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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

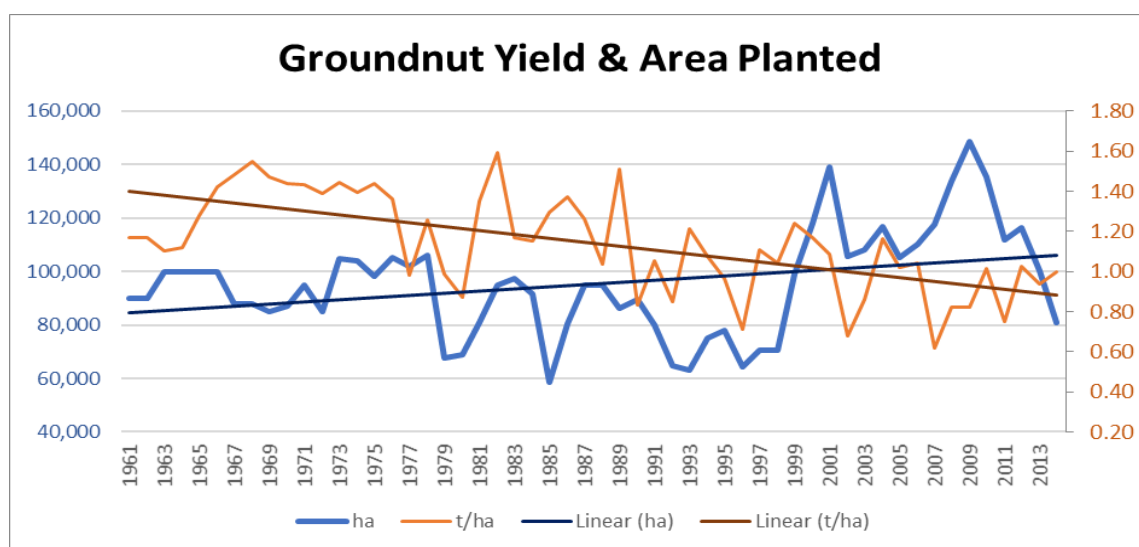
The value chain is divided into Farming, Primary Processing and Secondary Processing

### 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		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
- Decorticating: 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

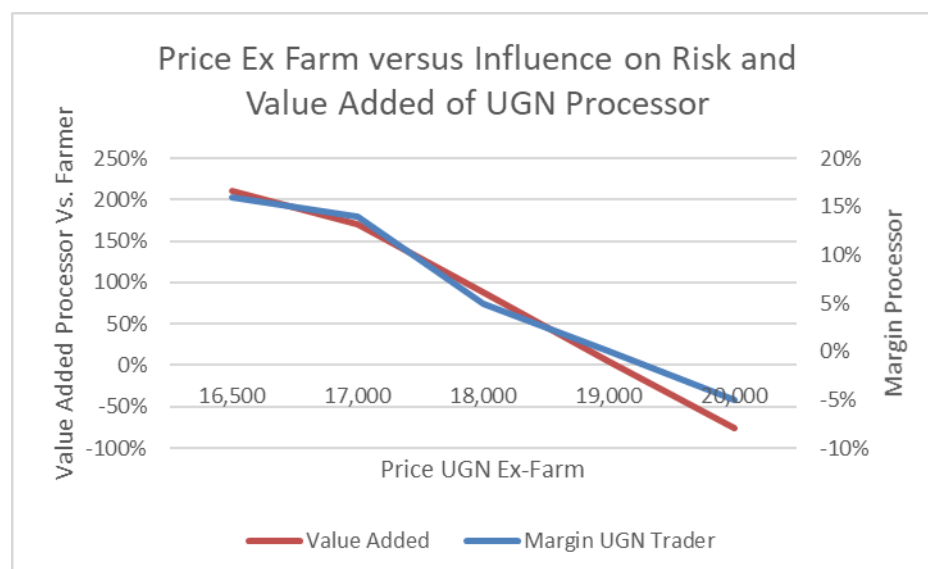
After winnowing, the shelled peanuts are sorted into two broad grades: HPS handpicked selected and FAQ Fair Average Quality. The processing parameters and prices in the overview below are used for the Cigar Box calculations.

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 decorticating 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

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

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

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.

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).

