note: figures in blue are assumptions; figures in pink are calculated in another sheet; figures in black are formulas

Table 9 - CB1 Groundnut Farm #2 – 2 hectares

CB1 GROUNDNUT FARM #2   2 HA   FOOD & SEED NOT SOLD						GAMBIA		2017		
Unshelled groundnuts (UGN), 6% moisture, 50-52% oil, in 60kg PP bag										
Hectares planted		2.0 ha		Yield per hectare		0.320 ton/ha		Harvests per year		1
						<b>GMD</b>		<b>GMD</b>		
						<b>per ton</b>		<b>per season</b>		
Quality grade finished product		UGN		Eaten		Seed				
Percentage grade		40%		44%		16%				
Price (delivered)		16,500		0		0		16,500		
VC4 Transport (farm to CPMS)								42		
VC4 Other costs								0		
<b>P (Ex Farm)</b>								<b>16,458</b>		
		qty		price total farm		cost/ha		cost/ton		
Seed, 90% germination		140		0		0		0		0%
Fertilizers (kg)		200		14		2,800		1,400		4,375 33%
Pesticides, herbicides (per ha)		2		0		0		0		0%
<b>VC1</b>				<b>2,800</b>		<b>1,400</b>		<b>4,375</b>		<b>33%</b>
Hired labor for weeding, man days		4		400		1,600		800		2,500 19%
Hired labor harvesting, man days		6		600		3,600		1,800		5,625 43%
Horse for seeding use (kms)		13		27		360		180		563 4%
Irrigation water, kWh		0		0		0		0		0%
<b>VC2</b>				<b>5,560</b>		<b>2,780</b>		<b>8,688</b>		<b>67%</b>
Packaging of groundnuts (60kg)		11		0		0.0		0		0%
Packaging of by-products		6		0		0.0		0		0%
<b>VC3</b>				<b>0.0</b>		<b>0</b>		<b>0</b>		<b>0%</b>
<b>VC</b>				<b>8,360</b>		<b>4,180</b>		<b>13,063</b>		<b>100%</b>
<b>Margin</b>				<b>1,086</b>		<b>3,395</b>				
Margin %										<b>21%</b>
VC						4,180		13,063		45%
FC / q						5,088		15,901		55%
TC / q						9,269		28,964		100%
<b>Profit / q</b>						<b>-4,002</b>		<b>-12,506</b>		<b>-76%</b>
						Total Revenue		10,560		
						Total Cost		18,564		
						<b>Profit Before Tax</b>		<b>-8,004</b>		
						Profit %		<b>-76%</b>		
						Cash flow		996		
						Asset value		58,000		
						Depreciation %		7.2%		
						<b>FC1</b>		<b>4,200</b>		<b>41%</b>
						Debt for working capital		8,360		
						Interest rate, 4 months		8.3%		
						<b>FC2</b>		<b>697</b>		<b>7%</b>
						FTE family labor, 2FTE 120 days		4,800		
						Purchase of GN for food		-		0%
						Other overhead (10% of family labor cost)		480		5%
						<b>FC3</b>		<b>5,280</b>		<b>52%</b>
						<b>FC</b>		<b>10,177</b>		<b>100%</b>
						FC % attributed to product		100%		
						<b>FC (attributed to product)</b>		<b>10,177</b>		<b>100%</b>
						<b>Contribution</b>		<b>2,173</b>		<b>0.21</b>
						Quantity sold q (= ha * yield)		0.6		
						Break even volume (ton)		3.0		
						Break even yield (ton/ha)		1.5		

Note: figures in blue are assumptions; figures in pink are calculated in another sheet; figures in black are formulas