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</b>	<b>Groundnut Processor, Gamt 1000 Dalasi</b>			
		<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2027</b>
<b>PRODUCTION</b>						
Margin Primary processing		16%	16%	14%	13%	23%
VC Primary Processing		3,822	5,732	7,825	9,896	14,024
Margin Secondary processing		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>	price/kg (ex VAT)					
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>		3,104	5,155	6,582	8,087	12,923
EBITDA %		20%	22%	21%	21%	21%
Depreciation		89	70	70	70	70
<b>EBIT</b>		3,015	5,085	6,512	8,017	12,853
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</b>	<b>Groundnut Processor, Gamt 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, Gao, 1000 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%			16,500		Total Revenue	26,400
Price (delivered)	16,500			42		Total Cost	36,692
VC4 Transport (farm to CPMS)				0		Profit Before Tax	-10,292
VC4 Other costs				16,458		Profit %	-39%
P (Ex Farm)						Cash flow	-1,292
	qty	price	total farm	cost/ha	cost/ton		
Seed, 90% germination	140	35	4,900	2,450	3,063	37%	Asset value
Fertilizers (kg)	200	14	2,800	1,400	1,750	21%	Depreciation %
Pesticides, herbicides (per ha)	2	0	0	0	0	0%	FC1
VC1			7,700	3,850	4,813	58%	
Hired labor for weeding, man days	4	400	1,600	800	1,000	12%	Debt for working capital
Hired labor harvesting, man days	6	600	3,600	1,800	2,250	27%	Interest rate, 4 months
Horse for seeding use (kms)	13	27	360	180	225	3%	FC2
Irrigation water, kWh	0	0	0	0	0	0%	
VC2			5,560	2,780	3,475	42%	FTE family labor, 2FTE 120 days
Packaging of groundnuts (60kg)	27	0	0.0	0	0	0%	Purchase of GN for food at D18/kg
Packaging of by-products	0	0	0.0	0	0	0%	Other overhead (10% of family labor cost)
VC3			0.0	0	0	0%	FC3
VC			13,260	6,630	8,288	100%	FC
Margin			6,536	8,171			FC % attributed to product
Margin %				50%			FC (attributed to product)
VC			6,630	8,288	36%		Contribution
FC / q			11,683	14,603	64%		Quantity sold q (= ha * yield)
TC / q			18,313	22,891	100%		
Profit / q			-5,146	-6,433	-39%		Break even volume (ton)
							Break even yield (ton/ha)

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	UGN	Eaten	Seed	GMD per ton		GMD per season	
Percentage grade	100%					Total Revenue	52,800
Price (delivered)	16,500			16,500		Total Cost	51,124
VC4 Transport (farm to CPMS)				42		Profit Before Tax	1,676
VC4 Other costs				0		Profit %	3%
P (Ex Farm)				16,458		Cash flow	10,676
	qty	price	total farm	cost/ha	cost/ton		
Seed, 90% germination	280	35	9,800	2,450	3,063	37%	Asset value
Fertilizers (kg)	400	14	5,600	1,400	1,750	21%	Depreciation %
Pesticides, herbicides (per ha)	4	0	0	0	0	0%	FC1
VC1			15,400	3,850	4,813	58%	
Hired labor for weeding, man days	8	400	3,200	800	1,000	12%	Debt for working capital
Hired labor harvesting, man days	12	600	7,200	1,800	2,250	27%	Interest rate, 4 months
Horse for seeding use (kms)	26	27	721	180	225	3%	FC2
Irrigation water, kWh	0	0	0	0	0	0%	
VC2			11,121	2,780	3,475	42%	FTE family labor, 2FTE 120 days
Packaging of groundnuts (60kg)	53	0	0.0	0	0	0%	Purchase of GN for food at D18/kg
Packaging of by-products	0	0	0.0	0	0	0%	Other overhead (10% of family labor cost)
VC3			0.0	0	0	0%	FC3
VC			26,521	6,630	8,288	100%	
Margin			6,536	8,171			FC
Margin %				50%			FC % attributed to product
VC			6,630	8,288	52%		FC (attributed to product)
FC / q			6,118	7,647	48%		
TC / q			12,748	15,935	100%		
Profit / q			419	524	3%		
Note: figures in blue are assumptions; figures in pink are calculated in another sheet; figures in black are formulas							
						Contribution	26,146
						Quantity sold q (= ha * yield)	3.2
						Break even volume (ton)	3.0
						Break even yield (ton/ha)	0.7