Table 10 - CB1 Groundnut Farm #2 – 4 hectares

CB1 GROUNDNUT FARM #2   4 HA   FOOD & SEED NOT SOLD						GAMBIA		2017	
Unshelled groundnuts (UGN), 6% moisture, 50-52% oil, in 60kg PP bag									
Hectares planted	4.0 ha		Yield per hectare	0.320 ton/ha		Harvests per year		1	
Quality grade finished product			<b>GMD</b>					<b>GMD</b>	
Percentage grade	UGN	Eaten	Seed	<b>per ton</b>			<b>per season</b>		
Price (delivered)	40%	44%	16%	16,500			21,120		
VC4 Transport (farm to CPMS)	16,500	0	0	42			27,647		
VC4 Other costs				0			<b>-6,527</b>		
<b>P (Ex Farm)</b>				<b>16,458</b>			<b>Profit Before Tax</b>		
							<b>Profit %</b>		
							2,473		
							<b>Cash flow</b>		
	qnty	price	total farm	cost/ha	cost/ton				
Seed, 90% germination	280	0	0	0	0	0%	Asset value	58,000	
Fertilizers (kg)	400	14	5,600	1,400	4,375	33%	Depreciation %	7.2%	
Pesticides, herbicides (per ha)	4	0	0	0	0	0%	<b>FC1</b>	<b>4,200</b>	39%
<b>VC1</b>			<b>5,600</b>	<b>1,400</b>	<b>4,375</b>	33%	Debt for working capital	16,721	
Hired labor for weeding, man days	8	400	3,200	800	2,500	19%	Interest rate, 4 months	8.3%	
Hired labor harvesting, man days	12	600	7,200	1,800	5,625	43%	<b>FC2</b>	<b>1,393</b>	13%
Horse for seeding use (kms)	26	27	721	180	563	4%	FTE family labor, 2FTE 120 days	4,800	
Irrigation water, kWh	0	0	0	0	0	0%	Purchase of GN for food		0%
<b>VC2</b>			<b>11,121</b>	<b>2,780</b>	<b>8,688</b>	67%	Other overhead (10% of family labor cost)	480	4%
Packaging of groundnuts (60kg)	21	0	0.0	0	0	0%	<b>FC3</b>	<b>5,280</b>	49%
Packaging of by-products	6	0	0.0	0	0	0%	<b>FC</b>	<b>10,873</b>	100%
<b>VC3</b>			<b>0.0</b>	<b>0</b>	<b>0</b>	0%	FC % attributed to product	100%	
<b>VC</b>			<b>16,721</b>	<b>4,180</b>	<b>13,063</b>	100%	<b>FC (attributed to product)</b>	<b>10,873</b>	100%
<b>Margin</b>				<b>1,086</b>	<b>3,395</b>		<b>Contribution</b>	<b>4,346</b>	<b>0.21</b>
Margin %					21%		Quantity sold q (= ha * yield)	1.3	
VC				4,180	13,063	61%	Break even volume (ton)	3.2	
FC / q				2,718	8,495	39%	Break even yield (ton/ha)	0.8	
TC / q				6,899	21,558	100%			
<b>Profit / q</b>				<b>-1,632</b>	<b>-5,100</b>	-31%			

Note: figures in blue are assumptions; figures in pink are calculated in another sheet; figures in black are formulas

Table 11 - CB1 Groundnut Farm 2 Ha in INDIA

CB1 GROUNDNUT FARM   2 HA   IRRIGATED					INDIA		2017	
CB1 [Groundnut dried, Unshelled in 40 kg jute bags]								
hectares planted	2.0 hectare		Yield per hectare	2.0 ton/hectare		Harvests per year	2.0	
Quality grade finished product	A-grade	B-grade	C-grade	Waste	USD per ton		USD per year	
Percentage grade	70%	30%	0%	0%	100%		Total Revenue	9,702
Price (delivered)	1,277	1,064	0.0	0.0	1,213		Total Cost	7,387 76%
VC4 Transport					11	1%	<b>Profit Before Tax</b>	<b>2,315</b>
VC4 Other costs					0	0%	Profit %	24%
<b>P (Ex Farm)</b>					<b>1,202</b>		Cash flow	3,847
	qty/hectare	price	tal/hectare	cost/farm	cost/ton			
Seeds (kgs)	100	1.9	191	383	96	15%	Asset value	6,383
Fertilizers, manure (ton)	2,000	0.2	426	851	213	32%	Depreciation %	8.0%
Pesticides, herbicides (liters)	10	12.8	128	255	64	10%	<b>FC1</b>	<b>511</b> 25%
All other inputs	50	0.6	32	64	16	2%		
<b>VC1</b>			<b>777</b>	<b>1,553</b>	<b>388</b>	<b>59%</b>	Debt	4,255
Hired labor cultivation, man days	30	5.3	160	319	80	12%	Interest rate	12.0%
Hired labor harvesting, man days	20	6.4	128	255	64	10%	<b>FC2</b>	<b>511</b> 25%
Tractor use (hours)	6	21.3	128	255	64	10%		
Irrigation water, days	6	10.6	64	128	32	5%	Family labor, mandays per hectare	10
Consumables, spare parts	5	4.3	21	43	11	2%	Cost of family labor (80% of hired labor)	4.26 0%
<b>VC2</b>			<b>500</b>	<b>1,000</b>	<b>250</b>	<b>38%</b>	Family requirement	1,021 50%
Cost of packaging, incl. losses	25.0	0.53		53	13	2%	Land rental	0.00 0%
Storage cost, days	1.0	5.32		21	5	1%	<b>FC3</b>	<b>1,026</b> 50%
<b>VC3</b>				<b>74</b>	<b>19</b>	<b>3%</b>	<b>FC</b>	<b>2,047</b> 100%
<b>VC</b>				<b>2,628</b>	<b>657</b>	<b>100%</b>	<b>FC (attributed to product)</b>	<b>2,047</b>
<b>Margin</b>					<b>545</b>		<b>Contribution</b>	<b>4,362</b>
Margin %					45%		Quantity sold q (= hectare * yield * harve:	8 ton
					per/ton			
VC1,VC2,V3,VC4					668	72%	Break even volume (ton)	3.8
FC / q					256	28%	Break even yield (ton/hectare)	1.9
TC / q					923	100%		
<b>Profit / q</b>					<b>289</b>	<b>24%</b>		
Note: figures in blue are assumptions; figures in pink are calculated in another sheet; figures in black are formulas								

Table 12 - CB1 UGN Decortication Tolling

CB1 UGN   DECORTICATION   TOLLING		GAMBIA		Sep-17
Decorticated groundnuts, 60 kg PP bag				
	GMD per ton			GMD per year
Price (PROCESSING FEE)	3,100	100%	Total Revenue (Delivered)	1,264,800
VC4 Sales commission, 4%	-	0%	Total Cost	935,974
VC4 Transport	-	0%	<b>Profit Before Tax</b>	<b>328,826</b>
<b>Price (EXW)</b>	<b>3,100</b>	<b>100%</b>	Profitability %	<b>26%</b>
			Cash flow	448,796
Price (UGN delivered)	-		Peanut sheller, excl building	141,000
Processing ratio	1.47		Depreciation %	17.0%
Raw Material cost	-	0%	<b>FC1</b>	<b>23,970</b> 16%
Other ingredients	-	0%	Debt (70% of variable costs)	-
<b>VC1</b>	-	0%	Interest rate, 2 months	4.0%
Milling cost per hour	195		<b>FC2</b>	- 0%
Production quantity per hour (kg)	0.68		Number of FTE employed	2
Winnowing / sieving (D1 per kg)	1,000		Salaries staff incl. social taxes	96,000 65%
<b>VC2</b>	<b>1,287</b>	<b>67%</b>	Other overhead, 30% of staff cost	28,800 19%
Cost of packing material	28		<b>FC3</b>	<b>124,800</b> 84%
Number of selling units per kg	17		<b>FC</b>	<b>148,770</b> 100%
<b>VC3</b>	<b>467</b>	<b>24%</b>	FC % attributed to product	100.0%
FG losses % in storage	0.0%		<b>FC (attributed to product)</b>	<b>148,770</b>
<b>VC (+ 10% for the bag in kind)</b>	<b>1,929</b>	<b>100%</b>	Quantity sold q (ton)	408
<b>Margin</b>	<b>1,171</b>		<b>Contribution</b>	<b>477,596</b>
Margin % of Price (EXW)	38%		<b>Break even volume (sales)</b>	<b>127</b> 17%
<b>VC</b>	<b>1,929</b>	<b>84%</b>	Break even volume (raw material)	187
<b>Fixed Cost / q</b>	<b>365</b>	<b>16%</b>	Output capacity per hour (ton)	0.68
<b>Total Cost / q</b>	<b>2,294</b>	<b>100%</b>	Hours per day	12
<b>Profit / q</b>	<b>806</b>		Length of processing season in days	90
			Maximum capacity per year	734
			<b>Capacity utilization</b>	<b>56%</b>