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
Quality grade finished product	UGN	Eaten	Seed	GMD per ton		GMD per season	
Percentage grade	40%	44%	16%			Total Revenue	10,560
Price (delivered)	16,500	0	0	16,500		Total Cost	18,564
VC4 Transport (farm to CPMS)				42		Profit Before Tax	-8,004
VC4 Other costs				0		Profit %	-76%
P (Ex Farm)				16,458		Cash flow	996
	qty	price	total farm	cost/ha	cost/ton		
Seed, 90% germination	140	0	0	0	0	Asset value	58,000
Fertilizers (kg)	200	14	2,800	1,400	4,375	Depreciation %	7.2%
Pesticides, herbicides (per ha)	2	0	0	0	0	FC1	4,200 41%
VC1			2,800	1,400	4,375	33%	
Hired labor for weeding, man days	4	400	1,600	800	2,500	19%	Debt for working capital 8,360
Hired labor harvesting, man days	6	600	3,600	1,800	5,625	43%	Interest rate, 4 months 8.3%
Horse for seeding use (kms)	13	27	360	180	563	4%	FC2 697 7%
Irrigation water, kWh	0	0	0	0	0	0%	FTE family labor, 2FTE 120 days 4,800
VC2			5,560	2,780	8,688	67%	Purchase of GN for food - 0%
Packaging of groundnuts (60kg)	11	0	0.0	0	0	0%	Other overhead (10% of family labor cost) 480 5%
Packaging of by-products	6	0	0.0	0	0	0%	FC3 5,280 52%
VC3			0.0	0	0	0%	FC 10,177 100%
VC			8,360	4,180	13,063	100%	FC % attributed to product 100%
Margin			1,086	3,395			FC (attributed to product) 10,177 100%
Margin %				21%			
VC			4,180	13,063	45%		Contribution 2,173 0.21
FC / q			5,088	15,901	55%		Quantity sold q (= ha * yield) 0.6
TC / q			9,269	28,964	100%		Break even volume (ton) 3.0
Profit / q			-4,002	-12,506	-76%		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	UGN	Eaten	Seed	GMD per ton		GMD per season	
Percentage grade	40%	44%	16%			Total Revenue	21,120
Price (delivered)	16,500	0	0	16,500		Total Cost	27,647
VC4 Transport (farm to CPMS)				42		Profit Before Tax	-6,527
VC4 Other costs				0		Profit %	-31%
P (Ex Farm)				16,458		Cash flow	2,473
Seed, 90% germination	qty	price	total farm	cost/ha	cost/ton	Asset value	58,000
Fertilizers (kg)	280	0	0	0	0	Depreciation %	7.2%
Pesticides, herbicides (per ha)	400	14	5,600	1,400	4,375	FC1	4,200 39%
VC1			5,600	1,400	4,375		
Hired labor for weeding, man days	4	0	0	0	0	Debt for working capital	16,721
Hired labor harvesting, man days	8	400	3,200	800	2,500	Interest rate, 4 months	8.3%
Horse for seeding use (kms)	12	600	7,200	1,800	5,625	FC2	1,393 13%
Irrigation water, kWh	26	27	721	180	563		
VC2	0	0	0	0	0	FTE family labor, 2FTE 120 days	4,800
Packaging of groundnuts (60kg)			11,121	2,780	8,688	Purchase of GN for food	
Packaging of by-products						Other overhead (10% of family labor cost)	480
VC3			0.0	0	0	FC3	5,280 49%
VC			0.0	0	0	FC	10,873 100%
Margin			1,086	3,395		FC % attributed to product	100%
Margin %				21%		FC (attributed to product)	10,873 100%
VC			4,180	13,063	61%	Contribution	4,346 0.21
FC / q			2,718	8,495	39%	Quantity sold q (= ha * yield)	1.3
TC / q			6,899	21,558	100%	Break even volume (ton)	3.2
Profit / q			-1,632	-5,100	-31%	Break even yield (ton/ha)	0.8