Note: figures in blue are assumptions; figures in pink are calculated in another sheet; figures in black are formulas

Table 13 - CB1 UGN Decortication Trading

CB1 UGN   DECORTICATION   TRADING		GAMBIA		Sep-17
<b>Decorticated groundnuts, 60 kg PP bag</b>				
	<b>GMD per ton</b>			<b>GMD per year</b>
Price (60% HPS and 40% FAQ)	31,000	100%	Total Revenue (Delivered)	12,648,000
VC4 Sales commission, 4%	-	0%	Total Cost	11,061,648
VC4 Transport	-	0%	<b>Profit Before Tax</b>	<b>1,586,352</b>
<b>Price (EXW)</b>	<b>31,000</b>	<b>100%</b>	Profitability %	<b>13%</b>
			Cash flow	1,706,322
Price (UGN delivered)	16,500		Peanut sheller, excl building	141,000
Processing ratio	1.47		Depreciation %	17.0%
Raw Material cost	24,265	93%	<b>FC1</b>	<b>23,970</b> 5%
Other ingredients	-	0%	Debt (70% of variable costs)	7,430,948
<b>VC1</b>	<b>24,265</b>	<b>93%</b>	Interest rate, 2 months	4.0%
Milling cost per hour	195		<b>FC2</b>	<b>297,238</b> 67%
Production quantity per hour (kg)	0.68		Number of FTE employed	2
Winnowing / sieving / sorting (D1 per kg)	1,000		Salaries staff incl. social taxes	96,000 22%
<b>VC2</b>	<b>1,287</b>	<b>5%</b>	Other overhead, 30% of staff cost	28,800 6%
Cost of packing material	28		<b>FC3</b>	<b>124,800</b> 28%
Number of selling units per kg	16.7		<b>FC</b>	<b>446,008</b> 100%
<b>VC3</b>	<b>467</b>	<b>2%</b>	FC % attributed to product	100.0%
FG losses % in storage	0.0%		<b>FC (attributed to product)</b>	<b>446,008</b>
<b>VC</b>	<b>26,019</b>	<b>100%</b>		
<b>Margin</b>	<b>4,981</b>		Quantity sold q (ton)	408
Margin % of Price (EXW)	16%		<b>Contribution</b>	<b>2,032,360</b>
<b>VC</b>	<b>26,019</b>	<b>96%</b>	<b>Break even volume (sales)</b>	<b>90</b> 12%
<b>Fixed Cost / q</b>	<b>1,093</b>	<b>4%</b>	Break even volume (raw material)	132
<b>Total Cost / q</b>	<b>27,112</b>	<b>100%</b>	Output capacity per hour (ton)	0.68
<b>Profit / q</b>	<b>3,888</b>		Hours per day	12
			Length of processing season in days	90
			Maximum capacity per year	734
			<b>Capacity utilization</b>	<b>56%</b>
<i>Note: figures in blue are assumptions; figures in pink are calculated in another sheet; figures in black are formulas</i>				

Table 14 - CB1 Groundnuts Processing #1 Roasting HPS

CB1 GROUNDNUTS HPS   ROASTED   B2C		GAMBIA		Sep-17
Roasted groundnuts HPS, packed in 50g pouches, 20 pieces in PE bag (1 kg)				
	GMD per ton			GMD per year
Price retail, delivered	100,000	100%	Total Revenue (Delivered)	22,083,408
VC4 Sales commission, 20%	20,000	20%	Total Cost	17,843,266
VC4 Transport	8,000	8%	<b>Profit Before Tax</b>	<b>4,240,142</b>
<b>Price (EXW)</b>	<b>72,000</b>	<b>72%</b>	Profitability %	19%
			Cash flow	4,847,162
Price (HPS delivered)	35,000		Large roaster, excl building	155,100
Processing ratio	1.08		Depreciation %	20.0%
Raw Material cost	37,634	79%	<b>FC1</b>	<b>31,020</b> 3%
Other ingredients	3	0%	Debt (70% of variable costs)	7,408,623
<b>VC1</b>	<b>37,637</b>	<b>79%</b>	Interest rate, 2 months stock	4.0%
Roasting cost per batch	65		<b>FC2</b>	<b>296,345</b> 28%
Production quantity per batch (ton)	0.080		Number of FTE employed	12
Other processing costs	-		Salaries staff incl. social taxes	576,000 54%
<b>VC2</b>	<b>814</b>	<b>2%</b>	Other overhead, 30% of staff cost	172,800 16%
Cost of packing material	9.0		<b>FC3</b>	<b>748,800</b> 70%
Number of selling units per ton	1000		<b>FC</b>	<b>1,076,165</b> 100%
<b>VC3</b>	<b>9,000</b>	<b>19%</b>	FC % attributed to product	100.0%
FG losses % in storage	1.0%		<b>FC (attributed to product)</b>	<b>1,076,165</b>
<b>VC</b>	<b>47,926</b>	<b>100%</b>		
<b>Margin</b>	<b>24,074</b>		Quantity sold q (kg)	221
Margin % of price	24%		<b>Contribution</b>	<b>5,316,307</b>
<b>VC</b>	<b>47,926</b>	<b>91%</b>	<b>Break even volume (sales)</b>	<b>45</b> 13%
<b>Fixed Cost / q</b>	<b>4,873</b>	<b>9%</b>	Break even volume (raw material)	48
<b>Total Cost / q</b>	<b>52,799</b>	<b>100%</b>	Output capacity per hour (ton)	0.080
<b>Profit / q</b>	<b>19,201</b>		Hours per day	12
			Length of processing season in days	360
			Maximum capacity per year	346
			<b>Capacity utilization</b>	<b>64%</b>

Note: figures in blue are assumptions; figures in pink are calculated in another sheet; figures in black are formulas