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	
Percentage grade		70%		30%		0%		0%		100%	
Price (delivered)		1,277		1,064		0.0		0.0		1,213	
VC4 Transport										11 1%	
VC4 Other costs										0 0%	
P (Ex Farm)										1,202	
Total Revenue										9,702	
Total Cost										7,387 76%	
Profit Before Tax										2,315	
Profit %										24%	
Cash flow										3,847	
Seeds (kgs)		100 1.9		191		383		96		15%	
Fertilizers, manure (ton)		2,000 0.2		426		851		213		32%	
Pesticides, herbicides (liters)		10 12.8		128		255		64		10%	
All other inputs		50 0.6		32		64		16		2%	
VC1				777		1,553		388		59%	
Hired labor cultivation, man days		30 5.3		160		319		80		12%	
Hired labor harvesting, man days		20 6.4		128		255		64		10%	
Tractor use (hours)		6 21.3		128		255		64		10%	
Irrigation water, days		6 10.6		64		128		32		5%	
Consumables, spare parts		5 4.3		21		43		11		2%	
VC2				500		1,000		250		38%	
Cost of packaging, incl. losses		25.0 0.53				53		13		2%	
Storage cost, days		1.0 5.32				21		5		1%	
VC3						74		19		3%	
VC						2,628		657		100%	
Margin								545			
Margin %								45%			
Contribution										4,362	
Quantity sold q (= hectare * yield * harve										8 ton	
VC1,VC2,V3,VC4								668 72%		3.8	
FC / q								256 28%		1.9	
TC / q								923 100%			
Profit / q								289 24%			
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 %	26%	
			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				
Winnowing / sieving (D1 per kg)	1,000		Number of FTE employed	2	
<b>VC2</b>	<b>1,287</b>	67%	Salaries staff incl. social taxes	96,000	65%
Cost of packing material	28		Other overhead, 30% of staff cost	28,800	19%
Number of selling units per kg	17		<b>FC3</b>	<b>124,800</b>	84%
<b>VC3</b>	<b>467</b>	24%	<b>FC</b>	<b>148,770</b>	100%
FG losses % in storage	0.0%		FC % attributed to product	100.0%	
<b>VC (+ 10% for the bag in kind)</b>	<b>1,929</b>	100%	<b>FC (attributed to product)</b>	<b>148,770</b>	
<b>Margin</b>	<b>1,171</b>		Quantity sold q (ton)	408	
Margin % of Price (EXW)	38%		<b>Contribution</b>	<b>477,596</b>	
<b>VC</b>	<b>1,929</b>	84%	<b>Break even volume (sales)</b>	<b>127</b>	17%
<b>Fixed Cost / q</b>	<b>365</b>	16%	Break even volume (raw material)	187	
<b>Total Cost / q</b>	<b>2,294</b>	100%	Output capacity per hour (ton)	0.68	
<b>Profit / q</b>	<b>806</b>		Hours per day	12	
			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
Decorticated groundnuts, 60 kg PP bag					
	GMD per ton			GMD per year	
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 %	13%	
			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>	
Note: figures in blue are assumptions; figures in pink are calculated in another sheet; figures in black are formulas					

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%	Profit Before Tax	4,240,142	
Price (EXW)	72,000	72%	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%	FC1	31,020	3%
Other ingredients	3	0%	Debt (70% of variable costs)	7,408,623	
VC1	37,637	79%	Interest rate, 2 months stock	4.0%	
Roasting cost per batch	65		FC2	296,345	28%
Production quantity per batch (ton)	0.080		Number of FTE employed	12	
Other processing costs	-		Salaries staff incl. social taxes	576,000	54%
VC2	814	2%	Other overhead, 30% of staff cost	172,800	16%
Cost of packing material	9.0		FC3	748,800	70%
Number of selling units per ton	1000		FC	1,076,165	100%
VC3	9,000	19%	FC % attributed to product	100.0%	
FG losses % in storage	1.0%		FC (attributed to product)	1,076,165	
VC	47,926	100%			
Margin	24,074		Quantity sold q (kg)	221	
Margin % of price	24%		Contribution	5,316,307	
VC	47,926	91%	Break even volume (sales)	45	13%
Fixed Cost / q	4,873	9%	Break even volume (raw material)	48	
Total Cost / q	52,799	100%	Output capacity per hour (ton)	0.080	
Profit / q	19,201		Hours per day	12	
			Length of processing season in days	360	
			Maximum capacity per year	346	
			Capacity utilization	64%	
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%	Profit Before Tax	2,441,627	
Price (EXW)	46,000	92%	Profitability %	28%	
			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%	FC1	82,720	8%
Other ingredients	-	0%	Debt (70% of variable costs)	3,196,008	
VC1	22,499	87%	Interest rate, 2 months stock	4.0%	
Roasting costs per ton	814		FC2	127,840	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%
VC2	1,200	5%	Other overhead, 30% of staff cost	201,600	19%
Cost of packing material	10		FC3	873,600	81%
Number of selling units per ton	200		FC	1,084,160	100%
VC3	2,000	8%	FC % attributed to product	100.0%	
FG losses % in storage	1.0%		FC (attributed to product)	1,084,160	
VC	25,956	100%			
Margin	20,044		Quantity sold q (kg)	176	
Margin % of price	40%		Contribution	3,525,788	
VC	25,956	81%	Break even volume (sales)	54	16%
Fixed Cost / q	6,163	19%	Break even volume (raw material)	49	
Total Cost / q	32,119	100%	Output capacity per hour (ton)	0.080	
Profit / q	13,881		Hours per day	12	
			Length of processing season in days	360	
			Maximum capacity per year	346	
			Capacity utilization	51%	
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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