Table 15 - CB1 Groundnuts Processing #2 Paste from FAQ

CB1 GROUNDNUTS FAQ   PASTE   B2C		GAMBIA		Sep-17
Groundnut paste from FAQ in 5kg plastic buckets (recycled), sold in 100g portion on market				
	GMD per ton			GMD per year
Price delivered	50,000	100%	Total Revenue (Delivered)	8,795,124
VC4 Sales commission, 4%	-	0%	Total Cost	6,353,496
VC4 Transport	4,000	8%	<b>Profit Before Tax</b>	<b>2,441,627</b>
<b>Price (EXW)</b>	<b>46,000</b>	<b>92%</b>	Profitability %	<b>28%</b>
			Cash flow	3,196,347
Price (FAQ, delivered)	25,000		Roasting + pasting machine, excl. building	413,600
Processing ratio	0.90		Depreciation %	20.0%
Raw Material cost	22,499	87%	<b>FC1</b>	<b>82,720</b> 8%
Other ingredients	-	0%	Debt (70% of variable costs)	3,196,008
<b>VC1</b>	<b>22,499</b>	<b>87%</b>	Interest rate, 2 months stock	4.0%
Roasting costs per ton	814		<b>FC2</b>	<b>127,840</b> 12%
Pasting cost per hour	31		Number of FTE employed	14
Production quantity per (ton)	0.080		Salaries staff incl. social taxes	672,000 62%
<b>VC2</b>	<b>1,200</b>	<b>5%</b>	Other overhead, 30% of staff cost	201,600 19%
Cost of packing material	10		<b>FC3</b>	<b>873,600</b> 81%
Number of selling units per ton	200		<b>FC</b>	<b>1,084,160</b> 100%
<b>VC3</b>	<b>2,000</b>	<b>8%</b>	FC % attributed to product	100.0%
FG losses % in storage	1.0%		<b>FC (attributed to product)</b>	<b>1,084,160</b>
<b>VC</b>	<b>25,956</b>	<b>100%</b>	Quantity sold q (kg)	176
<b>Margin</b>	<b>20,044</b>		<b>Contribution</b>	<b>3,525,788</b>
Margin % of price	40%		<b>Break even volume (sales)</b>	<b>54</b> 16%
<b>VC</b>	<b>25,956</b>	<b>81%</b>	Break even volume (raw material)	49
<b>Fixed Cost / q</b>	<b>6,163</b>	<b>19%</b>	Output capacity per hour (ton)	0.080
<b>Total Cost / q</b>	<b>32,119</b>	<b>100%</b>	Hours per day	12
<b>Profit / q</b>	<b>13,881</b>		Length of processing season in days	360
			Maximum capacity per year	346
			<b>Capacity utilization</b>	<b>51%</b>

Note: figures in blue are assumptions; figures in pink are calculated in another sheet; figures in black are formulas

### 3 Annex B - Cigar Box Method Used in this Report

The report makes analysis of cost prices of the main product categories using the Cigar Box Method®. Costs are divided into variable costs (VC) and fixed costs (FC).

The **variable costs** are subdivided into five groups:

- VC1 Cost of raw materials and ingredients (flour, yeast, butter, etc.)
- VC2 Cost of processing inputs into outputs (electricity, spare parts, consumable)
- VC3 Cost of packaging (primary, secondary, tertiary packaging)
- VC4 Cost of delivery (transportation, C&F handling, sales commission, etc.)
- Cost of returned goods (VC1+VC2+VC3+VC4 of the goods returned)

The **fixed costs** are subdivided into four groups:

- FC1 Depreciation of fixed assets
- FC2 Interest paid on capital
- FC3 Overhead costs (salaries, maintenance, communications, etc.,
- FC4 Marketing, advertisement

The **margin calculation** is done with the following formulas:

- VAT is deducted from the Sales Price
- The net sales price per unit is recalculated to a price per kg.
- VC4 (distribution cost) is deducted from the sales price per kg:
- The ex-factory price is calculated  $P - VC4 = P_{(EXW)}$
- VC1 is calculated from the recipe multiplied by actual prices of the procured inputs.
- VC2 is calculated on estimated energy and labor use by the actual prices per hour plus an estimate for water, consumables and repairs.
- VC3 is the cost of primary, secondary and tertiary packaging material used
- Returned goods are estimated for the categories.
- The total variable cost of the goods sold  $VC = VC1 + VC2 + VC3 + \text{returned goods cost}$
- The margin per kg =  $P_{(EXW)} - VC$
- The margin % =  $\text{margin} / P$

The **contribution** is calculated as follows:

- The quantity sold per product or products category is taken from the bookkeeping
- The contribution is the margin per unit \* quantity sold per year
- The contribution of each product is ranked from high to low indicating the most important product categories and the least important ones.

The **profit** is calculated in two ways:

- Bookkeeping method:  $\text{profit} = \text{total revenues} - \text{total costs} = P * q - (VC * q + FC)$
- Cigar Box method:  $\text{profit} = \text{contribution} - \text{fixed costs} = (P - VC) * q - FC$

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